

STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

APPLICATION OF INDIANA MICHIGAN)
POWER COMPANY, AN INDIANA)
CORPORATION, FOR APPROVAL OF 20)
MW_{AC} CLEAN ENERGY SOLAR PROJECT;)
FOR APPROVAL OF RELATED)
ACCOUNTING AND RATEMAKING)
INCLUDING: TIMELY RECOVERY OF COSTS)
INCURRED DURING CONSTRUCTION AND)
OPERATION OF THE PROJECT THROUGH)
I&M'S BASIC RATES OR A SOLAR POWER)
RIDER, APPROVAL OF DEPRECIATION)
PROPOSAL, AND AUTHORITY TO DEFER)
COSTS UNTIL SUCH COSTS ARE)
REFLECTED IN RATES; AND FOR)
APPROVAL OF SALE OF RENEWABLE)
ENERGY CREDITS.)

FILED
August 26, 2019
INDIANA UTILITY
REGULATORY COMMISSION

CAUSE NO. 45245

**SUBMISSION OF REBUTTAL TESTIMONY OF
DAVID A. LUCAS**

Applicant, Indiana Michigan Power Company (I&M), by counsel, respectfully
submits the rebuttal testimony and attachment of David A. Lucas in this Cause.



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CERTIFICATE OF SERVICE

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CAUSE NO. 45245

PRE-FILED VERIFIED REBUTTAL TESTIMONY

OF

DAVID A. LUCAS

**PRE-FILED VERIFIED REBUTTAL TESTIMONY OF DAVID A. LUCAS
ON BEHALF OF
INDIANA MICHIGAN POWER COMPANY**

I. Background

1 **Q. Please state your name and business address.**

2 A. My name is David A. Lucas, and my business address is Indiana Michigan
3 Power Center, P.O. Box 60, Ft. Wayne, Indiana 46801.

4 **Q. By whom are you employed and what is your position?**

5 A. I am employed by Indiana Michigan Power Company (I&M or Company) as
6 Vice President Finance and Customer Experience.

7 **Q. What are your principal areas of responsibility with I&M?**

8 A. I am responsible for managing the integrated financial plan and strategic
9 planning process for all I&M business units – Fossil & Hydro Generation,
10 Nuclear Generation, Transmission, and Utility Operations - which includes
11 distribution, customer services & marketing, regulatory services, energy
12 efficiency and demand side management, and other I&M corporate support
13 groups. I am responsible for managing the business operations, project
14 controls, energy efficiency, and customer service organizations. I also lead
15 strategic efforts across our organization to improve the customer experience.

16 **Q. Would you please describe your educational and professional
17 background?**

18 A. I have a Bachelor Degree in Business Management and a Master of Business
19 Administration from Marshall University. I have completed the Program for

1 Leadership Development at Harvard Business School and the American
2 Electric Power (AEP) Leadership Development Program at The Ohio State
3 University. I am a registered Project Management Professional (PMP). Prior
4 to joining AEP, I worked for more than 12 years in the heavy industrial
5 construction industry. I was an officer and Director of Business Operations
6 for Williams Service Group, Inc. My responsibilities in this position included
7 working with the executive management teams of multiple business units to
8 develop strategic plans and manage the financial functions of the business
9 units. I joined AEP in January 2005 as Manager- Financial Analysis &
10 Budgeting SCR and Environmental. My primary roles since joining AEP have
11 been in the areas of project management, budgeting, and project controls
12 where I have served as Manager- Project Cost Management and Director –
13 Project Controls. I also held the position of Director – Environmental Retrofits
14 from November 2010 – January 2013. In April 2014, I was named Vice
15 President Finance of I&M and in November 2016 was named Vice President
16 Finance and Customer Experience.

II. Purpose of Testimony

17 **Q. What is the purpose of your testimony in this proceeding?**

18 A. The purpose of my testimony is to respond to certain matters raised in the
19 direct testimony filed in this Case by Lauren M. Aguilar and John E. Haselden
20 on behalf of the Indiana Office of Utility Consumer Counselor (OUCC).

21 **Q. Are you sponsoring any rebuttal attachments?**

22 A. Yes, my testimony includes the following attachments:

- 1 • Attachment DAL-1R: executed copy of the Alliance Agreement with
2 Notre Dame, including the executed SREC Agreement.
- 3 • Attachment DAL-2R and 2C, which are public and confidential copies
4 of the executed EPC contract for the SBSP.
- 5 • Attachment DAL-3R, I&M Response to OUCC DR 3-2 and 3-3.
- 6 • Attachment DAL-4R, OUCC Response to I&M DR 1-11.
- 7 • Attachment DAL-5R, OUCC Response to I&M DR 1-3
- 8 • Attachment DAL-6R, I&M Response to OUCC DR 3-22
- 9 • Attachment DAL-7R, I&M Response to OUCC DR 5-2
- 10 • Attachment DAL-8R, OUCC Response to I&M DR 1-14

11 **Q. Were the attachments you are sponsoring prepared or assembled by**
12 **you or under your supervision?**

13 A. Yes.

III. Project Agreements

14 **Q. OUCC witness Aguilar states in testimony (p. 5) that I&M failed to meet**
15 **its burden of proof in this case because it did not provide fully executed**
16 **copies of all agreements in the case. Do you agree?**

17 A. No. I&M discussed the key terms of the agreements in testimony and
18 provided copies of the draft agreements to the OUCC and the Commission
19 through the discovery process and in response to the July 3rd Docket Entry in
20 this Cause. As explained in the Company's response to this Docket Entry,
21 the Company is not always in a position to present executed contracts with its
22 case-in-chief. Thus, the OUCC proposal that projects not be submitted unless
23 and until all associated contracts have been executed is impractical. This

1 requirement has not been imposed in other cases and should not be imposed
2 here.

3 **Q. Do the agreements that were provided to the OUCC during the discovery**
4 **process provide the necessary information to support the structure of**
5 **the project?**

6 A. Yes. The agreements that were provided to the OUCC during the discovery
7 process fully support the structure of the project in the Company's case-in-
8 chief and are a reasonable basis for the OUCC to perform its review. In
9 discovery, the OUCC informed I&M that the OUCC does not find any of the
10 provisions in the EPC Agreement to be unreasonable.¹

11 **Q. What is the current status of the agreements on the SBSP project?**

12 A. The three agreements on the SBSP have been executed by all parties. Both
13 the Alliance Agreement and SREC Agreement with Notre Dame were fully
14 executed on August 9th (see Attachment DAL-1R). The EPC contract for the
15 project was executed on August 13th (see Attachment DAL-2R and 2C).

16 **Q. Was the EPC contracting process completed in a manner consistent**
17 **with I&M's normal business practices?**

18 A. Yes. The EPC contract was completed in a timeframe that supports the
19 execution of the project. Consistent with I&M's normal business practices on
20 large capital projects, upon approval of the project charter I&M's project
21 management team established a project schedule to support a December

¹ See Attachment DAL-8R (OUCC Response to I&M DR 1-14).

2020 in-service date. As described by Company witness DeRuntz the Request for Proposal (RFP) process was included in the project schedule. The project team executed the RFP process in accordance with the schedule and entered into contract negotiations with the successful contractor as soon as they were identified. The negotiations and approvals on these types of contracts are complex and take time. I&M and the contractor negotiated in good faith and were able to reach agreement in a timeframe that supports the execution of the project by the December 2020 in-service date.

Q. Were the Notre Dame contracts completed in a manner consistent with I&M's normal business practices?

A. Yes. I&M has been working with Notre Dame for nearly two years to determine the appropriate structure of the agreements and how the SBSP can be used to benefit, not only Notre Dame, but all I&M customers. There are unique elements to these Agreements that have required significant collaboration with different departments within Notre Dame. This has taken an extensive amount of time and effort, but has been essential to ensure that the SBSP is not just an emission free solar project, but has a unique opportunity to recognize a number of different value streams that will have far ranging benefits over the life of the project.

Q. Were there any substantive changes in the fully executed agreements compared to the draft documents provided to the OUCC?

A. No. The Alliance Agreement and SREC Agreement with Notre Dame did not change from what was provided to the OUCC. The overall price and scope

1 of work in the final EPC Agreement is the same as provided in the draft
2 agreement and summarized in the Company's testimony.

3 **Q. OUCC witness Aguilar states that I&M's Agreement with Notre Dame is**
4 **inconsistent with the Company's case-in-chief and cites (p. 9) the**
5 **example that I&M discusses naming rights in testimony but it does**
6 **appear in the Agreement with Notre Dame. Do you agree?**

7 A. No. While witness Aguilar is correct in a strictly literal context that the Alliance
8 Agreement with Notre Dame does not include the term "naming rights," this is
9 simply a difference in terminology. Section 3.4 of the Alliance Agreement
10 states that "The Executive Team (representatives from I&M and Notre Dame)
11 shall determine co-branded signage at the project..." Thus the agreement
12 does provide Notre Dame the right to have its name associated with the
13 project. The actual contract language clarifies the parties' intention and is
14 reasonable. It is also consistent with the Company's statement to the OUCC
15 through the discovery process that Notre Dame does not have exclusive
16 signage rights but rather additional stakeholders can be included in the
17 project.²

18 **Q. Based on the fully executed copies of agreements on the SBSP project**
19 **did the documents the OUCC was provided for its review provide a**
20 **reasonable basis for the project review?**

21 A. Yes. The documents provided to the OUCC during the discovery process

² I&M Response to OUCC DR 3-2 and 3-3 included as Attachment DAL-3R.

1 accurately represent all of the essential elements of the final executed
2 Agreements and are consistent with the discussion of pricing and other key
3 terms reflected in the Company's case-in-chief.

4 **Q. Do you agree with assessment of the overall agreement between Notre**
5 **Dame and I&M offered by OUCC witnesses Aguilar and Haselden in their**
6 **direct testimony?**

7 A. No. Contrary to the statements by OUCC witnesses Aguilar and Haselden,
8 the agreements for the SBSP are comprehensive and consistent with the
9 goals of the project outlined in Company witness Thomas' direct testimony.
10 The agreements also provide a framework to capture the significant value that
11 both I&M and Notre Dame have placed on making SBSP beneficial to the
12 Michiana region, the state of Indiana, and all I&M customers.

IV. Relationship between I&M and Notre Dame

13 **Q. OUCC witness Aguilar states there are some uncertainties and**
14 **conflicting statements regarding the relationship Notre Dame has to the**
15 **project. Can you please some background on the relationship between**
16 **I&M and Notre on the SBSP?**

17 A. Yes. Over two years ago, I&M and Notre Dame met to discuss a common
18 goal of diversifying our generation resources and promoting a sustainable
19 energy future. At the time the discussion with Notre Dame began I&M was
20 utilizing its 2015 Integrated Resource Plan (IRP) as the planning tool for
21 generation resources. The 2015 IRP identified the need for solar resources
22 as a part of I&M's future generation portfolio and Notre Dame had, around

1 that same time, made a number of commitments around sustainability and
 2 environmental impact. Notre Dame was also clear in these discussions that
 3 they had a strong desire to make an impact beyond their campus through
 4 education, research, and community awareness. As a result of these
 5 discussions, I&M and Notre Dame determined that the common goals shared
 6 between the two organizations provided an opportunity to engage in a
 7 strategic partnership for a solar facility that would not only provide emission
 8 free energy, but also serve as a catalyst for promoting a sustainable energy
 9 future throughout the region and state.

10 **Q. Please respond to Ms. Aguilar's contention that the Company**
 11 **misrepresented the agreement between I&M and Notre Dame in its case-**
 12 **in-chief.**

13 A. While the parties used two different documents to memorialize the overall
 14 agreement, the substance of the overall agreement is reasonably and
 15 accurately communicated through the Company's testimony. The Company
 16 certainly did not intend to cause confusion or misrepresent the terms of the
 17 agreement between Notre Dame and I&M. In fact, we sought to provide clarity
 18 by offering to meet with the OUCC to discuss the matter after the Company's
 19 case-in-chief was filed. This offer was declined. The purpose of the Alliance
 20 Agreement is to form an alliance to combine the efforts of the two parties to
 21 achieve the goals of the project. The SREC Agreement (which is an exhibit
 22 to the Alliance Agreement) defines the transactional terms related to the
 23 retirement of REC's on Notre Dame's behalf. Setting forth the details of the

1 overall agreement in two documents better facilitates the ongoing
2 administration of the project.

V. Community and Educational Benefits

3 **Q. Do you agree with the OUCC contention that the potential customer**
4 **benefits of the project are unsupported or overstated? See OUCC**
5 **Witness Aguilar, pp. 11-12; Haselden, p. 8.**

6 A. No. Both I&M and Notre Dame firmly believe that this project has the
7 opportunity to provide many benefits in addition to generating homegrown,
8 emission free energy for I&M's current and future customers. These benefits
9 are not illusory but are supported by the Company's communications with
10 stakeholders as discussed below. Furthermore, the Alliance Agreement
11 provides a framework for I&M and Notre Dame to work together to realize
12 these benefits. Thus I disagree with the contention that the benefits are
13 unsupported.

14 **Q. OUCC witness Haselden says that it is misleading to say customers**
15 **have the opportunity to participate in the SBSP (p. 9). Do you agree?**

16 A. No. The Alliance Agreement addresses this specifically in section 2.3: "The
17 parties (I&M and Notre Dame) will work together to identify potential
18 stakeholders to which an Alliance proposal should be made or Alliance
19 information should be provided." Since the beginning of the discussions
20 between I&M and Notre Dame, both parties have been fully committed to
21 working together to bring other customers into the project through their own
22 Alliance Agreement or through the IM Green program proposed in I&M current

1 base rate case proceeding.

2 **Q. OUCC witness Aguilar contends that the SBSP is being only driven by**
3 **Notre Dame and that I&M customers will not benefit (p. 14). Do you**
4 **agree?**

5 A. No. Section 3.2 of the Alliance Agreement states “I&M shall own all right, title,
6 and interest in and to the Project, and Notre Dame shall have no ownership
7 interest in the Project.” I&M has the full capability and responsibility to
8 manage this emission free renewable energy resource in the best interest of
9 all I&M customers.

10 **Q. OUCC witness Haselden states that naming the facility an extension of**
11 **Notre Dame implies it is the recipient of all environmental attributes (p.**
12 **20) and that the arrangement could be a violation of the Federal Trade**
13 **Commission guidelines (p. 21). Please respond to Mr. Haselden’s**
14 **assertions.**

15 A. As an initial matter, I would point out that Mr. Haselden’s testimony uses the
16 words “could be”; he is not making a definitive claim. Mr. Haselden
17 emphasized these words when I&M asked about this testimony in the
18 discovery process. See Attachment DAL-4R (OUCC Response to I&M DR 1-
19 11).

20 The Alliance Agreement provides that any sign and public information
21 shall conform to any legal requirements of an applicable Government
22 Authority. More specifically Section 3.4 of the Alliance Agreement states,
23 “The Executive Team shall determine co-branded signage at the Project;

provided, however, that any sign or other public awareness information shall conform to any legal requirements of any applicable Government Authority, any signage criteria or limitations imposed by I&M or its parent company American Electric Power, Inc. from time to time, and any insurance requirements.” Thus, the language of the agreement provides an adequate safeguard with respect to the possible concern Mr. Haselden identified.

I&M disagrees with OUCC witness Haselden’s statement that co-branded signage “could invalidate the remaining 60% of the REC’s generated by the SBSP.” As clearly stated in the Alliance Agreement, Notre Dame does not have exclusive naming rights and this facility will not be an extension of Notre Dame.

Q. OUCC witness Haselden states that the SBSP is a conventional commercial operation and is not an experimental or research project (p. 8). How do you respond to these Haselden’s opinions?

A. While I do agree with Haselden’s perspective that that this facility will bring the conventional value of a home grown, emission free renewable resource, I disagree that it does not offer significant opportunity for future research and development projects. There is a difference between the technology itself being an experimental (which appears to be the focus of Mr. Haselden’s testimony), and the project, including the project operational data, being used for and in connection with education and research, which is the point made by I&M and supported by our discussions with Notre Dame.

Section 3.6 of the Alliance Agreement specifically addresses these

1 opportunities when it states, “Subject to the requirements of all applicable Law
2 and any Government Authority, I&M will provide Notre Dame with such
3 production data related to the Project and I&M determines to be necessary for
4 Notre Dame to conduct specifically identified research and education
5 projects.”

6 The Alliance Agreement goes on to say in Section 3.8 that “The Parties
7 may desire to research and develop one or more additional projects with
8 respect to the Project, including with respect to energy, technology,
9 intellectual property, or otherwise, in each case subject to mutually acceptable
10 future development project agreements.” This language does not call into
11 question the commercial operability of the proposed project. Rather, it simply
12 provides flexibility should additional opportunities arise in the future and I&M
13 will comply with applicable regulatory requirements in pursuing any such
14 opportunities.

15 Throughout the two year long discussion that has taken place between
16 I&M and Notre Dame, there has been a very strong desire by both parties for
17 the SBSP to be a transformational project that will provide the opportunity for
18 Notre Dame students and faculty to perform research, experiments, and bring
19 tremendous educational value over the life of the facility. The Alliance
20 Agreement specifically provides a framework for Notre Dame and I&M to work
21 together to identify new technologies and research projects that may be
22 performed at the facility to advance not only solar technology, but other
23 technologies as well (e.g. batteries and storage systems).

1 **Q. OUCC witnesses Aguilar and Haselden feel that the educational value of**
2 **the project is overstated. Do you agree?**

3 A. No. It is clear in both OUCC witnesses Aguilar's and Haselden's testimony
4 that their vision for the SBSP is significantly different than how I&M and Notre
5 Dame will use the project. OUCC witness Haselden views the project through
6 his perspective as an engineer, but educators, students, and curious
7 community members view the educational value of these technologies much
8 differently. I&M sees many different options to use this facility in a way that
9 transforms our energy future. As an example, there are currently
10 approximately 4,000 students per year in Elkhart, LaPorte, and St. Joseph
11 counties that are participating in I&M's energy efficiency educational
12 curriculum. I&M could offer these students and teachers an opportunity to
13 explore the SBSP as lesson on renewable energy resources. With this site
14 being highly visible and something students and parents would be able to see
15 and connect with, this is just one example that would provide an outstanding
16 opportunity for thousands of students and parents per year to increase
17 education, awareness, and community involvement in a sustainable energy
18 future. I&M has many other ideas, partnering with Notre Dame, local cities,
19 non-profit organizations and others to use the facility for education and
20 awareness.

21 Information gathered in the discovery process corroborates the view
22 offered here that the SBSP can provide beneficial educational and research
23 opportunities. The Ball State University is an example I&M identified in

1 discovery.³ The Ball State University website states that its Sustainability
2 Knowledge Group provides a focal point for research and education.⁴ In
3 response to I&M discovery, the OUCC identified a solar project at IUPUI.⁵
4 The IUPUI website states the following with respect to this 43 kW rooftop
5 project, which was established in 2013: “More importantly, however, the
6 project will provide research opportunities and extend IUPUI initiatives to
7 advance sustainability.”⁶

8 **Q. OUCC witness Aguilar (p. 12) states that it is unsupported that some**
9 **communities in I&M’s service area want to differentiate themselves with**
10 **regard to sustainability and climate change plans. Do you agree?**

11 A. No. The many conversations I&M has had with its customers, site selectors,
12 and communities do not support this view. I&M’s response to OUCC Data
13 Request 05-02, shows the commitment that just a few of its communities have
14 made to sustainability.⁷ As shown in this response, the City of South Bend’s
15 Mayor has committed to the Global Covenant of Mayors for Climate & Energy.
16 Upon joining the Covenant the Mayor declared:

17 “We joined the Covenant because we are serious about
18 ensuring South Bend is a healthy, prosperous place for the next
19 several generations, and because we want South Bend to

³ See I&M Response to OUCC DR 5-4 included with OUCC Witness Aguilar Attachment LMA-1.

⁴ <https://www.bsu.edu/academics/centersandinstitutes/cote/sustainability/academy>

⁵ Attachment DAL 5R (OUCC Response to I&M 1-3).

⁶ <http://archive.inside.iupui.edu/features/stories/2013-04-16-story-solar-panels-iupui.shtml>

⁷ Attachment DAL-7R (I&M Response to OUCC 5-02) (this response is cited in Ms. Aguilar’s footnote 20 but not included in her attachment.

1 contribute to the global effort to protect the climate.” *Id.*

2 The City of South Bend’s website states:

3 “Communities that commit to sustainability have stronger
4 economies, bounce back more easily after disasters, are
5 inclusive of all types of people, and enjoyable places to live and
6 work. Working together towards sustainability will promote
7 investment in our community, celebrate and preserve our local
8 assets, and cultivate parks and open spaces.”

9 Other communities within I&M’s service area, including Fort Wayne and
10 Muncie, have also make public declarations for their support of I&M adding
11 more renewable energy to its generation portfolio. This too is specifically
12 identified in the Company’s discovery response included as Attachment DAL-
13 6R.

14 Additionally, in I&M’s response to OUCC Data Request 03-22, I&M
15 pointed out that the US Environmental Protection Agency also supports I&M’s
16 perspective relative to the value of renewable energy.⁸ It states the
17 organizations (including communities) see the following benefits:

- 18 • Potential to serve as a brand differentiator
- 19 • Generate customer, investor, or stakeholder loyalty and employee
20 pride
- 21 • Create positive publicity and enhance the organization’s public image

⁸ See Attachment DAL-6R (which is a complete copy of this I&M discovery response including the attachment). The copy included with Mr. Haselden’s testimony omitted the attachment.

- 1 • Demonstrate civic leadership

2 Contrary to the testimony of OUCC witnesses Aguilar and Haselden, it is
 3 clear, based on all of the facts above, that our communities do desire to make
 4 a statement about their commitment to sustainability and SBSP offers a great
 5 opportunity for the Michiana area and beyond to bring great benefit to the
 6 region for decades to come.

7 **Q. OUCC witness Aguilar (p. 12) states that it is unsupported that access**
 8 **to renewable energy will enhance economic development or attract new**
 9 **business to the area. Do you agree?**

10 A. No. In I&M's response to OUCC data request 05-03, I&M explained that it
 11 has been in contact with no fewer than five confidential companies
 12 considering placing a new facility in the I&M service area that have requested
 13 I&M to include a renewable generation solution as part of its proposal to
 14 provide electric service.⁹ Ten years ago this type of request would have been
 15 highly unusual; today it is becoming an increasing consideration, and in the
 16 future it will likely be required in order to be considered by many companies.

17 Many public examples exist demonstrating how partnerships among
 18 states, communities, strategic partners, and utilities to develop renewable
 19 energy resources have aided substantially in their ability to attract new
 20 business. States like Iowa, which ranks in the top ten in job growth, attribute
 21 the access to renewables as a key factor in its ability to attract progressive

⁹ This discovery response is included with OUCC witness Aguilar's Attachment LMA-1.

companies.¹⁰

The Commission's recent order approving a solar project for Vectren recognized the testimony in that case showed that renewable resources are beneficial in efforts to retain and attract industrial and commercial customers seeking to meet renewable energy goals. Petition of Southern Indiana Gas & Electric Company, Cause No. 45086 (IURC 3/20/2019) p. 26.¹¹

As I&M stated in its response to OUCC data request 05-03, seventy-eight percent of S&P 500 companies issue annual sustainability reports with environmental performance metrics. Of those companies that issued sustainability reports, ninety-five percent offer environmental performance metrics and sixty-seven percent set quantified and time-bound environmental goals. In many instances, these goals are now beginning to contain certain expectations for communities where the companies are located and for companies that provide products and services in the supply chain the these larger companies. This is beginning to become the case with a number of automotive companies which is critical to businesses in I&M's service area that provide parts to that industry.

Despite the claims from OUCC witnesses Aguilar and Haselden, access to renewable energy is becoming an increasingly significant factor in economic development.

¹⁰(<https://www.areadevelopment.com/ContributedContent/Q3-2017/advanced-manufacturing-drives-iowa-economy.shtml>)

¹¹ In I&M's response to OUCC data request 03-22 (Attachment DAL-6R), I&M cited Cause No. 43097 as another example where the Commission has recognized the value of renewable energy to economic development.

1 **Q. OUCC witness Haselden (p. 9) makes that statement that corporate**
2 **customers will not use the SBSP facility to achieve their renewable**
3 **energy goals. Do you agree?**

4 A. No. OUCC witness Haselden has made this claim based on hand picking one
5 of the Corporate Renewable Energy Buyers' Principles and calling it out as a
6 requirement. As a starting point, the Principles are not requirements. They
7 are criteria developed by a select group of seventy-eight large energy buyers,
8 on some common strategies for large corporations to engage with renewable
9 projects. A key strategy from the Principles that Haselden failed to mention in
10 his direct testimony includes:

11 "Where possible, we would like to procure renewable energy
12 from projects near our operations and/or on the regional energy
13 grids that supply our facilities so our efforts benefit local
14 economies and communities as well as enhance the resilience
15 and security of the local grid."

16 It should be noted that similar to the other Principles, the strategy I just quoted
17 starts with "where possible" as a recommended strategy, but not a
18 requirement.

19 Haselden also does not mention, Principle number 6 – Opportunities to
20 work with utilities and regulators to expand our choices for buying renewable
21 energy. It states in the description under this Principle:

22 "We welcome the opportunity to work with local utilities to design
23 and develop innovative programs and products that meet our

1 needs as well as those of our energy suppliers.”¹²

2 It should also be mentioned that a significant number of I&M's
3 commercial, industrial and educational customers are not part of this select
4 group of large energy buyers. I&M plans to also work with our local
5 commercial and industrial customers to provide them the opportunity to
6 participate in the SBSP to meet their own sustainability goals or goals that are
7 becoming necessary for them to continue to provide products and services to
8 their larger customers.

9 **Q. OUCC witness Aguilar (p. 13) takes the position that because a customer**
10 **has not participated in its existing programs they will not participate in**
11 **future renewable offerings. Do you agree?**

12 A. No, I do not. There are three factors that have made I&M's existing programs
13 difficult to market to customers. First, I&M does not have a visible renewable
14 facility in a community that customers can relate to. In conversations with
15 customers there is a desire to participate in a visible, community project that
16 they can see, experience, and feel a part of. This is particularly true for small
17 business and residential customers who place less value on RECs, but more
18 value on community engagement and a commitment to sustainability.
19 Second, as discussed by I&M witness Auer, the cost to participate in the
20 existing REC programs is out of alignment with the market. I&M has proposed
21 a new IM Green in the pending base rate case that will significantly reduce

¹² <https://buyersprinciples.org/principles/>

the costs to participate by aligning the costs with a market index. Third, with the exception of a few very large companies, the concept of RECs and how companies claim to be green has not been well-understood. Upon approval of this project, I&M intends engage in a marketing campaign for residential, commercial, and industrial companies to invite them to tour the project, participate in available renewable offerings, and educate them on how RECs work.

Q. Much of Ms. Aguilar's testimony rests on her claim (p. 13) that the Company's responses to the OUCC discovery questions, such as those provided in Attachment LMA-1, are not adequately supported. Do you have any additional response to this criticism?

A. Yes. I disagree with Ms. Aguilar's suggestion that our discovery responses are inadequate.

OUCC DRs 1-21 and 1-23 concern the location of the project, which was identified in the Company's case-in-chief. In discovery, the Company explained that with this proposed site, thousands of cars will pass by the SBSP facility every day. See I&M Response to OUCC DR 1-21. Given that this project is located in Indiana, it is reasonable to expect the OUCC to understand that the Indiana Roll area is highly traveled.

Similarly, OUCC DR 1-23 asked why the company considered sites only in the South Bend area. The Company responded that it sought a location that could be accessible by Notre Dame for education and research purposes. The response directly answers the question posed. The suggestion that the

1 Company should have done more to document these points lacks merit.

2 As pointed out above, I&M's response to DR 5-03 stated that no fewer
3 than five companies that have been in contact with I&M regarding the potential
4 location of a new facility in the Company's service area have requested I&M
5 provide service though renewable generation. This response as well as the
6 response to OUCC DR 5-04 corroborated I&M's recent experience with
7 statistics from a recent report published on a Harvard Law School Forum, Ball
8 State University and relevant corporate websites. These responses also
9 referred the OUCC to the Company's response to OUCC 3-22, a complete
10 copy of which is included herewith as Attachment DAL-6R. This discovery
11 response also discussed I&M's recent experience and corroborated this
12 experience with published information from buyersprinciples.org, US EPA and
13 the Commission's docket. I&M also provided an attachment that compiled a
14 sample of requests from residents in South Bend requesting renewable
15 projects in the area. Simply put, I&M supported its position with Company
16 specific experience and corroborated with this experience with industry and
17 Indiana specific information.

18 In the Company's response to OUCC DR 5-02 (which is included with Mr.
19 Haselden's testimony and Attachment DAL-7R) the Company identified
20 additional support specific to the South Bend and Fort Wayne areas. In its
21 response to OUCC DR 5-01 (which the OUCC did not include with its
22 testimony), I&M provided additional documents showing customer interest in

renewable investment.¹³

Additionally, in discovery Mr. Haselden identified numerous solar facilities he has visited.¹⁴ While the identified facilities appear to be located in the Indianapolis area, this response also corroborates I&M's contention that consumers are interested in solar energy.

Finally, Ms. Aguilar also cited the Company's response to OUCC DR 7-06 and 7-07 as being inadequate. Yet, as shown by her Attachment LMA-1, each of these responses directly answer the questions posed. In particular, the Company very directly acknowledged that the referenced corporations had not purchased RECs through I&M's Green Power Rider or Renewable Energy Option. While this fact indicates that these programs have not been sufficiently attractive to these consumers, it does not invalidate the totality of the information the Company provided in these discovery responses.

In sum, Ms. Aguilar's criticism of the Company's discovery responses does not accurately characterize the information provided by the Company and therefore the OUCC contention that the Company's positions are not adequately supported should be rejected.

VI. Location of the SBSP Project

Q. OUCC witness Aguilar (p. 11) says that no one other Notre Dame will benefit from the Project's chosen location. Do you agree?

A. No. Again, this statement does not appreciate the vision we have for this

¹³ A copy of this response is included herewith as Attachment DAL-7R.

¹⁴ See Attachment DAL-5R.

1 project and the area in which it will be located. As Company witness Thomas
2 presented in direct and I have mentioned above, I&M views this project as a
3 transformational project for the Michiana region and the state of Indiana. The
4 SBSP will be located along the heavily traveled toll road and will serve as a
5 daily reminder of the commitment that the region and state of Indiana are
6 making towards a sustainable energy future. Among those travelers seeing
7 the facility will be business leaders, entrepreneurs, and technology leaders
8 that may have an interest in locating a business, starting a new business, or
9 providing funding to support future green energy efforts.

10 Having a highly visible, public facility will also serve as a symbol of
11 innovation and commitment to sustainability for the citizens of Indiana that
12 travel by the facility. I&M has learned through conversations with customers
13 about the existing renewable offerings that it is very important that they be
14 able to see the project and feel that it is part of their community to gain the full
15 benefits of the project.

16 Last, I previously discussed the educational benefits that this project can
17 have by inviting students and educators to the SBSP each year to tour the
18 facility and conduct community workshops. Utilizing this facility to expose the
19 next generation to the value of renewable resources and putting the facility in
20 a location where they will see it in their regular travels is a part of the
21 technology adoption cycle and making this technology more accepted as the
22 next generation takes on the future challenges.

1 **Q. Mr. Haselden (p. 5, 17, 22) contends that the purchase of the land for the**
 2 **SBSP was “imprudent”, states that other projects have been located in**
 3 **more rural areas, and recommends the cost land purchased for this**
 4 **project be disallowed due to its image-building nature. Please respond.**

5 **A.** Mr. Haselden does not present information demonstrating the price paid for
 6 this location is unreasonable for the area. Rather, Mr. Haselden’s claim that
 7 the cost of the land is excessive rests on the contention that the cost of land
 8 in a rural location would be less. While this may be so, it does not
 9 demonstrate that the price paid for the SBSP project land is excessive given
 10 its location. As stated above, a location that benefits local economies and
 11 communities is consistent with the Corporate Renewable Energy Buyers’
 12 Principles relied on by Mr. Haselden. I&M’s Real Estate group evaluated cost
 13 of the land for this project by comparing the cost for to other agricultural real
 14 estate transactions in the area. Based on the information available at the
 15 time, the costs of comparable agriculture land purchases in the area ranged
 16 from \$18,242/acre to \$35,012/acre. I&M’s cost of \$21,500/acre was very
 17 much in line with the market at the time and confirms that I&M did not pay a
 18 premium for this land.

19 The suggestion that the Company should not have purchased the land
 20 prior to receiving Commission approval of the project also lacks merit.
 21 Purchasing the land allowed the Company to secure this location and bring
 22 definition to the overall project. Paying for an “option to purchase” subject to
 23 Commission approval of the project may have increased the ultimate cost.

Thus, while the Company is not always in a position to secure sites in advance of project approval, doing so here allowed the Company to solidify its agreement with the anchor tenant and otherwise develop the project to a point where it can be reviewed and assessed by the Commission.

Finally, Mr. Haselden's testimony acknowledges the proximity and visibility attributes of the SBSP. Ironically, this testimony refutes Ms. Aguilar's contention that these benefits are unsupported. Furthermore, I disagree with Mr. Haselden's contention that the location benefits only I&M's image. For example, when I drive by the wind farms located off Interstate 65 north the image I see is not a corporate logo. Rather, I see large renewable resources and this is a positive image of Indiana. I imagine the impression is the same for travelers who see the solar farm on the way to and from the Indianapolis airport. Similarly, the proximity and visibility attributes of the SBSP location near the Indiana Toll Road and one of the premier educational institutions in the country, are not isolated to I&M, but rather benefit the area as a whole.

Therefore, the Commission should reject the recommendation that the cost of the land should be disallowed.

VII. Summary and Conclusion

Q. Can you please summarize your testimony in response to OUCC witnesses Aguilar and Haselden?

A. I&M has been working for over the two years to develop a transformational project that can have tremendous impact on the Michiana area, state of Indiana, and beyond for decades to come. Notre Dame is one of the premier

1 institutions in the country. Through research projects, educational programs,
2 partnerships with local communities and companies, and economic
3 development opportunities the SBSP has the opportunity to provide significant
4 benefits for all of I&M's customers far beyond the 20MW of home-grown
5 emission free energy it will be producing.

6 The SBSP is a reasonable means of providing renewable energy
7 educating the next generation on a sustainable energy future and otherwise
8 advancing our energy future. Furthermore, by locating this project by the toll
9 road, we can showcase Indiana as leader in innovation and technology and
10 attract potential customers to the region.

11 I&M request approval of this project as a catalyst for the future and to
12 establish Michiana and the state of Indiana as a leader in a sustainable energy
13 future.

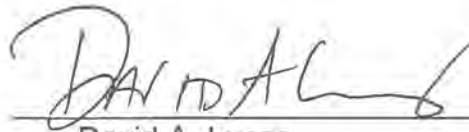
14 **Q. Does this conclude your pre-filed verified rebuttal testimony?**

15 **A. Yes.**

VERIFICATION

I, David A. Lucas, Vice President Finance and Customer Experience of Indiana Michigan Power Company (I&M or the Company), affirm under penalties of perjury that the foregoing representations are true and correct to the best of my knowledge, information, and belief.

Date: August 23, 2019



David A. Lucas

Alliance Agreement

This Alliance Agreement (this "**Agreement**"), dated as of [DATE] (the "**Effective Date**"), is by and between Indiana Michigan Power Company, an Indiana corporation ("**I&M**") and University of Notre Dame du Lac, an Indiana Nonprofit Corporation located in St. Joseph County, Indiana ("**Notre Dame**" and together with I&M, the "**Parties**", and each a "**Party**").

WHEREAS, I&M intends to undertake the development, construction, ownership, operation, and maintenance of a 20MW solar electric power generation project located in South Bend, Indiana (the "**Project**"); and

WHEREAS, Notre Dame desires to purchase certain solar renewable energy credits associated with the Project, use the Project for educational and research purposes, and otherwise benefit from the generation of electricity from renewable sources; and

WHEREAS, the Parties wish to form an alliance (the "**Alliance**") pursuant to which the Parties' efforts will be combined to establish the project for the mutual benefit of the Parties as described in this Agreement.

NOW, therefore, in consideration of the foregoing, the mutual covenants set forth herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1 Definitions. Capitalized terms have the meaning set forth in this Section.

"**Affiliate**" of a Person means any other Person that directly or indirectly, through one or more intermediaries, Controls, is Controlled by, or is under common Control with, such Person.

"**Agreement**" has the meaning set forth in the preamble to this Agreement.

"**Alliance**" has the meaning set forth in the preamble to this Agreement.

"**Business Day**" means a day other than a Saturday, Sunday, or other day on which commercial banks in South Bend, Indiana, are authorized or required by Law to be closed for business.

"**Confidential Information**" has the meaning set forth in Section 5.1.

"**Control**" (and with correlative meanings, the terms "**Controlled by**" and "**under common Control with**") means, with respect to any Person, the possession, directly or indirectly, of the power to direct or cause the direction of the management or policies of another Person, whether through the ownership of voting securities, by contract, or otherwise.

"**Defaulting Party**" has the meaning set forth in Section 13.2.

"**Disclosing Party**" has the meaning set forth in Section 5.1.

"**Dispute**" has the meaning set forth in Section 11.1.

"**Dispute Notice**" has the meaning set forth in Section 11.2(a).

"**Effective Date**" has the meaning set forth in the preamble to this Agreement.

"**Escalation to the Executive Team Notice**" has the meaning set forth in Section 11.2(a).

"**Escalation to Mediation Date**" has the meaning set forth in Section 11.2(c).

"Executive Team" has the meaning set forth in Section 2.1.

"Good Utility Practice" means any of the practices, methods, and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods, and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety, and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in the region.

"Governmental Approvals" means any approval required by a Governmental Authority.

"Governmental Authority" means any federal, state, county, municipal, or local government or any political subdivision thereof, or any other governmental, quasi-governmental, executive, legislative, administrative, regulatory, judicial, public, or statutory department, body, instrumentality, agency, ministry, court, commission, bureau, board, or other governmental authority or regional transmission organization having jurisdiction over all or any portion of the Project or a Party (in connection with the Project).

"Force Majeure Events" has the meaning set forth in Section 12.

"I&M" has the meaning set forth in the preamble to this Agreement.

"Impacted Party" has the meaning set forth in Section 12.

"Indemnified Party" has the meaning set forth in Section 7.1.

"Indemnifying Party" has the meaning set forth in Section 7.1.

"Law" means any statute, law, ordinance, regulation, rule, code, order, constitution, treaty, common law, judgment, decree, other requirement or rule of law of any federal, state, local, or foreign government or political subdivision thereof, or any Governmental Authority, arbitrator, court, or tribunal of competent jurisdiction.

"Losses" has the meaning set forth in Section 7.

"Notice" has the meaning set forth in Section 18.

"Notre Dame" has the meaning set forth in the preamble to this Agreement.

"Party" and **"Parties"** have the meaning set forth in the preamble to this Agreement.

"Person" means any individual, partnership, corporation, trust, limited liability entity, unincorporated organization, association, Governmental Authority, or any other entity.

"Project" has the meaning set forth in the preamble to this Agreement.

"REC(s)" has the meaning set forth in the SREC Agreement.

"Receiving Party" has the meaning set forth in Section 5.1.

"Representatives" has the meaning set forth in Section 5.2.

"Required Disclosure" has the meaning set forth in Section 6.

"SREC Agreement" has the meaning set forth in Section 4.

"Term" has the meaning set forth in Section 13.1

2. Management and Operation of the Alliance

2.1 Each Party will appoint three representatives to a joint executive team ("**Executive Team**"). Each Party may change its representatives on the Executive Team and will provide the other Party with written notice of any changes pursuant to Section 18, Notices. The Executive Team will conduct scheduled meetings to consider and advise on possible Project opportunities, exchange information of mutual interest, manage disputes that may arise between the Parties, and handle other similar matters arising during the Term. Such meetings shall take place either in person or via teleconference and will be held monthly during construction of the Project and annually upon the completion of construction of the Project, or as otherwise mutually agreed. Additional meetings may be conducted at the request of either Party and dependent on the availability of the other Party in order to maximize the efficiency and viability of the Alliance. The Executive Team will provide regular reports to the Parties' management on the progress of the Alliance and on the activities conducted under this Agreement.

2.2 Each Party will facilitate contacts and the dissemination of information between the Parties by providing the other with opportunities to present and demonstrate its offerings at the appropriate planning, public awareness, and other meetings and conferences as may be mutually agreed.

2.3 The Parties will work together to identify potential stakeholders to which an Alliance proposal should be made or Alliance information should be provided. Identified opportunities will be pursued through cooperative arrangements, including with respect to joint announcements with respect to the Project, the joint commitment to green energy, and economic development in the South Bend area. In furtherance thereof, each Party will provide the other with information that may be reasonably requested in order to pursue mutually beneficial Project opportunities. The Executive Team shall determine appropriate co-branded information related to the Project

2.4 Each Party shall use reasonable efforts to keep the other Party informed of communications regarding Project status.

2.5 For the avoidance of doubt, I&M shall have no obligation to notify Notre Dame of any proposals or filings it is making to any third party (including any vendor, customer, or Governmental Authority) with respect to the Project. I&M may enter into agreements with other customers, including power purchase agreements and agreements for the sale of RECs generated from the Project, in its sole discretion.

3. Management and Operation of The Project

3.1 Project Development. Subject to the other provisions of this Agreement, I&M shall use commercially reasonable efforts to develop the Project, including the acquisition of the rights-of-way, easements, and other interests in real property on which the Project will be built, and the engineering, procurement, and construction of the Project. It is understood that development of the Project is not guaranteed and is subject to further scoping review,

approval of, or proper vetting through, all applicable Governmental Approvals. I&M may make such modifications to the Project as it determines are necessary or desired in accordance Good Utility Practice. The obligations of I&M under this Agreement may be performed by a third party designee of I&M or one or more Affiliates of I&M in its sole discretion. Notre Dame will not take, and it will cause its Affiliates not to take, any action that would frustrate the development, construction, ownership, operation or maintenance of the Project. I&M shall be responsible for preparing, filing, and prosecuting applications for approval from any Governmental Authority required or desired for the development, planning, construction, use, operation, and maintenance of the Project in its sole discretion

3.2 Project Ownership. I&M shall own all right, title and interest in and to the Project, and Notre Dame shall have no ownership interest in the Project.

3.3 Project Control. Except as otherwise provided herein, I&M shall at all times have the sole right to determine the nature and extent of the Project, and to make such changes thereto as it shall elect in its sole discretion, including, without limitation, the location and relocation of driveways, entrances, exits, and automobile parking spaces, the direction and flow of traffic, and the installation of prohibited areas, landscaped areas, signage, and any and all systems, machinery, facilities, installations, supply lines, transformers, pipes, conduits, ducts, penetrations, components, appurtenances, and equipment used in or in connection with the Project.

3.4 Signage. The Executive Team shall determine co-branded signage at the Project; provided, however, that any sign or other public awareness information shall conform to any legal requirements of any applicable Governmental Authority, any signage criteria or limitations imposed by I&M or its parent company American Electric Power Company, Inc. from time to time, and any insurance requirements. Any proposed changes to the co-branded signage shall be reviewed and approved by the Executive Team.

3.5 Maintenance. The Project and any approved signs shall be maintained by I&M in accordance with Good Utility Practice.

3.6 Production Data. Subject to the requirements of all applicable Law and any Governmental Authority, I&M will provide Notre Dame with such production data related to the Project that I&M determines to be necessary for Notre Dame to conduct specifically identified research and education projects. Notre Dame shall not use I&M's production data, which may constitute I&M's Confidential Information under this Agreement, for any purpose other than solely to perform noncommercial research and education in compliance with all applicable Laws. I&M will identify any Confidential Information prior to submission to Notre Dame and clearly communicate to Notre Dame the specific information that is subject to confidentiality. All right, title, and interest in and to such data, and any replication, copy, derivative, or progeny thereof, including all intellectual property rights relating to any of the foregoing, is and shall remain vested in I&M irrespective of any disclosure or provision of such Confidential Information to Notre Dame.

3.7 Educational Tours. I&M shall permit educational tours of the Project by students and employees of Notre Dame, subject in all cases to applicable Law, I&M's safety

and security policies, and appropriate and mutually acceptable site visitation agreements to be executed by the Parties and each tour participant.

3.8 Additional Project Development. The Parties may desire to research and develop one or more additional projects with respect to the Project, including with respect to energy, technology, intellectual property, or otherwise, in each case subject to mutually acceptable future development project agreements.

4. SREC Agreement.

4.1 Contemporaneously with entering this Agreement, the Parties shall enter into an agreement for the purchase by Notre Dame of 40% of the RECs generated from the Project for a period of thirty (30) years from the date of completion of the Project, substantially in the form attached as Exhibit A (the "**SREC Agreement**"). Such SREC Agreement shall also be subject to approval of the Project by the Indiana Utility Regulatory Commission, and any other required or necessary Governmental Approvals as provided for in the SREC Agreement.

4.2 Any controversy or claim regarding the SREC Agreement shall be resolved in accordance with the provisions of the SREC Agreement and not in accordance with the provisions of Section 11 of this Agreement.

5. Confidentiality.

5.1 From time to time during the Term of this Agreement, either Party (as the "**Disclosing Party**") may disclose or make available to the other Party (as the "**Receiving Party**") information about its business affairs, services, third-party confidential information and other sensitive or proprietary information, whether orally or in written, electronic or other form or media, and whether or not marked, designated or otherwise identified as "confidential" (collectively, "**Confidential Information**").

5.2 Confidential Information shall not include information that, at the time of disclosure and as established by documentary evidence: (i) is or becomes generally available to and known by the public other than as a result of, directly or indirectly, any breach of this Section 5 by the Receiving Party or any of its Affiliates, employees, officers, directors, partners, shareholders, agents, attorneys, third-party advisors, successors, and permitted assigns (collectively "**Representatives**"); (ii) is or becomes available to the Receiving Party on a non-confidential basis from a third-party source, provided that such third party is not and was not prohibited from disclosing such Confidential Information; (iii) was known by or in the possession of the Receiving Party or its Representatives before being disclosed by or on behalf of the Disclosing Party; (iv) was or is independently developed by the Receiving Party without reference to or use, in whole or in part, of any of the Disclosing Party's Confidential Information; or (v) is required to be disclosed in connection with obtaining any Government Approval.

5.3 The Receiving Party shall: (A) protect and safeguard the confidentiality of the Disclosing Party's Confidential Information with at least the same degree of care as the Receiving Party would protect its own Confidential Information, but in no event with less

than a commercially reasonable degree of care, (B) not use the Disclosing Party's Confidential Information, or permit it to be accessed or used, for any purpose other than to exercise its rights or perform its obligations under this Agreement; and (C) not disclose any such Confidential Information to any person or entity, except to the Receiving Party's Representatives who need to know the Confidential Information to assist the Receiving Party, or act on its behalf, to exercise its rights or perform its obligations under the Agreement.

5.4 The Receiving Party shall be responsible for any breach of this Section 5 caused by any of its Representatives. At any time during or after the term of this Agreement, at the Disclosing Party's written request, the Receiving Party shall promptly return, and shall require its Representatives to return to the Disclosing Party all copies, whether in written, electronic or other form or media, of the Disclosing Party's Confidential Information, or destroy all such copies and certify in writing to the Disclosing Party that such Confidential Information has been destroyed. In addition to all other remedies available at law, the Disclosing Party may seek equitable relief (including injunctive relief) against the Receiving Party and its Representatives to prevent the breach or threatened breach of this Section 5 and to secure its enforcement.

6. Public Announcements.

Neither Party, nor any of its Affiliates or Representatives, shall (orally or in writing) publicly disclose, issue any press release, or make any other public statement, or otherwise communicate with the media, concerning the existence of this Agreement or the subject matter hereof, without the prior written approval of the other Party (which shall not be unreasonably withheld, conditioned or delayed), except if and to the extent that such Party (based on the reasonable advice of counsel) is required to make any public disclosure or filing ("**Required Disclosure**") regarding the subject matter of this Agreement (i) by applicable Law, (ii) pursuant to any rules or regulations of any Governmental Authority or securities exchange of which the securities of such Party or any of its Affiliates are listed or traded, (iii) in connection with obtaining any Governmental Approval, or (iv) in connection with enforcing its rights under this Agreement. Without limitation of the foregoing, the Parties shall issue a joint press release following the full execution and delivery of this Agreement on or after the Effective Date as determined by the Parties. Each Party shall be liable for any failure of its Affiliates or Representatives to comply with the restrictions set forth under this Section 6.

7. Indemnification.

7.1 Subject to the terms and conditions set forth in Section 7.2, each Party (as "**Indemnifying Party**") shall indemnify, hold harmless, and defend the other Party and its managers, officers, directors, employees, agents, affiliates, successors, and permitted assigns (collectively, "**Indemnified Party**") against any and all losses, damages, liabilities, deficiencies, claims, actions, judgments, settlements, interest, awards, penalties, fines, costs, or expenses of whatever kind, including professional fees and reasonable attorneys' fees, that are incurred by Indemnified Party (collectively, "**Losses**"), arising out of any third-party claim alleging:

(a) any negligent or more culpable act or omission of Indemnifying Party (including any reckless or willful misconduct) in connection with the performance of its obligations under this Agreement;

(b) any bodily injury, death of any person, or damage to real or tangible personal property caused by the negligent or more culpable acts or omissions of Indemnifying Party (including any reckless or willful misconduct); or

(c) any failure by Indemnifying Party to materially comply with any applicable federal, state, or local laws, regulations, or codes in the performance of its obligations under this Agreement.

7.2 Notwithstanding anything to the contrary in this Agreement, Indemnifying Party is not obligated to indemnify, hold harmless, or defend Indemnified Party against any claim (whether direct or indirect) to the extent such claim or corresponding Losses arise out of or result from Indemnified Party's:

(a) negligence or more culpable act or omission (including recklessness or willful misconduct); or

(b) bad faith failure to comply with any of its material obligations set forth in this Agreement.

8. No Consequential or Indirect Damages

IN NO EVENT SHALL EITHER PARTY OR ANY OF ITS REPRESENTATIVES BE LIABLE UNDER THIS AGREEMENT TO THE OTHER PARTY OR ANY THIRD PARTY FOR CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, PUNITIVE OR ENHANCED DAMAGES, LOST PROFITS OR REVENUES OR DIMINUTION IN VALUE, ARISING OUT OF, OR RELATING TO, AND/OR IN CONNECTION WITH ANY BREACH OF THIS AGREEMENT, REGARDLESS OF (A) WHETHER SUCH DAMAGES WERE FORESEEABLE, (B) WHETHER OR NOT IT WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND (C) THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED.

9. Assignment and Delegation

Neither Party shall assign any of its rights or delegate any of its obligations hereunder without the prior written consent of the other Party; provided, however, that either Party may assign its rights or delegate its obligations, in whole or in part, without such consent and upon 30 days' prior written notice to the other Party, to (a) one or more of its Affiliates, or (b) an entity that acquires all or substantially all of the business or assets of such Party to which this Agreement pertains, whether by merger, reorganization, acquisition, sale, or otherwise. Any purported assignment or delegation in violation of this Section 9 shall be null and void. No assignment or delegation shall relieve the assigning or delegating Party of any of its obligations hereunder unless the non-assigning or non-delegating Party enters into a novation releasing the assigning or delegating Party of its obligation under the Agreement.

10. Relationship of the Parties

10.1 Each Party is an independent contractor with regard to the Alliance. Nothing contained in this Agreement shall be construed as creating any agency, partnership, joint venture or other form of joint enterprise, employment, or fiduciary relationship between the Parties. Neither Party, by virtue of this Agreement, will have any right, power, or authority to act or create an obligation, express or implied, on behalf of the other Party.

10.2 Any Persons employed or engaged by a Party in connection with the Alliance shall be that Party's employees or contractors. Each Party assumes responsibility for the actions of its employees and contractors under this Agreement and will be solely responsible for their supervision, daily direction, and control, wage rates, withholding income taxes, providing unemployment and disability benefits, and the manner and means through which the work under this Agreement will be accomplished.

11. Dispute Resolution.

11.1 Exclusive Dispute Resolution Mechanism. The parties shall resolve any dispute, controversy, or claim arising out of or relating to this Agreement, or the breach, termination or invalidity hereof (each, a "**Dispute**"), under the provisions of Sections 11.2 through Section 11.4. The procedures set forth in Sections 11.2 through 11.4 shall be the exclusive mechanism for resolving any Dispute that may arise from time to time and Sections 11.2 through Section 11.4 are express conditions precedent to binding arbitration of the Dispute.

11.2 Negotiations

(a) A Party shall send written notice to the other Party of any Dispute ("**Dispute Notice**"). The Parties shall first attempt in good faith to resolve any Dispute set forth in the Dispute Notice by negotiation and consultation between themselves, including without limitation, not fewer than two negotiation sessions. In the event that such Dispute is not resolved on an informal basis within 10 Business Days after one party delivers the Dispute Notice to the other party, either party may, by written notice to the other party ("**Escalation to Executive Team Notice**"), refer such Dispute to the Executive Team.

(b) For purposes of clarification, the party sending the Dispute Notice and the Escalation to Executive Team Notice shall send such notices in compliance with this Agreement's notice provisions (Section 18).

(c) If the Executive Team cannot resolve any Dispute during the time period ending 10 Business Days after the date of the Escalation to Executive Team Notice (the last day of such time period, the "**Escalation to Mediation Date**"), either Party may initiate mediation under Section 11.3.

11.3 Mediation.

(a) Subject to Section 11.3(b), the parties may, at any time after the Escalation to Mediation Date, submit the Dispute to any mutually agreed mediation service for mediation by providing to the mediation service a joint, written request for mediation, setting forth the subject of the dispute and the relief requested. The parties shall cooperate with one another in selecting a mediation service, and shall cooperate with the mediation service and with one another in selecting a neutral mediator and in scheduling the mediation proceedings. The Parties shall use commercially reasonable efforts to resolve the Dispute in the mediation. The mediator's fees and expenses and the costs incidental to the mediation will be shared equally between the Parties.

(b) All offers, promises, conduct, and statements, whether oral or written, made in the course of the mediation by any of the Parties, their agents, employees, experts, and attorneys, and by the mediator and any employees of the mediation service, shall be confidential, privileged, and inadmissible for any purpose, including impeachment, in any litigation, arbitration or other proceeding involving the Parties, provided that evidence that is otherwise admissible or discoverable shall not be rendered inadmissible or non-discoverable as a result of its use in the mediation.

11.4 Arbitration as a Final Resort.

(a) If the Parties cannot resolve any Dispute for any reason, including, but not limited to, the failure of either Party to agree to enter into mediation or agree to any settlement proposed by the mediator, within 30 Business Days after the Escalation to Mediation Date, either Party may initiate final and binding arbitration by delivering a notice of arbitration to the other setting out the nature of the claim(s) and the relief requested. Within 30 days of the receipt of the notice of arbitration, the respondent shall deliver to the claimant its answer and any counterclaim(s), setting out the nature of such counterclaims(s) and the relief requested.

(b) The arbitral tribunal shall have the sole power to rule on any challenge to its own jurisdiction and all issues regarding arbitrability shall be decided solely by the arbitral tribunal. The place of arbitration shall be Columbus, Ohio.

(c) The tribunal shall consist of three arbitrators with the initiating Party selecting one in the notice of arbitration and the respondent selecting one in its answer. The arbitrators so selected shall, within 30 days of delivery of the answer, appoint one additional arbitrator who shall act as the chair of the tribunal. If any arbitrators are not selected within this time period, such arbitrator shall be appointed at the request of any Party by the American Arbitration Association.

(d) The tribunal shall make its decisions by a majority or by the chair if no majority is possible. Judgment may be entered upon the award by any court having jurisdiction.

12. Force Majeure.

Neither Party shall be liable or responsible to the other Party, nor be deemed to have defaulted under or breached this Agreement, for any failure or delay in fulfilling or

performing any term of this Agreement, when and to the extent such failure or delay is caused by or results from acts beyond the impacted Party's ("**Impacted Party**") reasonable control, including, without limitation, the following force majeure events ("**Force Majeure Events**"): (a) acts of God; (b) flood, fire, earthquake or explosion; (c) war, invasion, hostilities (whether war is declared or not), terrorist threats or acts, riot or other civil unrest; (d) government order or law; (e) actions, embargoes or blockades in effect on or after the date of this Agreement; (f) action by any Governmental Authority; (g) national or regional emergency; (h) strikes, labor stoppages or slowdowns or other industrial disturbances; and (i) shortage of adequate power or transportation facilities. The Impacted Party shall give notice within 30 days of the Force Majeure Event to the other Party, stating the period of time the occurrence is expected to continue. The Impacted Party shall use diligent efforts to end the failure or delay and ensure the effects of such Force Majeure Event are minimized. The Impacted Party shall resume the performance of its obligations as soon as reasonably practicable after the removal of the cause. In the event that the Impacted Party's failure or delay remains uncured for a period of 180 days following written notice given by it under this Section 12, either Party may thereafter terminate this Agreement upon 30 days' written notice.

13. Term, Termination, and Survival.

13.1 This Agreement shall commence as of the Effective Date and shall continue thereafter for a period of thirty (30) years from the date of completion of the project unless sooner terminated pursuant to Section 13.2 or Section 13.3 ("**Term**"). Notwithstanding the foregoing or anything to the contrary herein, in the event this Agreement, or the Project referenced herein, fails to obtain all necessary Governmental Approvals, this Agreement shall be terminated and neither Party shall have any obligations or liability to the other hereunder. The term of the SREC Agreement is independent of the Term of this Agreement, and any termination of this Agreement for any reason shall have no effect on the SREC Agreement.

13.2 Either Party may terminate this Agreement, effective upon written notice to the other Party (the "**Defaulting Party**") if the Defaulting Party:

- (a) Breaches this Agreement, and such breach is incapable of cure, or with respect to a breach capable of cure, the Defaulting Party does not cure such breach within 30 days after receipt of written notice of such breach.
- (b) Becomes insolvent or admits its inability to pay its debts generally as they become due.
- (c) Becomes subject, voluntarily or involuntarily, to any proceeding under any domestic or foreign bankruptcy or insolvency law, which is not fully stayed within seven days or is not dismissed or vacated within 45 days after filing.
- (d) Is dissolved or liquidated or takes any corporate action for such purpose.
- (e) Makes a general assignment for the benefit of creditors

(f) Has a receiver, trustee, custodian, or similar agent appointed by order of any court of competent jurisdiction to take charge of or sell any material portion of its property or business.

13.3 The rights and obligations of the Parties set forth in Sections 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, and any right or obligation of the Parties in this Agreement which, by its nature, should survive termination or expiration of this Agreement, will survive any such termination or expiration of this Agreement.

14. Severability.

If any term or provision of this Agreement is invalid, illegal or unenforceable in any jurisdiction, such invalidity, illegality or unenforceability shall not affect any other term or provision of this Agreement or invalidate or render unenforceable such term or provision in any other jurisdiction. Upon a determination that any term or provision is invalid, illegal or unenforceable, the Parties shall negotiate in good faith to modify this Agreement to effect the original intent of the Parties as closely as possible in order that the transactions contemplated hereby be consummated as originally contemplated to the greatest extent possible.

15. Waiver.

No waiver by either Party of any of the provisions hereof shall be effective unless explicitly set forth in writing and signed by the Party so waiving. No waiver by either Party shall operate or be construed as a waiver in respect of any failure, breach, or default not expressly identified by such written waiver, whether of a similar or different character, and whether occurring before or after that waiver. No failure to exercise, or delay in exercising, any right, remedy, power, or privilege arising from this Agreement shall operate or be construed as a waiver thereof, nor shall any single or partial exercise of any right, remedy, power, or privilege hereunder preclude any other or further exercise thereof or the exercise of any other right, remedy, power, or privilege.

16. Entire Agreement.

This Agreement, together with the SREC Agreement, constitutes the sole and entire agreement of the Parties with respect to the subject matter of this Agreement and the SREC Agreement, and supersedes all prior and contemporaneous understandings, agreements, representations, and warranties, both written and oral, with respect to the subject matter. In the event of an inconsistency between the terms of the SREC Agreement and the terms of this Agreement, the terms of the SREC Agreement shall control.

17. No Oral Amendments.

No amendment to this Agreement is effective unless it is in writing and signed by an authorized representative of each Party.

18. Notice.

Each Party shall deliver all notices, requests, consents, claims, demands, waivers, and other communications under this Agreement (each, a "**Notice**") in writing and addressed to the other Party at the addresses set forth on Exhibit B (or to such other address that the receiving Party may designate from time to time in accordance with this section). Each Party shall deliver all Notices by personal delivery, nationally recognized overnight courier (with all fees prepaid), or email (with confirmation of transmission), or certified or registered mail (in each case, return receipt requested, postage prepaid). Except as otherwise provided in this Agreement, a Notice is effective only (a) upon receipt by the receiving party and (b) if the party giving the Notice has complied with the requirements of this Section.


19. Choice of Law.

This Agreement and all matters arising out of or relating to this Agreement, whether sounding in contract, tort, or statute are governed by, and construed in accordance with, the laws of the State of Indiana, without giving effect to the conflict of laws provisions thereof to the extent such principles or rules would require or permit the application of the laws of any jurisdiction other than those of the State of Indiana.

[SIGNATURE PAGE FOLLOWS]

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement as of the date set forth above.

INDIANA MICHIGAN POWER COMPANY

By 
Name Toby Thomas
Title: President

UNIVERSITY OF NOTRE DAME DU LAC


By 
Name: DOUG MARSH
Title: VP FDO

EXHIBIT A
SREC AGREEMENT

See attached

EXHIBIT B
NOTICE ADDRESSES

Indiana Michigan Power Company
110 E. Wayne Street
Fort Wayne, IN 46802
Attention: David A. Lucas, Vice President Finance & Customer Experience

American Electric Power
1 Riverside Plaza, 29th Floor
Columbus, OH 43215
Attention: Patricia Castro, Senior Counsel

University of Notre Dame
Utilities Department
100 Facilities Building
Notre Dame, IN 46556
Attention: Paul A. Kempf, Asst. Vice President of Utilities & Maintenance

University of Notre Dame
Facilities Design & Operations
200 Facilities Building
Notre Dame, IN 46556
Attention: Doug Marsh, Vice President Facilities Design & Operations

University of Notre Dame
Office of General Counsel
231 Main Building
Notre Dame, IN 46556
Attention: John Lloyd Associate General Counsel

**EXHIBIT A
FORM OF SREC AGREEMENT**

**PURCHASE AND SALE AGREEMENT FOR RENEWABLE ENERGY CREDITS
TRANSACTION CONFIRMATION**

CONFIRMATION DATE: July 15, 2019

TO: The University of Notre Dame du Lac

This Confirmation confirms the terms of the agreement made between The University of Notre Dame du Lac ("**Buyer**") and Indiana Michigan Power Company ("**Seller**") as of the Effective Date (the "**Transaction**"). Seller and Buyer are each referred to as a "**Party**" and, collectively, as the "**Parties**." This Confirmation, including the attached General Terms and Conditions and Annex A, shall constitute the entire agreement ("**Agreement**") between the Parties related to the subject matter hereof and supersedes and replaces any prior oral or written confirmation, including broker confirmations, regarding this Transaction

Subject to any Governmental Approval, the terms of the Transaction to which this Confirmation relates are as follows:

Seller	Indiana Michigan Power Company
Buyer:	The University of Notre Dame du Lac
Product:	Solar Renewable Energy Credits (" RECs ") generated from the Designated System.
Designated System:	Seller's ground mounted, inverter-based solar photovoltaic generation facility system located in South Bend, Indiana, St. Joseph County as identified similarly through its registration at PJM EIS GATS and that has an expected total system size of 20MW AC (the "Designated System" or the "South Bend Project").
Vintage	Compliance Years 2021 – 2050 (or such applicable compliance years to cover 30 years from completion of the project)

EXHIBIT A
FORM OF SREC AGREEMENT

Contract Quantity	<p>40% of the total RECs generated by the Unit during each Compliance Year beginning in 2021 through 2050, on a Unit Contingent basis.</p> <p>“Designated System Contingent” means Seller’s obligation to Deliver the RECs may be excused only on account of the failure of the Designated System to generate such RECs during the applicable Compliance Year, despite Seller’s diligent, commercial reasonable efforts if the Designated System is unavailable as a result of, or related to, (i) planned outages scheduled, noticed and permitted by this Agreement, (ii) forced outages, (iii) to the extent caused by, arising from or related to an event of force majeure, or (iv) any failure or derating of Designated System equipment which is not caused by failure to operate the Designated System in accordance with prudent industry practice or by the negligent acts or omissions of Seller or its contractors or agents (an “Equipment Failure”), provided, however, that Seller shall use commercially reasonable efforts, consistent with prudent industry practice, to mitigate the effects of such Equipment Failure by repairing or replacing such Facility equipment within a reasonable period following such Equipment Failure. In any of such events, Seller shall not be liable to Buyer for any damages. For the avoidance of doubt, economic shutdown is not an excused event.</p>
Contract Price	<p>The average of the New Jersey Class 1 REC price during the Compliance Year in which the RECs were produced, plus a twenty percent (20%) administrative fee for such RECs effectively Transferred by Seller. If the REC product index price referenced above is no longer available or the state of Indiana adopts a Renewable Portfolio Standard that includes solar, wind, hydro, and other renewables, the Seller and Buyer will mutually agree on a market based REC price index as a replacement for establishing a corresponding rate.</p>
Delivery and Transfer:	<p>Seller shall effect Transfer and Delivery of the RECs through Seller’s retirement of RECs on behalf of Buyer on an annual basis in the year following the Compliance Year but no later than June 15th following the Compliance Year.</p>
Tracking System	<p>PJM EIS GATS</p>

**EXHIBIT A
FORM OF SREC AGREEMENT**

Payment:	POST-TRANSFER. Within three (3) Business Days of the later of (a) the date the Buyer receives written, facsimile or electronic notification from Seller to Buyer that Transfer of the RECs have been confirmed from Seller to Buyer, as indicated on the PJM EIS GATS and (b) the date Buyer receives an invoice from Seller reflecting the total amount due Seller for such RECs at the Contract Price, then Buyer shall pay for such RECs in full.
Section 24: Financial Responsibility	<input checked="" type="checkbox"/> Financial Responsibility applicable. If not checked, inapplicable.
Seller's Account Information for Payments:	Name on Account: Indiana Michigan Power Co – Gen Bank: City Bank N.A. ABA Number: [REDACTED] Account Number: [REDACTED] Branch: New York Swift Code: [REDACTED] Bank Contact: [REDACTED] Phone No.: [REDACTED]
Buyer's Tracking System Account Information:	Account Name: University of Notre Dame Account Administrator: Paul Kempf, Asst. VP of Utilities & Maintenance
Seller's Contact Information:	<u>Non-Invoice:</u> Indiana Michigan Power 110 E. Wayne Street Fort Wayne, IN 46802 Attention: David A. Lucas, Vice President Finance & Customer Experience American Electric Power 1 Riverside Plaza, 29 th Floor Columbus, OH 43215 Attention: Patricia Castro, Senior Counsel <u>Invoice:</u> Indiana Michigan Power 110 E. Wayne Street Fort Wayne, IN 46802 Attention: Bill King, Director of Business Operations

**EXHIBIT A
FORM OF SREC AGREEMENT**

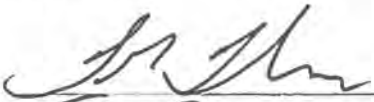
Buyer's Contact Information:	<p><u>Non-Invoice:</u> University of Notre Dame Utilities Department 100 Facilities Building Notre Dame, IN 46556-5689 Attn: Contract Administration – Asst. VP of Utilities & Maintenance Phone: 574-631-6594 Email: pkempf@nd.edu</p> <p>Also please cc: University of Notre Dame Facilities Design & Operations 200 Facilities Building Notre Dame, IN 46556-5689 Attn: VP of Facilities Design & Operations Phone: 574-631-4200</p> <p>University of Notre Dame Office of the General Counsel 203 Main Building Notre Dame, IN 46556 Phone: 574-631-6411 Email: gencoun@nd.edu</p> <p><u>Invoice:</u> University of Notre Dame Utilities Department 100 Facilities Building Notre Dame IN 46556-5689 Attn: Settlements Phone: 574-631-6594 Email: pkempf@nd.edu</p>
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**EXHIBIT A
FORM OF SREC AGREEMENT**


Capitalized terms used but not defined herein shall have the meaning given to them in the attached General Terms and Conditions and Annex A.

This Confirmation memorializes a verbal agreement between the Parties by reference part of and subject to the terms and conditions of the attached General Terms and Conditions and Annex A.

**INDIANA MICHIGAN POWER
COMPANY**

By: 
Name: Toby Thomas
Title: President
Date: 8/9/2019

**THE UNIVERSITY OF NOTRE DAME
du Lac**

By: 
Name: DOUG MARSH
Title: VP FDO
Date: 7/15/19

PURCHASE AND SALE AGREEMENT FOR RENEWABLE ENERGY CREDITS
GENERAL TERMS AND CONDITIONS

1. DEFINITIONS

1.1 **Definitions.** In addition to any other terms defined in the Confirmation or these General Terms and Conditions, the following terms shall have the meaning ascribed to them as set forth below:

"Business Day" means a day on which Federal Reserve member banks in New York City, New York are open for business. A Business Day shall begin at 8:00 a.m. and close at 5:00 p.m. Eastern Prevailing Time ("EPT").

"Compliance Year" or **"CY"** means: the calendar year in which the RECs are generated (for example Compliance Year 2019 is associated with generation from January 1 – December 31, 2019).

"Confidential Information" means all oral and written information exchanged between the Parties relative to the subject matter of this Agreement, including but not limited to the price, and all other material terms hereof. Notwithstanding the foregoing, the following shall not constitute Confidential Information for purposes of this Agreement: (i) information that is or becomes generally available to the public other than as a result of a disclosure by either Party in violation of this Agreement; (ii) information that was already known by either Party on a non-confidential basis prior to the execution of this Agreement; (iii) information which is obtained from a third person who, insofar as is known to the Party, is not prohibited from transmitting the information to the Party by a contractual, legal or fiduciary obligation to the other Party; (iv) information a Party is required to disclose in connection with obtaining any Government Approval; and (v) if applicable, information provided on the Attestation forms provided from Seller to Buyer.

"Costs" means, with respect to the Non-Defaulting Party, brokerage fees, commissions and other similar third party transaction costs and expenses reasonably incurred by such Party either in terminating any arrangement pursuant to which it has hedged its obligations or entering into new arrangements which replace this Agreement (or Tranche Transaction), and all reasonable attorneys' fees and expenses incurred by the Non-Defaulting in connection with the termination of this Agreement or a Tranche Termination.

"Effective Date" means the date on which the Parties execute this Agreement.

"Governmental Approvals" means any approval required by a Governmental Authority.

"Governmental Authority" means any federal, state, county, municipal, or local government or any political subdivision thereof, or any other governmental, quasi-governmental, executive, legislative, administrative, regulatory, judicial, public, or statutory department, body, instrumentality, agency, ministry, court, commission, bureau, board, or other governmental

authority or regional transmission organization having jurisdiction over all or any portion of the this Agreement or a Party (in connection with this Agreement).

“MWh” means Megawatt-hour.

1.2 Definitions applicable to PJM GATS REC Transfers.

“Certificate” means an electronic record produced by the PJM GATS that identifies the relevant generation attributes of each MWh accounted for in the PJM GATS.

“PJM” means PJM Interconnection, L.L.C.

“PJM EIS GATS” means the Generation Attribute Tracking System used by PJM to account for the generation attributes of facilities.

“RECs” or “Renewable Energy Credits” means Certificates, but does not include the energy associated with such RECs.

“Transfer” means when PJM EIS GATS posts the recordation of the transfer of RECs from Seller’s PJM EIS GATS account to the PJM EIS GATS account of the Buyer, or when PJM GATS posts or confirms the recordation of the retirement of RECs by Seller on behalf of Buyer.

2. **PAYMENT, TRANSFER, AND TITLE**

2.1 Payment. The Contract Price shall be paid in accordance with the method identified in the Confirmation. All funds to be paid directly to Seller under this Agreement shall be rendered in the form of immediately available funds (United States dollars) by wire transfer to, or in such other form as reasonably requested by Seller.

2.2 Transfer. Seller shall effect Transfer and Delivery of the Contract Quantity to Buyer in accordance with the method identified in the Confirmation, whereupon title to and interest in such RECs shall transfer to Buyer. Upon notice by the applicable tracking system that any Delivery contemplated by this Agreement will not be recorded, the Parties shall promptly confer and shall cooperate in taking all reasonable actions necessary to cure any defects in the proper Transfer, so that the Transfer can be recorded.

2.3 Taxes. Each Party shall pay any taxes or other fees that are associated with its respective purchase or sale of the RECs as described herein.

2.4 Term. This Agreement shall be effective on and as of the Effective Date and shall terminate upon satisfaction by Buyer and Seller of their respective obligations pursuant to this Agreement. Notwithstanding the foregoing or anything to the contrary herein, in the event this Agreement, or the referenced South Bend Project, fails to obtain all necessary Governmental Approvals, this Agreement shall be terminated and neither Party shall have any obligations or liability to the other hereunder.

3. WARRANTIES OF SELLER

Seller hereby warrants to Buyer that, at the time of the execution of this Agreement and subsequently upon the Delivery of the RECs: (i) Seller will convey good title to the RECs to Buyer free and clear of any liens or other encumbrances or title defects, and (ii) Seller has not otherwise sold to any other person or entity, retired for its own benefit, or represented as a part of any energy sale for the RECs to Transfer to Buyer. Seller further warrants that at the time of the execution of this Agreement and upon Delivery of the RECs hereunder, the RECs comply with the technical specifications and relevant codes, laws, and regulations as set forth in the Confirmation. THE FOREGOING WARRANTY IS EXCLUSIVE, AND SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE RECS TO TRANSFER TO BUYER HEREUNDER, WHETHER AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTER. This Section 3 shall survive the expiration or termination of this Agreement.

4. MUTUAL REPRESENTATIONS AND WARRANTIES

Each Party hereby warrants that the person signing this Agreement on behalf of such Party is legally authorized to obligate the Party. Each Party further represents and warrants that it has and will maintain all legal and regulatory authorizations necessary to perform its obligations under this Agreement. Each Party hereby warrants that there is no pending or threatened litigation, arbitration, or administrative proceeding that materially adversely affects such Party's ability to perform its obligations under this Agreement.

5. LIMITATION OF LIABILITY

5.1 No Indirect Damages. FOR BREACH OF ANY PROVISION OF THIS AGREEMENT, EACH PARTY'S LIABILITY SHALL BE LIMITED TO DIRECT, ACTUAL DAMAGES ONLY AS DETERMINED IN ACCORDANCE WITH SECTIONS 7 AND 8, AND SUCH DIRECT, ACTUAL DAMAGES SHALL BE THE SOLE AND EXCLUSIVE REMEDY HEREUNDER, AND ALL OTHER REMEDIES OR DAMAGES ARE WAIVED. IN NO EVENT SHALL EITHER PARTY BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, PUNITIVE, EXEMPLARY, OR INDIRECT DAMAGES, IN TORT, CONTRACT OR OTHERWISE.

5.2 Survival. This Section 5 shall survive the expiration or termination of this Agreement

6. EVENTS OF DEFAULT

A Party is in default hereunder if that Party (the "Defaulting Party") does any of the following (each an "Event of Default"):

- (i) the failure by a Party to make, when due, any payment required under this Agreement if such failure is not remedied within three (3) Business Days after written notice of such failure is given to such Party; or

- (ii) any representation or warranty made by a Party in this Agreement shall prove to have been false or misleading in any material respect when made; or
- (iii) the failure by a Party to perform any covenant or agreement set forth in this Agreement (other than its obligations to make any payment or obligations which are otherwise specifically covered as a separate Event of Default), and such failure is not cured within ten (10) Business Days after written notice thereof to such Party; or
- (iv) if a Party shall:
 - (a) make an assignment or any general arrangement for the benefit of creditors,
 - (b) file a petition or otherwise commence, authorize or acquiesce in the commencement of a proceeding or cause under any bankruptcy or similar law for the protection of creditors, or have such petition filed against it,
 - (c) otherwise become bankrupt or insolvent (however evidenced), or
 - (d) be unable to pay its debts as they fall due; or
- (v) the guaranty of a Party's guarantor, if any, shall expire or be terminated or shall cease to guarantee the obligations of such party hereunder, or such guarantor shall become subject to any of the events specified in Section 6(iv) above; or
- (vi) the failure by a Party to provide Performance Assurance pursuant to Section 24.2, if applicable.

7. REMEDIES UPON DEFAULT

If an Event of Default occurs with respect to a Party at any time during the term of this Agreement, and subject to the cure period identified in Section 6, the other Party (the "**Notifying Party**") may (a) upon two (2) Business Days' written notice to the Defaulting Party terminate this Agreement, (b) upon two (2) Business Days' written notice to the Defaulting Party withhold any payments due in respect of this Agreement to the extent of its damages pursuant to Section 5 of this Agreement, and (c) exercise such other remedies as may be available at law or in equity or as otherwise provided in this Agreement; provided, upon the occurrence of any Event of Default listed in Section 6(iv) above as it may apply to any Party, this Agreement shall automatically terminate, without notice, immediately upon such event.

8. BUYER'S AND SELLER'S LIABILITY

8.1 Buyer's Liability. In the event Buyer causes or suffers an Event of Default and Seller elects to terminate this Agreement, then Buyer shall pay Seller termination damages equal to the sum of (a) the price for any RECs delivered to Buyer for which Seller has not been paid, if any, plus (b) the excess, if any, of (i) the aggregate price for all remaining RECs to be delivered during the compliance period of this Agreement at a fixed price of \$10/Mwh over (ii) the aggregate amount for which Seller is forecasted to be able to sell the remaining RECs to be delivered during the compliance period of this Agreement. The forecasted market price for future RECs as of the date of termination are to be determined based upon the average of forecasted

prices for PJM Class 1 RECs quoted by three independent third party brokerage services selected by Seller and reasonably acceptable to Buyer plus (c) reasonable Seller's Costs.

8.2 Seller's Liability. In the event Seller causes or suffers an Event of Default and Buyer elects to terminate this Agreement, then Seller shall pay Buyer termination damages in an amount equal to (i) the price for any REC's produced but not delivered to Buyer prior to the date termination at the Contract Price; plus (ii) the forecasted amount of REC's to be delivered in the period twelve (12) after the termination date at a fixed price of \$10/Mwh, plus (iii) reasonable Buyer's costs.

8.3 No Penalty. Both Parties hereby stipulate that the payment obligations set forth above are reasonable in light of the anticipated harm and the difficulty of estimation or calculation of actual damages, and each Party hereby waives the right to contest such payments as an unreasonable penalty.

9. PAST DUE PAYMENTS

All overdue payments shall bear interest from, and including, the specified due date to, but excluding, the date of payment at a rate equal to the lesser of two percent (2%) over the "**Prime Rate**", which shall be the per annum rate of interest equal to the prime lending rate as may from time to time be published in *The Wall Street Journal* under "**Money Rates**" or the maximum rates allowed by law; provided, the interest rate shall never exceed the maximum lawful rate permitted by applicable law.

10. ASSIGNMENT

This Agreement is not assignable by either Party, except as provided herein, without the prior written approval of the non-assigning Party, which consent shall not be unreasonably withheld or delayed. Any assignment without the written approval of the non-assigning Party, except as provided herein, is voidable by the non-assigning Party.

11. NON-DISCLOSURE OF CONFIDENTIAL INFORMATION

Except as provided in this Section, neither Party shall publish, disclose, or otherwise divulge the Confidential Information to any person, at any time during or after the term of this Agreement, without the other Party's prior express written consent. Each Party shall permit knowledge of and access to the Confidential Information only to those of its corporate affiliates, attorneys, accountants, representatives, principals, officers, directors, agents, and employees who have a need to know related to this Agreement.

If required by any law, statute, ordinance, decision, order, or regulation passed, adopted, issued or promulgated by a court, any governmental agency or authority having jurisdiction over a Party, such Party may release the Confidential Information, or a portion thereof, to such court, governmental agency or authority, as required by law, statute, ordinance, decision, order or regulation or action and a Party may disclose Confidential Information to accountants in connection with audits, provided that such Party has used its reasonable efforts to cause that

court, governmental agency or authority or accountants to treat such information in a confidential manner and to prevent such information from being disclosed or otherwise becoming part of the public domain.

In performing their obligations under this Agreement, the Parties shall employ procedures established to prevent unauthorized disclosure or use of the Confidential Information. Such procedures shall be no less restrictive than the procedures used by each Party to protect its own confidential data.

This Section shall survive for a period of one (1) year following the expiration or termination of this Agreement.

12. NO AMENDMENT

This Agreement may not be amended, changed, modified, or altered unless such amendment, change, modification, or alteration is in writing and signed by both of the Parties to this Agreement or their successors in interest.

13. SEVERABILITY

If any article, phrase, provision or portion of this Agreement is, for any reason, held or adjudged to be invalid, illegal or unenforceable by any court of competent jurisdiction, such article, phrase, provision, or portion so adjudged will be deemed separate, distinct and independent and the remainder of this Agreement will be and remain in full force and effect and will not be invalidated or rendered illegal or unenforceable or otherwise affected by such adjudication, provided the basic purposes of this Agreement and the benefits to the Parties are not substantially impaired.

14. COUNTERPARTS

This Agreement may be executed in several counterparts, including facsimile, each of which is an original and all of which constitute one and the same instrument.

15. WAIVER

No delay or omission by a Party in the exercise of any right under this Agreement shall be taken, construed, or considered as a waiver or relinquishment thereof, and any such right may be exercised from time to time and as often as may be deemed expedient. If any of the terms and conditions herein are breached and thereafter waived by a Party, such waiver is limited to the particular breach so waived and is not deemed to waive any other breach hereunder.

16. GOVERNING LAW

This Agreement is governed by and construed in accordance with the laws of the State of Indiana. The Parties agree that, to the maximum extent possible under applicable law, no provision of Article 2 of the Uniform Commercial Code (as in effect from time to time in the

State of Indiana), that is inconsistent with any provision of this Agreement shall apply to this Agreement. The Parties agree that any transaction entered into pursuant to this Agreement is a "qualified financial contract" within the meaning of Indiana Code 27-9-3.1-7. THE PARTIES HEREBY WAIVE THE RIGHT TO ANY TRIAL BY JURY ASSOCIATED WITH ANY DISPUTE ARISING UNDER THIS AGREEMENT

17. NOTICES

All notices, certificates, or other communications hereunder shall be in writing. All written notices are deemed sufficiently given when mailed by United States certified mail, return receipt requested or by recognized overnight courier service, postage prepaid, or hand-delivered, or sent by facsimile transmission, if the original communication is delivered by recognized overnight courier service, and shall be effective when received. For purposes hereof, notices, demands and other communications shall be sent to the names and addresses listed in the Confirmation (or such other address as the Seller or Buyer shall have furnished to the other Party in writing).

18. ENTIRE AGREEMENT

This Agreement constitutes the entire agreement of the Parties with respect to the subject matter hereof, and supersedes all other prior understandings or agreements, both written and oral, between the Parties relating to the subject matter hereof

19. HEADINGS

The Article and paragraph titles in this Agreement are only for purposes of convenience and do not form a part of this Agreement and will not be taken to qualify, explain, or affect any provision thereof.

20. FORWARD CONTRACT

This transaction constitutes a "forward contract" and each Party represents and warrants that it is a "forward contract merchant" within the meaning of the United States Bankruptcy Code.

21. INDEMNIFICATION

Subject to Section 5, each Party agrees to indemnify, defend, and hold harmless the other Party, and any of said other Party's affiliates, directors, officers, employees, agents and permitted assigns, from and against all claims, losses, liabilities, damages, judgments, awards fines, penalties, costs, and expenses (including reasonable attorney's fees and disbursements) directly incurred in connection with or directly arising out of: (a) any breach of representation or warranty or failure to perform any covenant or agreement in this Agreement by said Party; or (b) any violation of applicable law, regulation or order by said Party.

22. SETOFFS

Each Party reserves to itself all rights, setoffs, counterclaims, combination of accounts, liens and other remedies and defenses which such Party has or may be entitled to (whether by operation of law or otherwise). The obligations to make payments under this Agreement and/or any other agreement between the Parties may be offset against each other, set-off or recouped therefrom.

23. CHANGE IN LAW

Upon the occurrence of a “**Change In Law Event**” (as defined herein), the Parties will in good faith use commercially reasonable efforts to reform this Agreement in order to give effect to the original intention of the Parties or transfer the RECs to another equivalent program if possible (an “**Alternative Program**”). If the Parties are unable, despite such commercially reasonable efforts, to reform this Agreement or transfer the RECs to an Alternative Program within thirty (30) days following notice by one Party to the other of the Change In Law Event (the “**Thirty Day Period**”), then the Parties shall resolve the matter through binding arbitration in accordance with the following procedures: (i) within five (5) Business Days after the conclusion of the Thirty Day Period (unless such period is mutually extended by the Parties), each of Buyer and Seller shall select an individual who is familiar with the solar industry and renewable portfolio standards to select an arbitrator to resolve the deadlock; (ii) within five (5) Business Days thereafter, the two individuals will select one individual familiar with the solar industry and renewable portfolio standards to act as sole arbitrator (the “**Sole Arbitrator**”) (to the extent that one of the Parties does not select an individual within the requisite time period, the one selected individual shall serve as the Sole Arbitrator), (iii) within five (5) Business Days of selection of the Sole Arbitrator, each Party shall submit a proposed amendment to reform this Agreement to resolve the Change In Law Event to the Sole Arbitrator, and (iv) within five (5) Business Days of the deadline for delivering the proposals, the Sole Arbitrator shall select one of the proposed amendments which the Sole Arbitrator regards as the better proposal to reform this Agreement and upon the Sole Arbitrator’s selection of such proposal this Agreement shall be deemed to be automatically reformed in accordance with that proposed amendment. The decision of the Sole Arbitrator shall be binding and nonappealable. To the extent there are any expenses related to the appointment of the Sole Arbitrator, the Parties shall equally share such expense. For purposes hereof, “**Change In Law Event**” means a change in any statutes, rules, regulations, laws, or any governmental action enacted, amended, granted or revoked that has the effect of changing the Transfer and sale procedures set forth herein such that the Delivery of the RECs becomes impracticable or impossible.

24. FINANCIAL RESPONSIBILITY

24.1 Financial Statements. Each Party agrees to make its annual financial statements available electronically to the other Party through a commercially accessible portal, the instructions for access to be provided when requested. The statements of either Party shall be prepared in accordance with generally accepted accounting principles.

24.2 Performance Assurance. In the event the public credit rating of either Party falls below investment grade at any time during which this Agreement is in effect, that Party (the “**Demanding Party**”) may demand security or assurance of performance in a form and amount reasonably required by it (“**Performance Assurance**”) before further deliveries or payments are made by it under this Agreement. In the event the other Party (the “**Demand Receiving Party**”) shall fail to give the required Performance Assurance within fourteen (14) Business days of the

request by the Demanding Party, that failure shall be an Event of Default of the Demand Receiving Party as described in Section 6(vi) of this Agreement.

24.3 Netting If Buyer and Seller are required to pay any amount on the same day or in the same month under this Agreement and/or any other agreement between the Parties, then such amounts with respect to each Party may be aggregated and the Parties may discharge their obligations to pay through netting, in which case the Party, if any, owing the greater aggregate amount shall pay to the Party owed the difference between the amounts owed. Each Party reserves to itself all rights, setoffs, counterclaims, combination of accounts, liens and other remedies and defenses which such Party has or may be entitled to (whether by operation of law or otherwise). The obligations to make payments under this Agreement and/or any other agreement between the Parties may be offset against each other, set off or recouped therefrom.

PUBLIC VERSION

CONTRACT LETTER

THIS CONTRACT, NO. 03065263X132 (“Contract”) is made this 5th day of August, 2019 (**“Effective Date”**) between American Electric Power Service Corporation, as agent for Indiana Michigan Power Company, an Indiana corporation (**“Owner”**) and White Construction, LLC, an Indiana corporation (**“Contractor”**).

Subject to the terms and conditions hereof, Contractor hereby agrees to furnish all supervision, labor, equipment and specified materials necessary to perform all phases of the Work as set forth and defined in Owner's Scope of Work (defined below) at a 210-acre parcel, located along Bittersweet Road in Granger, Indiana, as more fully described in Contractor's Proposal dated December 14, 2018.

Contractor and Owner agree that the Work will be performed in accordance with:

1. This Contract Letter.
2. Owner's Scope of Work Specification AEP-LC-2672 Revision 13 dated August 2, 2019, including the attached Appendices 1 through 13 and all referenced documents therein, all of which are collectively designated as Exhibit A to the Contract and attached hereto and made a part hereof (collectively referred to as **“Owner's Scope of Work Specification AEP-LC-2672,”** the **“Scope of Work”** or the **“SOW”**).
3. Contractor's Proposal dated December 14, 2018, designated as Exhibit B to the Contract and attached hereto and made a part hereof.

In the event of a conflict among any of the Contract documents, the conflict shall be resolved by interpreting the documents in the following order of priority:

1. This Contract Letter;
2. Exhibit A; then
3. Exhibit B;

PROVIDED THAT, the Parties agree that the “WC AEP South Bend Solar Project Form D: Commercial Exceptions, Deviations, Clarifications FINAL 08/02/19” attached to and modifying Appendix 2 of the SOW shall govern in the event of any conflicts between it and any other terms or conditions in any of the Contract documents.

Pursuant to Section 5.2.1 of the SOW, Contractor shall achieve Substantial Completion of the Work on or before December 31, 2020 and complete all Work on or before April 1, 2021. Contractor's achievement of Substantial Completion no later than December 31, 2020 is a material obligation under this Contract.

AEP CONFIDENTIAL

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In consideration of the performance of the Work by Contractor, Owner agrees to pay Contractor the fixed price, turnkey Contract Price of [REDACTED]
[REDACTED]
[REDACTED] in accordance with the terms of the Contract. Contractor and Owner agree that in the event Contractor's costs increase due directly or indirectly to [REDACTED]
[REDACTED], the Contract Price shall be equitably adjusted in accordance with Article 14.0, Changes in Work and Extra Work, of the AEP General Terms and Conditions for Engineering, Procurement, and Construction Work, as modified as set forth in the Contract.

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be signed by their respective officers thereunto duly authorized on the date set forth below to be effective as of the Effective Date.

AMERICAN ELECTRIC POWER SERVICE CORPORATION, as agent for
INDIANA MICHIGAN POWER COMPANY

DS
PML

DocuSigned by:
nick akins
6605BFAD35FA4FD...

By: _____
Nick Akins
Chairman, President, & CEO

Accepted this date: 8/13/2019 | 9:29 AM EDT

WHITE CONSTRUCTION, LLC

DocuSigned by:
Dave Berthelsen
62848E4CC1F6416...

By: _____
Dave Berthelsen

Full Name: _____

Title: President
8/13/2019 | 6:27 PM EDT

Accepted this date: _____

AEP CONFIDENTIAL

DocuSign Envelope ID: 4502034B-00F3-4FE4-8E7C-E62021C82C8B

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EXHIBIT A

CONTRACT 03065263X132

**AMERICAN ELECTRIC POWER SERVICE CORPORATION
INDIANA MICHIGAN POWER COMPANY
SOUTH BEND SOLAR PROJECT
ENGINEERING PROCUREMENT AND CONSTRUCTION SERVICES**

SPECIFICATION AEP-LC-2672

PUBLIC VERSION



**Indiana Michigan Power Company (I&M)
South Bend Solar Project**

**SCOPE OF WORK ("SOW")
South Bend Solar RFP
RFP No. AEP-LC-2672**

FINAL REVISION 13 DATED AUGUST 2, 2019

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 1 of 30
Final Rev. 13 dated August 2, 2019

Table of Contents

1.0	INTRODUCTION.....	2
2.0	LOCATION.....	2
3.0	DOCUMENTS.....	2
4.0	DESCRIPTION OF WORK	3
4.16	Vegetation Requirements.....	8
5.0	SCHEDULE OF WORK	8
6.0	LIQUIDATED DAMAGES (LDs).....	11
7.0	PROGRESS REPORTING	13
8.0	SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS	14
9.0	GUARANTEES AND WARRANTY	15
10.0	TAXES.....	15
11.0	LABOR INFORMATION [NMA SIGNATORY FACILITIES]	16
12.0	TECHNICAL REPRESENTATIVES	16
13.0	IDENTIFICATION OF CONTRACTOR'S EMPLOYEES.....	17
14.0	CHANGES IN WORK AND EXTRA WORK.....	17
15.0	PAYMENTS TO CONTRACTOR	18
16.0	CONTRACTOR-FURNISHED SERVICES AND FACILITIES	19
17.0	MOBILIZATION AND DEMOBILIZATION.....	20
18.0	CLEANUP AND DISPOSAL OF NON-HAZARDOUS SCRAP AND DEBRIS	21
19.0	OWNER SUPPLIED DOCUMENTS	22
20.0	SHOP DRAWINGS	23
21.0	MATERIAL STORAGE AND HANDLING	23
22.0	PROTECTION OF WORK	24
23.0	DIMENSIONS AND LEVELS	25
24.0	COMPLETION REQUIREMENTS	25
25.0	CONTRACTOR LICENSING REQUIREMENTS	27
26.0	SECURITY REQUIREMENTS.....	28
27.0	OTHER PROJECT REQUIREMENTS.....	28
28.0	NOTICES	29
29.0	QUALITY ASSURANCE / QUALITY CONTROL REQUIREMENTS	29
30.0	INSURANCE	30
31.0	ISNETWORLD	30

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 2 of 30
Final Rev. 13 dated August 2, 2019

1.0 INTRODUCTION

- 1.1 This Scope of Work is for the South Bend Solar Work ("**Work**") to be performed for Indiana Michigan Power Company ("**I&M**" or "**Owner**") at a 210-acre parcel located in Granger, Indiana. The South Bend Solar Work is to include the engineering, procurement, and construction of a 20 MW AC photovoltaic solar power generation facility in Granger, Indiana and interconnect to the 34.5Kv Capital Avenue Distribution Substation on the western side of the project.
- 1.2 This Scope of Work also extends to any additional solar site proposal options Contractor would like to propose. Owner is interested in additional proposals of solar sites within 20 miles of The University of Notre Dame du Lac that would accommodate an 8-20 MW AC solar facility. These options will be considered in addition to the proposals for the Work described in Section 1.1. At a minimum, Contractor must submit a proposal for the Work described in Section 1.1.
- 1.3 The provisions of the Scope of Work shall apply to the Contractor and the Contractor's Subcontractors.

2.0 LOCATION

- 2.1 Owner's Site is located on a 210-acre parcel located along Bittersweet Road in Granger, Indiana (Latitude: 41°43'30.975"N Longitude: 86°6'34.929"W).
- 2.2 All Work shall be performed in accordance with the governing federal, state and local codes, regulations and ordinances that are in force in the jurisdiction where the Owner's property is located and shall be in compliance with applicable industry standards and practices and Owner's procedures, policies and guidelines.
- 2.3 Site visits shall be arranged with Terry Smith at desk phone 260-408-3464, cell phone 260-438-7970 or via email at twsmith@aep.com.

3.0 DOCUMENTS

- 3.1 All Work shall be performed in accordance with the documents listed below.
 - 3.1.1 Contract Letter.
 - 3.1.2 This Scope of Work document for South Bend Solar, Specification Number AEP-LC-2672, Final Revision 13, dated August 2, 2019, and attached Appendices:
 - Appendix 1: Proposal Requirements, Revision 0, dated 10/05/2018;
 - Appendix 2: AEP General Terms and Conditions for Engineering, Procurement, and Construction Work Revision 3, dated 06/14, as modified by the WC_AEP South Bend Solar Form D: Commercial Exceptions, Deviations and Clarifications FINAL 08/02/19 (collectively, referred to as the "**General Terms and Conditions**");
 - Appendix 2-A: Payment Schedule Revision 0 dated August 2, 2019;
 - Appendix 3: Generation Contractor Supplement Safety & Health Requirements, Revision 9, dated 10/02/2017; Pre-Work Hazard Assessment ("**PWHA**") revised 09/24/2018;
 - Appendix 4: Contractor Environmental Requirements Document ("**CERD**"), Revision 2, dated 10/20/2016; and, Environmental Work Compliance Assessment ("**EWCA**"), dated 11/02/2018;
 - Appendix 5: Solar Facility Technical Specification and Design Criteria Rev 3, dated 10/12/2018;
 - Appendix 6: AEP Generation Scheduling Requirements, Revision 9, dated 07/30/2015 ("**GSR**"); AEP Projects Invoicing Requirements revised 04/17/2017;

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 3 of 30
Final Rev. 13 dated August 2, 2019

- Appendix 7: Geotechnical Report, AEP South Bend Solar Project prepared by Terracon Consultants, 12/27/2017;
- Appendix 8: South Bend Solar Farm ALTA Survey;
- Appendix 9: Permit Summary Report Form;
- Appendix 10: Vaisala Solar Client Data Review Form;
- Appendix 11: Power Output (Exhibit G-1) and Energy Performance (Exhibit G-2) Testing Requirements;
- Appendix 12: Form of Limited Notice To Proceed and Form of Notice To Proceed; and
- Appendix 13: Typical Owner Checklist for CTO Walk Down.

3.1.3 Contractor's Proposal.

3.2 In case of conflicts, the documents listed in Section 3.1 are listed in their order of priority. Any conflicts shall be brought to Owner's attention.

3.3 Documents contained, listed and/or referenced herein identify the scope of work, technical requirements, performance requirements and commercial requirements and will become part of the Contract, when executed. It is the Contractor's responsibility to review all documents for this Work and ensure that Contractor is in receipt of all current necessary and applicable documents pertaining to the Work, including drawings and technical specifications, whether or not these documents are provided by Owner, Owner's architect-engineer or other parties.

4.0 DESCRIPTION OF WORK

4.1 Contractor shall conduct a Site visit to review existing field conditions for this Work prior to finalizing a proposal. Requests for Change Orders and associated costs for Extra Work or additional work, required as a direct result of the existing field conditions, will not be accepted or approved by Owner if such existing field conditions could have been reasonably ascertained by a Site visit.

4.2 The Contractor shall provide labor, materials, equipment, tools, services and supervision required to perform the Work shown on the drawings and described in the Scope of Work and subsequent Contract documents including all work and services as may be normally provided and performed for similar work unless specifically excluded in the Contract documents.

4.3 The Work described in this Scope of Work document generally encompasses all the Work to be performed; however, the description is in no way definitive of all the details and tasks which must be performed by the Contractor to fully and properly complete the Work.

4.4 Engineering

Contractor will perform the Work required for the completion of the following:

4.4.1 Design services and engineering to provide a complete set of signed and sealed civil, structural, and electrical drawings, plans, and specifications (collectively, the "**Engineered Documents**"), by a licensed professional engineer registered in the state of Indiana, for (i) zoning, building, utility interconnection, and other permitting; (ii) construction plans, details, and As Built Drawings, and (iii) provide technical support to interpret the Engineered Documents.

4.4.2 Design and engineering for the Facility will conform to Industry Standards and will be consistent with the Contract documents and the manufacturers' specifications for Equipment and will be appropriate for the operation, maintenance, and repair of the Equipment in accordance with the Requirements.

4.4.3 In those states that require a firm to be licensed to practice engineering or surveying, Contractor will furnish Owner with evidence that Contractor holds a current Certificate of Authorization (or its

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 4 of 30
Final Rev. 13 dated August 2, 2019

equivalent) issued by the state licensing authorities for professional engineers and surveyors. Prior to commencing work, Contractor will provide owner with a written list of the names and registration numbers of the engineers and surveyors who will have responsibility for the work or who will sign and seal documents.

4.5 Procurement

Contractor will perform the Work required for the completion of the following:

- 4.5.1 Contractor will procure all Equipment per the GEN 4550 Solar Projects Technical Spec Rev 3.
- 4.5.2 All Equipment will meet the specifications of the GEN 4550 Solar Projects Technical Spec Rev 3.
- 4.5.3 Inverters will comply with UL 1741 and IEEE 1547.
- 4.5.4 Racking will comply with UL standards
 - Fixed – UL 2703
 - Tracking – UL 3703
- 4.5.5 Step-up transformers will have a design life that exceeds the life of the project.
- 4.5.6 Obtain Vendor Warranties with terms as described in GEN 4550 Solar Projects Technical Spec Rev 3.

4.6 Civil and Foundation Construction

Contractor will perform the Work required for the completion of the following:

- 4.6.1 The geotechnical report, necessary for the siting, construction, installation, and operation of the components of Facility in accordance with their designs and the applicable vendor specifications.
- 4.6.2 Any investigation of existing structures on the Site, if any, that is necessary for the siting, construction, installation, and operation of the components of Facility in accordance with their designs and the applicable vendor specifications. All such investigations will be carried out in compliance with the Land Rights Agreement and other Site Information.
- 4.6.3 Structural foundation work for equipment and buildings.
- 4.6.4 Excavation and backfilling as required for subsurface piers, inverter(s), foundations, duct banks (if required), concrete structures (if required) and implementation of the SWPPP.
- 4.6.5 Supply, installation, and implementation/maintenance of erosion control materials in accordance with a SWPPP approved by local AHJ(s).
- 4.6.6 Supply, installation, and implementation/maintenance of all construction storm water pollution prevention measures including:
 - Drawings for Owner and governmental approval.
 - Silt fencing and/or filter socks.
 - Inlet protections.
 - Outlet protections.
 - Hay bales.
 - Construction entrance/exit.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 5 of 30
Final Rev. 13 dated August 2, 2019

- 4.6.7 Grading of the Site to the final elevations as indicated on the drawings. Contractor shall include in the Contract Price an allowance for stripping 6" of topsoil from the site along with minor grading. No allowance for mass grading shall be included in the Contract Price.
- 4.6.8 Maintain grading of Site during construction and excavation to avoid any safety incidents, such as open holes, ruts or other unmarked hazards.
- 4.6.9 Supply and construction of a security fence around the Site as specified in the approved GEN 4550 Solar Projects Technical Spec Rev 3. The fence will be electrically grounded according to Article 250.194 of NEC and will comply with all local permits.
- 4.6.10 Site will include a five (5) acre construction laydown area of which three (3) acres will included 6" aggregate base and the other two (2) acres will include compacted subgrade.
- 4.6.11 Contractor shall include in the Contract Price an allowance for up to 100 6" drain tile repairs and 10,000' of drain tile replacement.

4.7 Module Installation

Contractor will perform the Work as required for the completed installation and interconnection of the Modules as follows:

- 4.7.1 Accept delivery, provide handling and secure storage of the Modules when on Site. Install and interconnect the Modules according to the installation manuals provided by the manufacturer.
- 4.7.2 Ensure proper operation of modules through on-Site testing or by providing Module Flash Test Data reports from the manufacturer prior to module installation. Testing of the installed modules will be performed per the Performance Acceptance Tests.
- 4.7.3 Identify, store, and return substandard Modules to supplier per manufacturer return policy.
- 4.7.4 For ground based projects, all modules will be at least 30" above the ground.

4.8 Inverter Installation

Contractor will perform the Work as required for the completed installation and interconnection of the inverters as follows:

- 4.8.1 Accept delivery, provide handling and secure storage of the inverters when on Site. Install and interconnect the inverters according to the installation manuals provided by the manufacturer.
- 4.8.2 Provide manufacturer testing of inverter(s). Testing and commissioning of the inverter(s) will be performed per the Performance Acceptance Tests.
- 4.8.3 Identify, store, and return substandard inverters to supplier per manufacturer return policy.

4.9 Transformer Installation

Contractor will perform the Work as required for the completed installation and interconnection of the transformers, if applicable, as follows:

- 4.9.1 Accept delivery, provide handling and secure storage of the transformers when on Site. Install and interconnect the transformers according to the installation manuals provided by the manufacturer.
- 4.9.2 Provide manufacturer testing of transformer. Testing and commissioning of transformer will be performed per the Performance Acceptance Tests.
- 4.9.3 Identify, store, and return substandard transformers to supplier per manufacturer return policy.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 6 of 30
Final Rev. 13 dated August 2, 2019

4.10 Racking and Tracker Systems

Contractor will perform the Work required for the complete installation and interconnection of the racking and tracker systems as follows:

- 4.10.1 Supply tracker foundation piles of 20' in length including W6x10.5 and W6x12 widths.
- 4.10.2 Install mounting posts, tracker frames, motors, and controls according to the installation manuals provided by the manufacturer. Racking posts will not be cut due to Site conditions or post refusal unless approved by Owner.
- 4.10.3 Fill all holes, particularly on the tracking torque tubes, to prevent insects from nesting inside the racking system.
- 4.10.4 Provide AC wiring to tracker motors and motor controls according to the installation manuals provided by the manufacturer.
- 4.10.5 Test racking systems for proper operation and with weather monitoring systems, data aggregation and alarms when tracking systems is used.

4.11 Instrumentation and Control

Contractor will perform the Work required for the complete installation and interconnection of the following:

- 4.11.1 Plant controller shall be built to the Control System Requirements in the GEN 4550 Solar Projects Technical Spec Rev 3.
- 4.11.2 Other Instrumentation and Controls: Provide the plans and specifications, and install, interconnect, test, and calibrate systems per the manufacturer's recommendations.
- 4.11.3 Data from all Major Equipment, including but not limited to inverters with string level information, trackers (if applicable), meter, weather station, and transformers, will be routed to the RTU
- 4.11.4 Meteorological station shall meet the requirements described in the GEN 4550 Solar Projects Technical Spec Rev 3.
- 4.11.5 Owner will install revenue accuracy type metering off Site at the POI. Contractor to provide a check metering system with all necessary equipment to include fused potential transformers, current transformers and digital meter to facilitate measurement of the power flow (MW, MVAR), power factor, voltage, and current on a total and per phase basis.
- 4.11.6 Contractor shall install fiber for communications to/from inverters and SCADA.

4.12 Construction of Other Components of the Facility

Contractor will perform the Work as required for the completed installation and interconnection of the following:

- 4.12.2 For ground based systems, Owner-approved gravel or low-growth seed mix by hydro seeding or hay mulching will be applied to the Site after adequately preparing the Site by spraying the Site with the use of a non-selective herbicide, clearing the dead materials, regrading as necessary, and ensuring the proper soil pH.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 7 of 30
Final Rev. 13 dated August 2, 2019

4.13 Electrical Interconnection and Construction

Contractor will perform the Work required in order to complete the following:

- 4.13.1 Contractor will perform the Work required to interconnect the Facility with the POI or PCC.
- 4.13.2 Contractor interconnection scope includes a relay protection system, consisting of a pole-mounted recloser with relay controls per AEP specifications, a pole-mounted gang operated air break switch and a pole for AEP's metering PTs and CTs. This equipment shall be located on the project Site.
- 4.13.3 Owner will install revenue accuracy type metering off-Site at the POI. Contractor to provide a check metering system with all necessary equipment to include fused potential transformers, current transformers and digital meter to facilitate measurement of the power flow (MW, MVAR), power factor, voltage, and current on a total and per phase basis.

- 4.13.4 Contractor will perform the electrical Work required for the completed installation and interconnection of the following equipment:

- Modules
- Inverters
- Tracking systems
- Combiner boxes
- Transformers
- Balance of plant
- Contractor will furnish and install a protection system, including: overcurrent events, anti-islanding, lightning protection, and event recording.
- Contractor will furnish and install the communication system, including installation and termination of approved communications network.
- Contractor will furnish and install a ground grid system and install final connection of all grounding to transformers, buildings, structures, lightning protection leads, and equipment to the grid.
- All electrical enclosures will be at least 36 inches above grade if not pad-mounted.
- All underground cable will be contained in conduit. Direct-buried cable is not acceptable.
- All conduit above ground will be at least schedule 80.
- All open conduit will be filled.
- A single conduit is included to contain both PV homerun cables.
- All conductors above ground will be protected against physical damage in accordance to Article 230.50(B) of the NEC.
- DC wiring will be contained in a wire loom where exposed directly to the sun.
- DC conductors in the array will be installed within the racking system where possible. DC conductors which connect to adjacent racks will be attached to the modules or the racking system.
- Contractor will furnish and install appropriate surge protection where applicable.
- Freeze protection: If necessary, Contractor will furnish and install freeze protection.
- Cathodic protection: Contractor will furnish and install a cathodic protection system sufficient to mitigate galvanic corrosion. A passive cathodic protection system will be achieved through galvanization of piles.

4.14 Testing, Commissioning, and Startup

- 4.14.1 At least ten (10) days before the anticipated Substantial Completion Date, Contractor will notify Owner of the anticipated Substantial Completion Date.
- 4.14.2 Contractor will carry out all testing as required to show Site operation and compliance with performance requirements.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 8 of 30
Final Rev. 13 dated August 2, 2019

- 4.14.3 Contractor will carry out startup and commissioning to show compliance with local utility POI PCC requirements.

4.15 Interconnection

Contractor will perform the Work required for the complete installation and interconnection of the following:

- 4.15.1 Contractor shall provide confirmation that the PV systems will be designed to comply with applicable Owner interconnection requirements.
- 4.15.2 The Contractor shall coordinate with Owner to ensure that the project satisfies all criteria to interconnect the project to Owner's 34.5Kv Capital Avenue Substation system. This includes coordinating all negotiations, meetings with Owner, design reviews, and participating in any needed interaction between Owner.
- 4.15.3 The Contractor shall manage interconnection and startup of project in coordination with the Owner. The Contractor shall, at its own expense, pay any interconnection, processing, and other fees and expenses as may be required by OWNER for interconnection and operation of the project.

4.16 Vegetation Requirements

- 4.16.1 The Site shall be seeded with a low mow seed mix between/under the solar panels that only requires a mow once a year and obstructs invasive vegetation/weeds. The Site shall be seeded with a native habitat seed mix that consists of grasses, forbs and legumes in the common areas of the Site to provide aesthetic & ecosystem benefit.

5.0 SCHEDULE OF WORK

5.1 Notices to Proceed

- 5.1.1 Owner shall issue a limited notice to proceed ("**Limited Notice To Proceed**" or "**LNTP**") for the Preliminary Work (as defined below) in the form of Appendix 12, attached hereto, within five (5) Business Days of executing the Contract.

5.1.1.1 The "**Preliminary Work**" shall be limited to Contractor executing an agreement, with terms reasonably satisfactory to Contractor, with First Solar, Inc. ("**First Solar**") for the supply of the applicable First Solar FS-6/430w Series 6 thin film solar modules pursuant to Option 4 of the Bidder's Response Summary for the Project, incorporated herein by reference ("**Module Supply Agreement**"), which Module Supply Agreement shall include in its terms and conditions the following: (a) incorporate the requirements as provided in Section 9.2 under this SOW, (b) provide Contractor with the unconditional right to assign the Module Supply Agreement to Owner or any of Owner's affiliates, (c) contain commercially reasonable optionality regarding the defined delivery point without the incurrence of any additional costs, (d) provide Contractor with the right to terminate the Module Supply Agreement in the event Owner does not receive final approval from the Indiana Utility Regulatory Commission ("**IURC**") for the Project on or before 04/30/2020, and (e) have a deposit value of approximately [REDACTED] ("**LNTP Payment**"), which represents ten percent (10%) of the total Module Supply Agreement contract value. Upon Contractor's receipt of the LNTP Payment, Contractor shall provide Owner with an unredacted copy of the executed Module Supply Agreement.

5.1.1.2 If this Contract is terminated pursuant to Section 5.1.2 below prior to Owner issuing the Notice To Proceed, then Owner may at its sole discretion elect any one of the following remedies in connection with the Preliminary Work:

- (a) Owner may elect to have Contractor cause the Module Supply Agreement to be assigned to Owner or an affiliate of Owner and Owner or Owner's affiliate shall then assume the rights and

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 9 of 30
Final Rev. 13 dated August 2, 2019

obligations under the Module Supply Agreement and Contractor shall have no further obligations or liability under it; or

- (b) Owner may elect to give Contractor the option to reimburse Owner the amount of the LNTP Payment plus interest at the Contract Interest Rate, and such payment by Contractor to Owner shall be due thirty (30) days from receipt of Owner's notice of election. Contractor shall retain all further rights and obligations under the Module Supply Agreement, and neither party shall have any further rights or obligations under this Contract except for such obligations that have arisen prior to the termination date. Should Contractor not elect this option, then Owner shall be required to elect subpart (a) above.

5.1.2 Owner shall issue a notice to proceed ("**Notice To Proceed**" or "**NTP**") for the Work in the form of Appendix 12, attached hereto, to Contractor upon receiving regulatory approval from the Indiana Utility Regulatory Commission, which is currently targeted for 4/1/2020. If the Notice To Proceed has not been issued on or prior to 4/30/2020, Contractor and Owner each shall have the right, after such date and before the issuance of a Notice To Proceed, to terminate this Contract upon notice to the other party (which termination right shall terminate upon the issuance of the Notice to Proceed).

5.1.2.1 If this Contract is terminated pursuant to this Section 5.1.2 prior to issuing the Notice To Proceed, then except for obligations of the parties in connection with the issuance of the Limited Notice To Proceed as provided for in Section 5.1.1.2, neither party shall have any further rights or obligations under this Contract.

5.1.2.2 If the Notice To Proceed has not been issued on or prior to 6/30/2020, Contractor and Owner may but are not required to, negotiate a mutually agreed upon strategy and revised Contract Price (including a revised Payment Schedule).

5.2 Key Milestone Dates

5.2.1 The following dates for key milestones ("**Key Milestones Dates**") shall apply to Contractor's Work:

- Pre-Bid Meeting Date: 11/13/2018
- Proposal Due Date: 12/7/2018
- Projected Contract Award Date: Effective Date of this Contract, contingent upon regulatory approval
- Projected Notice to Proceed Date: target 04/01/2020, but on or before 04/30/2020, contingent upon regulatory approval
- Substantial Completion/Commercial Operation Date: 12/31/2020

5.3 Project Schedule

5.3.1 Contractor shall prepare a detailed, resource loaded Level 3 schedule in critical path method format using Primavera P6 or Microsoft Project for Owner's review in accordance with the requirements outlined in the GSR. Owner's template, code structures and calendar will be available for developing schedule.

5.3.2 The schedule shall be submitted to Charles Blankenbiller at cblankenbiller@aep.com. The submittal timeline requirements are outlined in Section 2.7 of the GSR.

5.3.3 Upon receipt of the schedule, Owner will conduct review sessions with Contractor and possibly other contractors to ensure Contractor's schedule:

- Contains sufficient detail with proper logic;
- Supports the overall project schedule; and,
- Complies with the GSR.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 10 of 30
Final Rev. 13 dated August 2, 2019

- 5.3.4 Contractor shall make corrections as necessary within two (2) calendar days, excluding Saturdays and Sundays, to correct and resubmit the schedule. It is anticipated this review and resubmittal cycle could last two (2) or more iterations.
- 5.3.5 Owner's acceptance and approval of Contractor's Level 3 schedule will be incorporated into the Contract by amendment. The approved schedule will be the baseline to track progress.
- 5.3.6 Subsequent to acceptance of the baseline schedule, if dates need to be adjusted due to Owner caused delays or other excusable delays in accordance with the General Terms and Conditions, Owner and Contractor will determine if any Key Milestone Dates or dates tied to the assessment of liquidated damages ("LDs") pursuant to the Contract will be impacted, and if so, the schedule shall be revised and will be incorporated into the Contract by amendment.
- 5.3.7 Contractor shall provide a qualified construction scheduler to support the Owner's Integrated Scheduler. The schedule shall provide Owner with weekly updates of the schedule.
- 5.3.8 Contractor shall provide weekly progress updates to their own schedule on a Citrix server. These updates for project Work are due each Monday no later than 11:00 AM. The update frequency for Work performed during outages will be determined at the Site but will range between daily shift updates to 3 times per week. Owner's Integrated Scheduler will consolidate the Contractor's separate schedule into the Integrated Project Schedule.
- 5.3.9 Contractor will sequence the Work in conformity with the Project Schedule and Contractor's detailed schedule, described in this Section, in a manner that ensures that for any elements of the Site all prerequisites to installation of that element have been completed before its installation. All costs of redesign or all subsequent rework to accommodate Contractor's failure to properly sequence the Work will be borne by Contractor. Contractor's sequencing of the Work will support the accomplishment of Substantial Completion and Final Acceptance as contemplated by the Contract.

5.4 Holidays

- 5.4.1 The following days are Owner recognized holidays. Work at the Site is not permitted on these days without Owner's prior approval.
- New Year's Day;
 - Memorial Day (last Monday in May);
 - Independence Day;
 - Labor Day;
 - Thanksgiving Day;
 - Day after Thanksgiving; and
 - Christmas (to include two days as specified by Owner).
- 5.4.2 When any holiday falls on a Saturday, the holiday will usually be observed on the preceding Friday. When a holiday falls on a Sunday the holiday will usually be observed on the following Monday.

5.5 Work Shift Schedules

- 5.5.1 Contractor's schedule shall outline plans for multiple shifts and/or extended workdays as necessary to perform each phase of the Work.
- 5.5.2 Contractor shall obtain Owner approval for any deviations from the work shift schedules.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 11 of 30
Final Rev. 13 dated August 2, 2019

6.0 LIQUIDATED DAMAGES (LDs)

6.1 General

6.1.1 Contractor's failure to comply with the schedule and/or the performance requirements of this Scope of Work will result in Owner incurring damages in amounts difficult to ascertain with certainty. It is agreed, therefore, that the LDs provided for herein represent reasonable amounts to compensate Owner for Contractor's failure to perform and are not to be construed as a penalty. Consequently, Owner will not be required to prove that it has incurred actual damages. Subject to Section 6.1.2, payment of one type of LD for Contractor's failure to comply with a specified requirement shall not relieve Contractor of its liability to pay LDs for Contractor's failure to comply with other specified requirements in this Section 6.

6.1.2 The total aggregate amount of all LDs herein shall not exceed [REDACTED] of the Contract Price.

6.2 Delay LDs

6.2.1 The following schedule activities will be subject to the following delay LDs ("Delay Liquidated Damages" or "Delay LDs"):

LD Activity ID	LD Activity Description	LD Date
LD1	South Bend Solar Substantial Completion	12/31/2020

6.2.2 The Work associated with the schedule activity subject to Delay LDs shall be completed on, or before, the corresponding Delay LD date set forth in Section 6.2.1 unless Owner has agreed to an extension of the date. Any Owner agreed extensions of Delay LD dates or Contractor and Owner agreed acceleration of Delay LD dates shall be incorporated into the Contract with an amendment. This includes extensions granted due to the regulatory process.

6.2.3 Contractor shall be liable to Owner in the amount of [REDACTED] per day as Delay LDs for each calendar day of delay in meeting the LD Activity by the LD Date listed in the table in Section 6.2.1. The total amount of Delay liquidated damages shall not exceed [REDACTED] of the Contract Price.

6.2.4 Delay LDs for each calendar day Contractor is late will not be prorated based on a partial calendar day.

6.2.5 In the event that Owner becomes entitled to Delay LDs as provided in this Section 6.2, Owner may deduct the amount of such Delay LDs from any money due or which may become due Contractor under the Contract.

6.2.6 Once paid, payment of the Delay Liquidated Damages shall be the sole and exclusive remedy of Owner, and Contractor's sole and exclusive liability, for failure of Contractor to achieve Substantial Completion as of 12/31/2020 (but shall not prejudice Owner's rights to receive Capacity Liquidated Damages if and when due pursuant to Section 6.3.1 or Energy Performance Liquidated Damages if and when due pursuant to Section 6.3.3).

6.3 Performance Guarantees, Energy Performance Testing, and LDs

6.3.1 Capacity Liquidated Damages

6.3.1.1 After achieving Substantial Completion, if the Power Output Guarantee has not been achieved, and if Contractor elects not to pursue a Remedial Plan during the Cure Period as provided in Section 6.3.8 (or if Contractor elects to pursue a Remedial Plan during the Cure Period but the Power Output Guarantee has not been achieved by the end of the Cure Period), then Contractor will pay

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 12 of 30
Final Rev. 13 dated August 2, 2019

Owner capacity liquidated damages ("**Capacity Liquidated Damages**") in accordance with the Power Output and Energy Performance Testing Requirements set forth in Appendix 11.

6.3.1.2 Once paid, payment of the Capacity Liquidated Damages, shall be the sole and exclusive remedy of Owner, and Contractor's sole and exclusive liability, for failure of the Facility to achieve Power Output Guarantee as of Substantial Completion (but shall not prejudice Owner's rights to receive Energy Performance Liquidated Damages, if and when due pursuant to Section 6.3.3).

6.3.2 Energy Performance Test Procedures

6.3.2.1 Contractor shall prepare and submit to Owner for its review and approval the proposed detailed Energy Performance Test Procedures to be applicable to the Energy Performance Test in accordance with the time for submittal set forth in this Scope of Work and the requirements of the Power Output and Energy Performance Testing Requirements set forth in Appendix 11, as applicable.

6.3.2.2 Within ten (10) Business Days of receipt of any proposed detailed Energy Performance Test Procedures, Owner shall Notify Contractor of any comments on the proposed detailed Energy Performance Test Procedures or indicate Owner's acceptance of such detailed Energy Performance Test Procedures. If Owner has Notified Contractor of any comments on the proposed detailed Energy Performance Test Procedures, Contractor and Owner shall jointly confer together as to the final Energy Performance Test Procedures. The detailed Energy Performance Test Procedures that are ultimately approved by Owner for each Energy Performance Test shall be the applicable Energy Performance Test Procedures for such Adjusted Energy Performance Test hereunder. If Owner makes no comments within the applicable ten (10) Business Day period, then such proposed detailed Energy Performance Test Procedures delivered to Owner shall be deemed acceptable to Owner. Contractor shall perform the Energy Performance Test in accordance with the Energy Performance Test Procedures approved or deemed acceptable to Owner in accordance herewith.

6.3.3 Energy Performance Test

6.3.3.1 Contractor shall conduct the Energy Performance Test of the Facility in accordance with the Energy Performance Test Procedures in accordance with this Contract. Owner, Owner's Representative, and Interconnection Provider shall have the right to be present during the Energy Performance Test.

6.3.3.2 If, upon conclusion of the Energy Performance Test, the Energy Performance Guarantee is not met, then Contractor may elect either to (a) at its own expense, perform corrections to the Facility and thereafter conduct a second Adjusted Energy Performance Test (at the conclusion of which, if the Energy Performance Guarantee is not achieved, then Contractor will pay Energy Performance Liquidated Damages), or (b) pay to Owner the Energy Performance Liquidated Damages calculated pursuant to the Power Output and Energy Performance Testing Requirements as set forth in Appendix 11.

6.3.3.3 Once paid, payment of the Energy Performance Liquidated Damages shall be the sole and exclusive remedy of Owner, and Contractor's sole and exclusive liability, for failure of the Facility to meet the Energy Performance Guarantee.

6.3.4 Test Schedules

6.3.4.1 Subject to Section 2 of Appendix 11, Power Output and Energy Performance Testing Requirements, Contractor shall agree on an Energy Performance Test schedule with Owner and shall give Notice (which Notice may be by email) to Owner of the first Energy Performance Test at least five (5) days prior to commencing any such test.

6.3.4.2 Contractor shall keep Owner Representative continuously apprised of the schedule for Energy Performance Tests and changes in the schedule, the commencement and performance of Energy

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 13 of 30
Final Rev. 13 dated August 2, 2019

Performance Tests, and shall give Owner Representative at least two (2) Business Days advance Notice (which Notice may be by email) of the re-performance of any Energy Performance Test.

6.3.5 Energy Performance Test Results

6.3.5.1 Contractor shall submit a test report for each Energy Performance Test performed by Contractor within five (5) days after the completion of such Energy Performance Test, which report shall provide the Energy Performance Test results, together with a comparison to, and showing of compliance with, the applicable performance criteria and other testing requirements and criteria set forth in the Energy Performance Test Procedures. Contractor shall cause all reports to contain the test data and calculations to allow Owner to verify the conclusions of such report.

6.3.6 Revenues

6.3.6.1 Owner shall be entitled to all revenues generated by the Facility during the performance of any Energy Performance Test of the Facility.

6.3.7 Use of SCADA

6.3.7.1 The Parties acknowledge and agree that Owner shall utilize the SCADA to calculate the results of the Power Output Tests and the Energy Performance Tests, all as set forth in the Power Output and Energy Performance Testing Requirements, as applicable. The SCADA system shall communicate with the Owner's OSI control system via Modbus with DNP3 capability.

6.3.8 Cure Period and Remedial Plan

6.3.8.1 After achieving Substantial Completion, if the Power Output Guarantee has not been achieved, then Contractor, may, at its option and its sole expense, continue to attempt to achieve the Power Output Guarantee during the Cure Period. The "**Cure Period**" means the period commencing on the Substantial Completion Date and ending on the date that is one hundred eighty (180) days thereafter.

6.3.8.2 During the Cure Period, Contractor may, (i) install replacement equipment and materials at the Site (which shall become part of the Facility following completion) and (ii) run multiple Power Output Tests before it Notifies Owner of the final Power Output Test (which, in any event, may only be (A) a Power Output Test run prior to the expiration of the Cure Period and (B) the most recently run Power Output Test).

6.3.8.3 In order to undertake such efforts, Contractor shall first submit to Owner a plan that specifies the actions Contractor will take and the commencement date of such corrective action, and the timing (e.g., off-peak and/or nighttime work) of such actions, for Owner's approval, which shall not be unreasonably withheld or delayed. Upon the approval of such plan (the "**Remedial Plan**") by Owner, Contractor shall promptly and diligently pursue completion of the Remedial Plan. If Contractor is unable to achieve the Power Output Guarantee after completing the initial Remedial Plan, and the Cure Period has not expired, Contractor may deliver a new Remedial Plan to Owner within seven (7) days after completion of such initial Remedial Plan; provided, that Owner may reject such new Remedial Plan if there is no reasonable probability of success or if the Cure Period will expire during the period covered thereby.

6.3.9 The combined total amount of Capacity Liquidated Damages and Energy Performance Liquidated Damages shall not exceed [REDACTED] of the Contract Price.

7.0 PROGRESS REPORTING

7.1 Upon request, Contractor shall provide audited quarterly financial statements including Income Statement, Balance Sheet and Cash Flow Statement to Owner. Financial documents provided in accordance with this provision shall be subject to Owner's confidentially terms. Financial

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 14 of 30
Final Rev. 13 dated August 2, 2019

documents provided in accordance with this provision shall be subject to Owner's confidentiality obligations as set forth in Section 24.0 of the General Terms and Conditions.

7.2 Contractor shall prepare and furnish to Owner weekly and monthly progress reports and updates as set forth in the GSR. Before submitting any reports to Owner, Contractor shall have Owner's Site representative verify the quantities and percent complete that Contractor intends to include in the invoicing report. The weekly progress reports shall also contain the following information:

- A list of major activities with original remove/install quantities listed, quantities removed/installed to date, quantities remaining to remove/install and percent complete;
- Overall progress percent complete (needs to coincide with the progress payment percent complete being requested in the invoicing);
- An updated project schedule showing the original plan start and completion dates versus actual start and actual or projected completion dates. It shall also show the original projected remove/install quantities per week versus actual quantities along with revised projections required to maintain the schedule completion dates;
- Craft availability including the number of and type of craft personnel requested versus actual show up;
- Safety process at the Site and weekly safety briefings;
- Any new risks identified as part of the ongoing work including environmental, commercial, personal, or other;
- Any opportunities that may arise from ongoing business including potential time savings, additional commercial opportunities, or other;
- Action items captured from meetings with the Owner; and,
- Status of each Extra Work Order ("**EWO**") including:
 - the original estimated man-hour and dollar values;
 - man-hours charged to date against the EWO;
 - percent complete;
 - projected total man-hours to complete the work authorized by the EWO versus the original estimate; and,
 - the projected cost to complete the work authorized by the EWO versus the original estimate.

7.3 Contractor shall attend Owner-conducted daily, weekly, and monthly meetings. Contractor shall have an employee with decision making and signatory authority available to participate in these meetings. Depending upon the work in progress, and contingent upon Owner's approval, this person might be able to conference into these meetings.

8.0 SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS

8.1 Contractor shall perform its work in a safe and careful manner in accordance with applicable law and is solely responsible for the safety of its personnel and Subcontractors. Owner's requirements as set forth in the General Terms and Conditions, Contractor Safety & Health Requirements and the CERD shall apply to the Work.

8.2 Completed PWSHA and EWCA forms are included herein. Contractor shall review these forms in order to prepare a Health and Safety Plan ("**HASP**") and an Environmental Work Compliance Plan. Contractor will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Contractor will take all necessary precautions for the safety of, provide the necessary protection to, and prevent damage, injury, or loss to all of Contractor's employees, consultants, or agents and those of its Subcontractors at the Site and other persons and organizations who may be affected at the Site.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 15 of 30
Final Rev. 13 dated August 2, 2019

- 8.3 The HASP shall include Contractor's drug testing policy. The cost of the drug testing shall be included in the cost of the Contract.
- 8.4 Contractor shall review its HASP and Environmental Work Compliance Plan with Owner's designated Site personnel prior to entering the Owner's buildings and other facilities.
- 8.5 Contractor shall provide its employees and Subcontractors with any personal protective equipment necessary for the Site.
- 8.6 Contractor will promptly notify Owner of all safety-related events. These include near-miss incidents; self-aid, first aid, and minor incidents; exposure incidents; OSHA recordable injuries and illnesses; and vehicle accidents.
- 8.7 Contractor and its Subcontractors will immediately report to the Owner all non-incidental spills, and all other significant impacts to the environment (soil, water, air) including new discovered conditions at the Site. Contractor will immediately notify the Owner of any failure to comply with state and federal environmental laws, rules, and regulations.
- 8.8 Contractor shall provide a full time safety supervisor for each shift of work who shall be on Site from mobilization through demobilization.
- 8.9 Owner's facilities might contain lead paint and asbestos materials unless noted otherwise. If the presence of lead paint, asbestos or other hazardous material is suspected, Contractor shall stop work in the area suspected of containing hazardous material(s) and notify Owner immediately for disposition.

9.0 GUARANTEES AND WARRANTY

- 9.1 Contractor shall warrant all material and workmanship in accordance with the General Terms and Conditions for a period of 12 months from initial operation and after Final Acceptance of the Work.
- 9.2 Contractor shall obtain no less than industry standard defect, limited, and performance warranties for all Work performed or Equipment supplied by each Subcontractor. All Subcontractor warranties shall be extended to Owner. Contractor shall deliver to Owner un-priced copies of all Subcontracts containing such representations, warranties, guarantees, and obligations. During the warranty period, Contractor will be responsible for enforcing all Subcontractor warranties at no cost to Owner.

10.0 TAXES

Taxes shall be paid in accordance with the provisions of the General Terms and Conditions as clarified below. Sales and Use Taxes are generally addressed as follows:

10.1 Contractor's Purchases

- 10.1.1 If Contractor's Purchases are exempt, Contractor shall use its own properly executed exemption or resale certificate.
- 10.1.2 Unless Owner otherwise specifies, consumable materials and supplies or Contractor's tools and equipment not incorporated into the work or project are not eligible for exemption, therefore, sales taxes for these items shall be included in the Contract Price and paid by Contractor.

10.2 Owner's Purchases

- 10.2.1 If Owner's Purchases are exempt, Owner shall furnish to Contractor its Direct Pay Permit or exemption certificate, or Contractor shall use appropriate state form to claim exemption.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 16 of 30
Final Rev. 13 dated August 2, 2019

- 10.3 For Indiana, purchases for direct use in generation projects are exempt. Owner shall furnish its Direct Pay Permit to Contractor provided Owner and Contractor have entered into a separated contract or Contractor provides a breakdown of labor and material costs on invoices. A separated contract specifically separates labor and material costs in the Contract.

11.0 LABOR INFORMATION [NMA SIGNATORY FACILITIES]

- 11.1 Work shall be performed under the terms of the National Maintenance Agreement. Maintenance Work at Owner's South Bend Solar site has been granted a 90% wage rate site modification by the National Maintenance Agreements Policy Committee ("NMAPC"). Work at this facility shall be performed at 90% of the wage rates listed in the local collective bargaining agreements and 100% of fringe benefits in those agreements.

- Contractor shall have applied for said Agreements at the time of bidding and must be in possession of them with permission for their use by the affected International Union(s) prior to being awarded the Work.
- Questions regarding the above may be addressed to Mr. Thomas P. Householder, Labor Relations (614-716-1713) (tphouseholder@aep.com).
- Owner's participation in the National Maintenance Program is predicated on the principles espoused by the NMAPC which include economy, efficiency, and harmonious labor relations.
- Picketing and failure to man Work by any craft shall be at the risk of losing future Work at this Site.

- 11.2 Contractor shall be responsible to assess the local labor conditions under which Work is to be performed.

- 11.3 The employment of necessary labor to perform all Work defined in these specifications will be Contractor's responsibility.

- 11.4 Contractor is required to have a pre-job meeting with the local Building and Trades Council before starting Work. Contractor shall notify Owner so that Owner may attend the meeting.

12.0 TECHNICAL REPRESENTATIVES

- 12.1 Start Up Personnel: Contractor will provide or cause to be provided, appropriate installation and start up representatives from Contractor and from Subcontractors of Major Equipment and control systems, all necessary supervising personnel, and all Temporary Work necessary for all of the Work to complete commissioning and start up and to Successfully Run each Performance Acceptance Test.

- 12.2 The technical field assistance representatives will be responsible for the following services:

- 12.2.1 Technical information during:

- Unloading, unpacking, and transferring the involved materials to temporary field storage and final location.
- Installation and assembly of the involved materials on suitable foundations and structures.

- 12.2.2 Assisting Contractor in inspecting the field assembly, clearance, alignment, and cleanliness of materials to insure correct installation.

- 12.2.3 Assisting Contractor with commissioning and start-up for successful completion of the Performance Acceptance Test.

- 12.2.4 Furnishing special installation test instruments and tools.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 17 of 30
Final Rev. 13 dated August 2, 2019

12.2.5 Preparing field reports, including reports of the as-installed condition of Equipment and any reports necessary to validate vendor warranties.

12.3 Technical representative(s) will not be authorized to direct modifications to the Work.

13.0 IDENTIFICATION OF CONTRACTOR'S EMPLOYEES

13.1 Prior to Contractor starting Work, Owner might require Contractor to comply with a color-coding system for Contractor hardhats.

13.2 Owner might provide numbered badges for Contractor to distribute to its employees. Contractor shall require its employees to wear these badges so that they are visible at all times.

13.3 Contractor shall require its employees to wear hardhats that display Contractor's company emblem and the employee's badge number.

13.4 Each time a change in employee status occurs, Contractor shall submit to Owner an updated list of all of its employees' names and their corresponding badge numbers. Contractor shall furnish Owner a copy of all termination slips.

14.0 CHANGES IN WORK AND EXTRA WORK

14.1 Change Orders

14.1.2 Any work Contractor performs that is not identified in this Scope of Work document and Appendices as being part of Contractor's Work scope under any resultant Contract will be authorized by issuing Contractor a Change Order as defined in Article 14 Changes in Work and Extra Work, of the General Terms and Conditions. The Owner's mechanisms for the issuance of Change Orders are either a Site generated EWO or a Contract amendment.

14.2 Notification to Owner

14.2.1 Contractor shall notify Owner within one (1) work day of its discovery of any discrepancies between drawings, specifications, field conditions and any laws, ordinances, rules, regulations or codes that apply to the Work for any item that Contractor deems to be qualified as Changes in Work for which it intends to seek compensation. Contractor shall provide in its notice the reasons its request should be considered a Change in Work. Contractor shall submit a written estimate of the impacts to the schedule, man-hours, labor cost and material cost of the Change in Work.

14.2.2 Owner and Contractor shall determine the method of payment (firm price, unit price, time and material, cost-plus) with the issuance of the Change Order. The requirements outlined in Section 14.4 shall apply to cost-plus work Change Orders.

14.3 Lump Sum Basis

14.3.1 Change Orders for Changes in Work to be performed on a lump sum price basis shall be firm including any incremental costs for superintendent(s), office manager(s) or timekeeper(s), or other non-manual personnel.

14.4 Cost-Plus Basis

14.4.1 Change Orders for Changes in Work to be performed on a cost-plus basis shall be compensated as outlined in the Contract documents including the following requirements:

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 18 of 30
Final Rev. 13 dated August 2, 2019

- Contractor shall provide Owner, at the start of each shift, a personnel roster, which must list the names and badge numbers of those persons who will be assigned to cost-plus work;
- Contractor's personnel shall be identified with a numbered badge in a visible location, such as outside a shirt pocket;
- Contractor shall submit daily timesheets by noon the following work day for all employees that worked on cost-plus work;
- The daily timesheets shall display the name, badge number and craft classification of each worker, Owner's EWO number and any further breakdown, as may be requested by Owner;
- The daily timesheets will be reviewed and signed by the Owner to verify accuracy and approval; and,
- Contractor will not receive payment for any Work performed where Owner has not received and signed a timesheet. The documentation for these Owner-approved costs must be submitted with the invoice.

14.5 Disputed EWOs

- 14.5.1 The requirements outlined in Article 14 of the General Terms and Conditions shall apply to work being performed by Contractor under dispute. Owner's signature of daily timesheets is not an admission of liability by Owner.

15.0 PAYMENTS TO CONTRACTOR

- 15.1 Contractor shall provide a fixed price, turnkey Contract Price, which shall consist of three (3) bases for payment as set forth in Appendix 2-A and further described as follows:
- 15.1.1 Major Equipment Payments. Contractor shall enter into agreements with suppliers for the procurement of Major Equipment as set forth in Appendix 2-A. Following payment by Contractor for such Major Equipment, Contractor shall submit to Owner an invoice from Contractor for the amount paid to the supplier plus (except for the LNTP Payment) a markup of ten percent (10%), which invoice shall include (a) a copy of the supplier's invoice to Contractor for the specified Major Equipment, and (b) an affidavit from the supplier confirming the amount paid by Contractor for the specified Major Equipment. Owner shall pay Contractor within fifteen (15) days from the date of its receipt of such invoice. Upon Contractor's completion of the Major Equipment Procurement listed on Appendix 2-A, Contractor and Owner shall revise Appendix 2-A to reflect the final amounts spent on Major Equipment Procurement and align the remaining payments due for Engineered Documents Payments and Balance of Plant Progress Payments with the Contract Price.
- 15.1.2 Engineered Documents Payments. Upon Engineering Kickoff, and as Contractor delivers the Engineered Documents to Owner, Contractor shall invoice Owner for the applicable amount allocated to Engineering Kickoff and such Engineered Documents in Appendix 2-A. Owner shall pay Contractor within thirty (30) days from the date of its receipt of such invoice, provided that in the case of payment for Engineered Documents, such payment shall be subject to Owner's verification that the Engineered Documents conform with the requirements of the Contract.
- 15.1.3 Balance of Plant Progress Payments. Appendix 2-A sets forth the Work activities and associated values of the Balance of Plant Work to be performed by Contractor ("**Balance of Plant Progress Payments**"). Contractor shall invoice Owner weekly for such Balance of Plant Progress Payments based on its completion of these Work activities and payment will be due to Contractor within thirty (30) days from the date of its receipt of such invoice, subject to Owner's verification that such Work conforms with the requirements of the Contract. Within sixty (60) days after the Effective Date, Owner and Contractor shall in good faith determine the rules of credit related to Balance of Plant Progress Payments for Work activities associated with MWs on Appendix 2-A ("**BOP Progress Payment Rules**"), which BOP Progress Payment Rules shall be referenced in calculating the payment due for Contractor's completion of such Work. Appendix 2-A shall be updated to incorporate the agreed BOP Progress Payment Rules.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 19 of 30
Final Rev. 13 dated August 2, 2019

- 15.2 Contractor's invoices shall be submitted in accordance with Projects Invoicing Requirements and addressed to:

M. K. Godich
American Electric Power
Cost Control Center
P.O. Box 301
Cheshire, OH 45620

- 15.3 Except for the LNTP Payment, Owner shall pay [REDACTED] of each properly submitted and accepted invoice and, except as specifically provided for herein, all payments shall be made within [REDACTED] days of receipt of invoice. The release of retention shall become due and payable [REDACTED] days after Final Acceptance (reference Section 24.4). Additionally, retention will not be withheld on EWO payment(s).

- 15.4 Owner reserves the right to direct pay Contractor's Subcontractors in the event that Contractor's financial condition deteriorates to an unsatisfactory position as reasonably determined by Owner. When this right is exercised:

- Contractor shall provide Owner with copies of executed purchase orders and contracts for Equipment and services; and,
- Owner shall provide direct payment to Subcontractors in accordance with applicable terms except that all invoices shall be reviewed and approved by Contractor prior to being sent to Owner for payment.

16.0 CONTRACTOR-FURNISHED SERVICES AND FACILITIES

- 16.1 Contractor shall provide and maintain a temporary field office and all other temporary facilities necessary for the use of its employees, including facilities for the storage of its tools and equipment, and the fabrication of materials. Contractor shall provide and maintain all supplies, furniture, equipment, temporary lighting, temporary heating, temporary cooling, janitorial services, porta-johns, sanitary facilities, and other similar services necessary for Contractor's temporary facilities.
- 16.2 Prior to constructing or locating any temporary construction facility, Contractor shall obtain authorization from Owner. Contractor shall provide a listing of trailers to be brought on Site five (5) days prior to commencement of Work at Site.
- 16.3 Contractor shall supply and maintain all necessary tools, equipment, rigging, welding and cutting gases, welding rod, bolts, nuts, washers, lock washers, shims, grout, consumable and miscellaneous supplies required to perform this Work.
- 16.4 Contractor shall permit Owner access to inspect Contractor's temporary construction facilities to ensure compliance with the requirements of the contract and all applicable codes and specifications. Inspections shall be for the sole benefit of Owner and shall not constitute Owner's approval or release.
- 16.5 Contractor shall arrange with the telecommunications company to pay for all telephone, computer and internet services for itself and its Subcontractors, including charges for installing and removing services.
- 16.6 Contractor shall provide and maintain temporary power and lighting for Work, including for tools, equipment and trailers. Contractor shall provide step-down transformers where required.
- 16.7 Contractor shall use such roads as are designated by Owner. Contractor shall build, maintain and remove all other roads, parking areas and other improvements necessary for Contractor to perform its Work or for its convenience, such as adjacent to Contractor's storage areas, fabrication shops and offices. Contractor shall maintain all existing roads, parking and laydown areas over which it

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 20 of 30
Final Rev. 13 dated August 2, 2019

operates heavy construction equipment and shall make repairs to any damaged areas including areas adjacent to such roads, parking and laydown areas. Laydown areas will be designated by Owner.

- 16.8 Contractor shall assure that its employees park their vehicles only in parking areas designated by Owner. Only company owned vehicles will be allowed on the work Site.
- 16.9 Contractor will be responsible for all environmental and non-environmental permits (e.g. Friends of Juday Creek, Izaak Walton League, St. Joe River Basin Commission) needed to facilitate this project. Contractor will be required to share all communication between permitting agencies with the respective AEP environmental and or non-environmental permit leads. Permitting updates should be presented to AEP Project Management during project meetings with AEP and should be presented using the AEP Permit Summary Report Form.
- 16.10 Contractor shall provide all consumables and all initial fills required through completion of Work.
- 16.11 Contractor will provide potable water, water containers, ice, and the distribution of drinking water to Contractor's employees from the fixed supply point will be the responsibility of Contractor.
- 16.12 Contractor must provide required temp/aux power. Contractor is responsible for all utility connections to their office trailers.
- 16.13 Site parking permits for Contractor's superintendent and office manager will be issued by and subject to Owner approval. Craft personnel and all other Contractor employees shall park in the craft/general parking area only.
- 16.14 Contractor will provide first aid services, porta-johns and waste containers for the Site. The waste containers will be marked for the type of waste and recyclables. Contractor is responsible to insure that its employees and Subcontractors correctly dispose of waste per the correct container. Any costs incurred by Owner due to Contractor's employees or Subcontractors damaging porta-john and/or waste containers or disposing of improper waste shall be the Contractors responsibility.
- 16.15 Contractor is responsible for snow and ice control for the project Site not for Contractors work area.

17.0 MOBILIZATION AND DEMOBILIZATION

- 17.1 Contractor shall supply a list of its electrical load requirements for equipment to be used, including trailers. This list shall be supplied ten (10) days prior to the commencement of Work.
- 17.2 Contractor shall provide Owner the following information upon arrival at the Site:
- Certificate of Insurance;
 - Workers Compensation Evidence of Coverage and Current Contributions;
 - State Unemployment Insurance Fund Account and Evidence of Current Contributions;
 - Safety Manual;
 - MSDS, as applicable;
 - Contractor Licenses, as applicable;
 - Completed Health and Safety Plan (HASP) or Job Hazard Analysis (JHA); and,
 - Completed Environmental Work Compliance Plan.
- 17.3 Additionally, Contractor shall meet with Owner's accounting, timekeeping, storeroom, environmental and safety personnel to review procedures required by these departments. Contractor may have representatives of its Subcontractor present at this meeting. Contractor shall be responsible for insuring that all Subcontractors are familiar with the above procedures. This meeting shall not relieve Contractor of its sole responsibility to supply accurate and timely information to its Subcontractors.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 21 of 30
Final Rev. 13 dated August 2, 2019

- 17.4 Contractor and its Subcontractors must obtain approval of Owner prior to removing from the Site any construction equipment, tools, supplies, materials, equipment to be installed, temporary construction facilities or debris.
- 17.5 Contractor shall submit a list of all construction equipment and temporary construction facilities as such items enter the Site which will aid the control of construction equipment and temporary construction facilities leaving the Site. The list shall describe each item in detail, including the serial number, make, model and model year. Failure to list such construction equipment shall exclude it from consideration for cost-plus work.
- 17.6 Welds made by Contractor for attaching temporary work to permanent work shall be properly removed. The surfaces of the permanent work shall be returned to their original condition to the satisfaction of Owner's representative.

18.0 CLEANUP AND DISPOSAL OF NON-HAZARDOUS SCRAP AND DEBRIS

18.1 Continuous Cleanup

- 18.1.1 Contractor shall keep its Work areas, storage areas, parking areas and other areas of operations clean, orderly, safe and secure.
- 18.1.2 Contractor shall provide an adequate crew at all times to perform continuous cleanup work at the Site.

18.2 Disposal

- 18.2.1 Contractor shall segregate all scrap and debris material and Owner shall make final determination as to material to be marked for disposal by Contractor and material to be marked for salvage by Owner.
- 18.2.2 Contractor shall promptly remove from the Site and dispose of all debris (except lead contaminated debris) resulting from the Work.
- 18.2.3 Contractor shall obtain Owner's written approval prior to such removal.
- 18.2.4 Scrap and debris shall be disposed of by Contractor at one of the landfills designated by Owner.
- 18.2.5 Contractor shall state in its proposal the disposal site it has chosen, as well as the additional cost for trucking and disposal at the alternate landfill. The use of any of these landfills is subject to change by Owner.

18.4 Preparation for Testing

- 18.4.1 Contractor shall thoroughly clean its Work areas in the vicinities of equipment to be tested and/or to be placed into initial operation.
- 18.4.2 Owner may provide Operating Personnel to witness commissioning, testing, start-up, and performance testing of the Facility. Owner will be notified ten (10) days in advance of any testing activities.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 22 of 30
Final Rev. 13 dated August 2, 2019

18.5 Completion of Work

18.5.1 Upon completion of the Work, Contractor shall:

- Remove from the Site its surplus material, construction equipment, and tools;
- Remove its temporary structures, power stands, supports, buildings, trailers and scaffolds, unless otherwise directed in writing by Owner;
- Leave all of its areas of operations in "broom clean" or equivalent condition; and
- Arrange a walk down of the areas with Owner to verify the condition is acceptable.

18.5.2 The cost to provide the cleanup and removal, including the cost of all labor, supplies, tools, construction equipment and transportation, shall be borne by Contractor.

19.0 OWNER SUPPLIED DOCUMENTS

19.1 The drawings, standards and specifications ("**Documents**") furnished by Owner to Contractor shall be used only for execution of the Work. These Documents are the property of the Owner and shall be returned to the Owner upon completion of the Work, upon termination of the Contract or upon request by Owner.

19.2 The Documents furnished by Owner, whether included in the Contract or issued after the Contract award, are intended to supplement each other without being unduly repetitive. Items adequately addressed in any one Document need not be re-addressed in any other Document.

19.3 Documents furnished at the Site by Owner to Contractor might be accompanied by an Owner prepared Document Issue Record that lists:

- The Document identification number;
- Revision number;
- Number of copies issued to Contractor; and,
- Date of issue.

Contractor shall sign and date any such Document Issue Record and return it to Owner within one (1) working day of receipt.

19.4 Additional Documents and revisions of previously issued Documents furnished by Owner shall become a part of the Contract. All Work required by such Documents shall be performed in accordance with the Contract.

19.5 Contractor shall maintain a copy of the signed Contract at the Site.

19.6 Contractor shall have copies of the latest revisions of all Documents available at the Site at all times for the use by Contractor and Owner.

19.7 Dimensions take precedence over the scale measurements of Documents; however, where obvious discrepancies exist, Contractor shall immediately report the discovery of such discrepancies to Owner and confirm this report in writing within twenty-four (24) hours of the discovery. Owner's interpretation of the meaning of such drawings shall govern.

19.8 Unless otherwise indicated, elevations shown or mentioned in the Documents are referenced from the datum elevation established at the Site by Owner, unless otherwise noted.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 23 of 30
Final Rev. 13 dated August 2, 2019

20.0 SHOP DRAWINGS

20.1 The term "shop drawings" includes the following items furnished by Contractor to explain in detail specific portions of the Work:

- Drawings (design, fabrication, erection), diagrams, layouts and schematics;
- Equipment data;
- Calculations;
- Descriptive literature;
- Illustrations;
- Performance and test data;
- Permits;
- Parts lists;
- Bills of materials;
- Recommended spare parts;
- Warranties;
- Maintenance manuals;
- Operations manuals; and,
- Similar materials.

20.2 Contractor shall review all shop drawings for accuracy, completeness and compliance with the Contract requirements; indicate its approval thereon as evidence of such review; and submit the shop drawings to Owner. Any Work performed prior to receiving Owner's approval shall be at Contractor's risk. Owner's approval shall not relieve Contractor from the responsibility for any errors or omissions in shop drawings, or from the responsibility for complying with the requirements of the Contract, except with respect to variations described and approved.

20.3 If shop drawings show variations from the Contract requirements, Contractor shall notify Owner in writing of the variations. Such variations shall not be deemed to have been accepted by Owner unless Owner explicitly acknowledges that the variations described by Contractor have been reviewed and Owner indicates "approved in general" or "approved except as noted" on the notice.

20.4 Owner may, without restriction, duplicate, use and disclose shop drawings submitted under this Contract.

20.5 All shop drawings shall be submitted to Owner by Contractor within 30 days of completion of work.

21.0 MATERIAL STORAGE AND HANDLING

21.1 Contractor will provide receiving, unloading, inspection, transporting (on-Site after initial delivery), storage, and protection of all Equipment and Contractor equipment.

21.2 For all Equipment and Contractor Equipment, all preservation, packing, marking, notification of and shipping of material to the Site or other location as specified by the Contract documents will be the responsibility of Contractor.

21.3 For all Equipment and Contractor Equipment containing any Hazardous Materials arriving at the Site, Contractor will provide Hazardous Materials documentation to Owner in accordance with Applicable Laws and Section 3.8.1 of the Contract. Both Owner and Contractor are required to have a copy of all Hazardous Materials documentation for any Hazardous Materials brought to the Site.

21.4 Contractor will arrange for the storage space for all Equipment and Contractor Equipment before shipments are made.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 24 of 30
Final Rev. 13 dated August 2, 2019

- 21.5 Contractor will pay any demurrage charges resulting from Contractor delays in unloading Equipment and Contractor Equipment.
- 21.6 Contractor will pay for damage to transportation equipment as a result of its unloading operations.
- 21.7 After mobilization, if any Equipment, Contractor Equipment, tools, or other articles to be used by Contractor in the Work are delivered to the Site while Contractor is not present, Owner will not, and will not cause Host to receive, unload, or store such materials, tools, or other articles.
- 21.8 All Equipment and Contractor Equipment will be stored in assigned lay-down areas or appropriate storage facilities.
- 21.9 Contractor will support and protect stored materials and Equipment to prevent damage or loss.

21.10 Contractor Furnished Materials

- 21.10.1 Contractor shall unload and place Contractor furnished materials and/or equipment into storage locations as designated by Owner.
- 21.10.2 Contractor will maintain care, custody and control of these materials and/or equipment and shall perform the required preventative maintenance with associated records.

21.11 Storage Areas

- 21.11.1 Owner will designate space on the Site that can be used by Contractor for storage areas for Contractor furnished equipment and materials, Owner furnished materials, materials supplied by others and/or equipment to be installed. No unloaded material or equipment may be stored at any of the barge unloading facilities without the prior written consent of Owner.
- 21.11.2 Owner may specify which material and equipment to be installed, whether Owner furnished, Contractor furnished, or furnished by others, shall be stored in a warehouse, storeroom, or shall otherwise be protected. If Contractor determines that additional measures are necessary to insure that such materials and equipment are properly protected, Contractor shall provide and pay for such additional protection.
- 21.11.3 Upon the written request of Owner, Contractor shall move from one part of the Site to another any material and equipment to be installed that has been temporarily stored at the Site. Owner shall reimburse Contractor for the cost of such moves provided that the previous storage location had been approved in writing by Owner.

22.0 PROTECTION OF WORK

- 22.1 Contractor shall use care and diligence so that the Work performed and all materials, equipment to be installed and tools are at all times thoroughly protected from the weather, loss, and any and all damage arising from falling debris, fly ash, etc. Contractor shall furnish and pay for all such protection.
- 22.2 Contractor shall provide and pay for protection from snow, ice and water and for removal of same from all Work areas and materials in its storage or Work areas.
- 22.3 Contractor shall provide and pay for winter protection of the Work, including protection for concrete pours and masonry work prior to, during, and after the placement of concrete and masonry work. Contractor shall submit its proposed winter and weather protection plans to Owner for review and approval prior to implementation. Owner's approval does not relieve Contractor of responsibility.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 25 of 30
Final Rev. 13 dated August 2, 2019

23.0 DIMENSIONS AND LEVELS

- 23.1 Owner will establish north-south and east-west axis lines and permanent benchmark monuments on these lines. Contractor is responsible for the proper execution of the Work to any such base lines, benchmarks and datum systems. Contractor shall check, verify and locate all dimensions, levels, grades and lines from base lines, benchmarks, datum systems and the drawings. Contractor shall report any discrepancies to Owner in writing before starting any Work that may be affected by such discrepancies.
- 23.2 Contractor shall provide its own personnel to perform all layout work necessary for the performance of the Work. Contractor shall, at its expense, furnish all labor and material necessary for the installation of all stakes, lines, templates, patterns or platforms necessary for layout of the Work from the base lines and benchmarks. Contractor shall, at its expense, maintain all stakes and other reference marks until the removal is authorized by Owner.
- 23.3 Contractor shall reimburse Owner for all costs incurred to reestablish reference points or benchmarks if, during the performance of the Work, Contractor destroys or moves any Owner established benchmarks or reference points.
- 23.4 Contractor shall notify Owner if specific information necessary for Contractor to lay out its Work has not been supplied by Owner. Under no circumstances shall Contractor proceed on assumption only.

24.0 COMPLETION REQUIREMENTS

24.1 Mechanical Completion

- 24.1.1 Contractor shall provide Owner a duly completed and executed Mechanical Completion Certificate for the Contract Work in its entirety when:
- Generation System equipment has been installed and is ready to be safely synchronized to the grid;
 - Generation System components have been inspected and functionally tested;
 - Approval drawings for interconnection equipment and protection systems have been submitted;
 - Final relay settings have been provided;
 - Proof of required insurance has been submitted;
 - Contractor has worked with local utility personnel and equipment vendor(s) to finalize the installation testing procedures.

24.2 Construction Turnovers/Construction Releases

- 24.2.1 Contractor shall perform the Work in accordance with the Project Schedule including system and/or sub-system construction turnover/construction release (“CTO”) package releases to the Owner to support the Owner’s subsequent activities. Contractor shall notify Owner seven (7) to ten (10) calendar days prior to completion of the Work of a given system and/or sub-system to schedule a CTO walk down and inspection. Release of a CTO package is the jurisdictional transfer of custody, care and control from Contractor to Owner.
- 24.2.2 Contractor shall provide a written list of remaining work and known exceptions to Owner prior to performance of the CTO walk down. Any additional discrepancies noted during walk down will be added to the list which will be turned over to the Owner and will be compiled into a single list (“Punch List”). The Owner will prioritize items on this Punch List in accordance with the following criteria:

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 26 of 30
Final Rev. 13 dated August 2, 2019

- Priority 1 – Resolution required prior to CTO package release to Owner which are outstanding safety issues or items required to commence checkout testing;
- Priority 2 - Resolution required to allow for proper system/equipment operation, and/or is required by Project specific design or AEP design basis/criteria;
- Priority 3 – All remaining resolutions that are not mandatory in terms of safety (Priority 1) or required for proper operation and performance (Priority 2); and,
- Priority 4 – Items that are identified to be outside the Contractor's scope of Work. Contractor shall not proceed with Priority 4 punch list items unless Owner has issued a Change Order as outlined in Section 14.0.

24.2.3 Contractor shall correct all exceptions prior to the scheduled release date for the CTO package. Priority 1 and Priority 2 items must be corrected prior to Owner acceptance of the CTO package. Any remaining deficiencies are recorded in the project Punch List at the time of Owner acceptance of the CTO package.

24.2.4 It is understood that partial releases of systems might be required to support the overall project schedule. These partial releases will modify the scope of equipment being released from the original system package into sub-systems. The boundaries of any partial releases shall be clearly defined, have scope boundary documents attached, be agreed to, and documented by the Contractor and Owner.

24.2.5 Owner's typical checklist for CTO walk down is included in this SOW as Appendix 13.

24.3 Substantial Completion

24.3.1 Contractor shall provide Owner a duly completed and execute Substantial Completion Certificate for the Contract Work in its entirety when:

- All CTO packages have been turned over to the Owner;
- All the Work is sufficiently complete and conforms to the Contract requirements for purposes of receipt;
- Owner can continually occupy and fully utilize the Work for its intended purpose;
- Punch List is accepted by Owner; and,
- Contractor has completed all Priority 1 and 2 Punch List items.

24.3.2 Owner agrees that Punch List items that do not impair, impede, or in any way affect the commercial operation of the overall project shall not be the basis for rejecting the Substantial Completion Certificate.

24.3.3 Owner shall within ten (10) calendar days following receipt by Owner of the Substantial Completion Certificate:

- Execute and deliver a copy of the Substantial Completion Certificate to Contractor to acknowledge Substantial Completion has occurred; or,
- State the reasons in sufficient detail as to why the requirements for achieving Substantial Completion have not been satisfied.

24.3.4 In the event Owner does not accept and execute the Substantial Completion Certificate presented, Contractor shall undertake steps to satisfy the requirements specified by Owner and shall re-submit Substantial Completion Certificate in accordance with this Section, whereupon the procedures set forth in this Section shall be repeated. Contractor shall bear the burden of proof, in any proceeding or otherwise, that Punch List items do not impair, impede, or in any way affect the commercial operation of the project.

24.3.5 The parties will agree on a format for the certificate.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 27 of 30
Final Rev. 13 dated August 2, 2019

24.4 Final Acceptance

24.4.1 Contractor shall provide Owner a duly completed and executed Final Acceptance Certificate for the contracted Work in its entirety when:

- All completion requirements have been met and all Work conforms to the provisions of the Contract;
- Contractor has completed all Priority 1, 2 and 3 punch list items;
- Contractor has completed all final Site Work and cleanup;
- Contractor has submitted all "as built" documents, manuals, inspection reports, etc., as required; and,
- All outstanding Work issues have been satisfied.

24.4.2 Within ten (10) calendar days following receipt by Owner of the Final Acceptance Certificate:

- Owner shall execute and deliver a copy of the Final Acceptance Certificate to Contractor to acknowledge Final Acceptance has occurred; or,
- Owner shall state the reasons in sufficient detail as to why the requirements for achieving Final Acceptance have not been satisfied.

24.4.3 Owner's execution of the Final Acceptance Certificate represents:

- The acknowledgement that the Work has been acceptably completed by Contractor; and,
- The initiation of the Materials and Workmanship Warranty outlined in Article 28 of the General Terms and Conditions.

24.4.4 In the event Owner does not accept and execute the Final Acceptance Certificate presented, Contractor shall undertake steps to satisfy the requirements specified by Owner and shall re-submit Final Acceptance Certificate in accordance with this Section, whereupon the procedures set forth in this Section shall be repeated.

24.4.5 In the event Contractor is delayed in completing certain Priority 3 punch list items, such as re-seeding and certain restoration Work of the Site, due to seasonal climate conditions, and such delay is the sole reason Contractor cannot deliver a Final Acceptance Certificate to the Owner as described in Section 24.4.1 above, Owner may, but is not required to, release to Contractor all but that portion of the retainage that corresponds to the reasonable estimated cost for completion of such Priority 3 punch list items.

24.4.6 The parties will agree on a format for the certificate.

25.0 CONTRACTOR LICENSING REQUIREMENTS

25.1 Contractor shall comply with any and all laws, regulations and/or ordinances pertaining to contractor licensing or any other licensing requirements for the states in which the Work is performed.

25.2 In those states that require a firm to be licensed to practice engineering or surveying, Contractor will furnish Owner with evidence that Contractor holds a current Certificate of Authorization (or its equivalent) issued by the state licensing authorities for professional engineers and surveyors. Prior to commencing Work, Contractor will provide Owner with a written list of the names and registration numbers of the engineers and surveyors who will have responsibility for the Work or who will sign and seal drawings and reports delivered to Owner by Contractor.

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 28 of 30
Final Rev. 13 dated August 2, 2019

26.0 SECURITY REQUIREMENTS

26.1 Contractor shall provide the forms of security indicated below:

- Retention as outlined in Section 15.3; and
- A parent guaranty from Contractor's ultimate corporate parent, Infrastructure and Energy Alternatives, Inc. in form and substance as agreed by the parties; and
- At Contractor's sole expense, a payment bond and a performance bond, each [REDACTED], in form and substance and from an issuer acceptable to Owner.

27.0 OTHER PROJECT REQUIREMENTS

27.1 Cooperation and Coordination

27.1.1 Contractor shall coordinate daily activities with Owner to insure Contractor's activities do not interfere with other Site activities.

27.1.2 Contractor shall avoid interferences with the public and local traffic.

27.1.3 Contractor shall not enter any adjoining publicly or privately owned properties.

27.1.4 Contractor shall provide Owner a detailed report of any complaints received from adjoining property owners, public, and/or local motorists.

27.2 Subcontractors

27.2.1 Contractor shall request Owner's consent for any Subcontractor conducting work on-Site that is not listed on the Form C included in the Contract as required in Article 5, Assignment and Subcontracting. If Contractor enters into a subcontract with a Subcontractor conducting work on Site for which Owner has not given consent, Contractor is responsible for all costs associated with the subcontract.

27.2.2 Contractor shall submit a completed Form A and Form B for each of its Subcontractors conducting work on Site, unless this information is included in the Contract. Owner might choose to incorporate the forms into the Contract by amendment. If Owner does not receive a completed Form A and Form B for a Subcontractor, that Subcontractor is not authorized to conduct extra work.

27.2.3 Contractor shall, at the request of Owner, provide pricing data in the case of extra work being performed on a time and materials basis. Documents provided in accordance to this provision shall be subject to Owner's confidentiality terms as set forth in Section 24.0 of the General Terms and Conditions.

27.3 Requests for Information ("RFIs")

27.3.1 Contractor shall submit RFIs to Owner's designated on-Site representative for disposition.

27.3.2 Owner will provide a form and will establish a numbering system for Contractor's use.

27.3.3 Each RFI shall include the following information:

- The date the RFI was generated;
- The name and contact information of the RFI originator/writer;
- Reference for all Documents in question;
- A clear description of the information that needs clarification and all pertinent background information;
- The signature of the RFI originator/writer; and,

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 29 of 30
Final Rev. 13 dated August 2, 2019

- The name and contact information of the person to receive Owner's response.

27.3.4 RFIs are not intended to be used to document Changes in Work.

27.4 Additional Equipment Mobilization

27.4.1 Contractor shall submit a revised Form B if Contractor mobilizes equipment that is not listed on the previous Form B. Owner might choose to incorporate the forms into the Contract by amendment.

28.0 NOTICES

28.1 Notices required to be given by Contractor to Owner under the Contract shall be sent either by (i) first class U.S. Mail, return receipt requested, or (ii) overnight delivery with confirmation of delivery, or (iii) by electronic mail, as long as confirmation of delivery is provided, promptly followed by mailing of a hard copy of the Notice jointly to:

SCOTT G. WILLIAMS
Generation Procurement
American Electric Power Service Corp.
1 Riverside Plaza, 20th Floor
Columbus, OH 43215
Email: SGWILLIAMS3@aep.com
Voice: (614) 716-4023

BRANDY KELLOM
Project Manager
American Electric Power Service Corp.
1 Riverside Plaza, 24th Floor
Columbus, OH 43215
Email: bjkellom@aep.com
Voice: (614) 716-2420

28.2 Notices required to be given by Owner to Contractor under the Contract shall be sent either by (i) first class U.S. Mail, return receipt requested, or (ii) overnight delivery with confirmation of delivery, or (iii) by electronic mail, as long as confirmation of delivery is provided, promptly followed by mailing of a hard copy of the Notice jointly to:

DAVID BERTHELSEN
President
White Construction, LLC
3900 E. White Avenue
P.O. Box 249
Clinton, IN 47842
Email: david.berthelsen@iea.net
Voice: (765) 820-0132

GIL MELMAN
General Counsel
Infrastructure and Energy Alternatives, Inc.
6325 Digital Way, Suite 460
Indianapolis, IN 46278
Email: gil.melman@iea.net
Voice: (765) 828-3513

29.0 QUALITY ASSURANCE / QUALITY CONTROL REQUIREMENTS

29.1 Contractor shall maintain a Site-specific Quality Assurance / Quality Control ("QA/QC") Plan for the Scope of Work. A preliminary QA/QC Plan shall be submitted with the proposal and Site-specific QA/QC Plan shall be submitted within fourteen (14) days of the signature of the Contract.

29.2 The Quality Assurance portion of the QA/QC Plan shall address the following minimum requirements:

- Management of Change Processes;
- Document Control/Records Retention Practices;
- Corrective/Preventative Action and Nonconformity Record Processes;
- Personnel Qualifications;
- Design and Review Procedures;
- Continuous Improvement/Process Measurement and Control; and,

PUBLIC VERSION

Scope of Work
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 30 of 30
Final Rev. 13 dated August 2, 2019

- Procedure to ensure Subcontractors and suppliers follow the Contractor's QA/QC Plan.

29.3 The Quality Control portion of the QA/QC Plan shall address the following as minimum requirements:

- Material Receipt and Storage;
- Inspection and Test Plans showing the Activity and the Inspection and Test Requirements based on Scope of Work;
- Corrective/Preventative Action and Nonconformity Record;
- Inspection Procedures including Inspection and Test Forms; and,
- As-Built Drawings and Controls.

29.4 The QA/QC Plan will be reviewed by the Owner for content and applicability to the Scope of Work. Contractor shall address all Owner noted deficiencies to the QA/QC Plan within fourteen (14) calendar days of receipt of Owner's comments.

29.5 AEP reserves the right to review Contractor to assure compliance to their QA/QC Plan.

29.6 Contractor shall maintain and have QA/QC Plan and associated records available for AEP review.

30.0 INSURANCE

30.1 Contractor shall provide insurance coverage in accordance with Article 18 as modified by The Insurance Requirements Supplement for the Affiliated Companies of the American Electric Power System dated June 6, 2017 of the General Terms and Conditions.

31.0 ISNETWORLD

31.1 In order to comply with Owner's subscription requirement to ISNetworld ("ISN"), Contractor and those of its Subcontractors providing on-Site services valued at more than fifty thousand dollars (\$50,000) must, at no additional cost to Owner, register with ISN, either online by going to www.isnetworld.com and clicking on "Become A Member" or by contacting ISN at (214) 303-4900 or (800) 976-1303 to establish Contractor's subscription.

31.2 During the term of the Contract, Contractor and such Subcontractors must acquire and maintain a passing ISN AEP Dashboard Grade as stated in the AEP ISN Dashboard.

31.3 If during the Contract term, Contractor's grade falls below AEP's minimal requirements as stated in the AEP ISN Dashboard, then, at Contractor's cost and expense and in addition to any other rights and remedies the Owner may have under the Contract or under the law, the Owner shall have the following rights:

- The right to apply a probationary period where all Work performed by Contractor is temporarily stopped until an investigation is performed;
- The right to stop the Work under the Contract until Owner is satisfied that the cause for the non-passing grade is remedied; and/or,
- The right to terminate the Contract for cause if, in AEP's sole opinion, the grade cannot be improved to a passing level within a reasonable time.

PUBLIC VERSION



**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 1
PROPOSAL REQUIREMENTS
South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

PUBLIC VERSION

Proposal Requirements
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 2 of 7
Rev. 0, 11/2/2018

Table of Contents

1.0	PROPOSAL FORMS AND REQUIREMENTS	3
1.1	General	3
1.2	Proposal Cover Sheet	3
1.3	Lump Sum, Turnkey Contract Price	3
1.5	Form A - Mark-Up Percentages for Cost-Plus Work	3
1.6	Form B – Rental Equipment	4
1.7	Form C - Subcontractor Information	4
1.8	Form D (Part D1 & Part D2) - Exceptions, Deviations and Clarifications	4
1.10	Form S - Safety Statistics Form	5
1.11	Diversity Vendor Information Forms	5
2.0	SUPPLEMENTAL PROPOSAL REQUIREMENTS	5
2.1	Supplemental Submittals	5
2.2	Disposal Site	6
3.0	PROPOSAL SUBMITTAL	6
4.0	PRE-BID MEETING	6
5.0	POST-BID MEETING	6
7.0	RIGHT TO REJECT PROPOSAL	7
7.0	COMMENCEMENT OF WORK	7
8.0	DISCLOSURE	7

PUBLIC VERSION

Proposal Requirements
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 3 of 7
Rev. 0, 11/2/2018

1.0 PROPOSAL FORMS AND REQUIREMENTS

1.1 General

- 1.1.1 Proposal forms are included in native electronic format. Forms shall be completed and submitted in native electronic format.
- 1.1.2 Proposal forms must be used without altering, modifying or editing.
- 1.1.3 Proposals must be typewritten. No alterations or corrections of Contractor's pricing will be permitted unless initialed and dated adjacent thereto.
- 1.1.4 When doubt exists in the mind of Contractor as to the true meaning of any part of the Documents, Contractor shall request Owner's interpretation thereof. Such request shall be directed to the responsible Contract Analyst as noted on the bid invitation letter. If written interpretations are required in response to Contractor inquiries, or if Owner initiated clarifications and corrections are made, then they will be mailed to Contractor. Owner assumes no other responsibility for explanations or interpretations of the Contract documents.

1.2 Proposal Cover Sheet

- 1.2.1 The Proposal Cover Sheet must be completely filled out and submitted with the proposal on Contractor's letterhead. The Proposal Cover Sheet shall be page number 1 of Contractor's proposal.

1.3 Lump Sum, Turnkey Contract Price

- 1.3.1 Contractor shall submit its pricing on the Lump Sum, Turnkey Contract Price form. Pricing shall include all costs of performing the Work as required by the drawings and specifications. Unless otherwise noted in the document, Contractor's pricing shall remain firm, not subject to escalation, for the duration of the Work.
- 1.3.2 Contractor shall outline plans for multiple shifts and/or extended work days in its proposal. All associated costs shall be included in the firm pricing, including, but not limited to, non-manual and manual supervision, equipment, tools, craft wage differentials, premiums and inefficiencies.
- 1.3.3 Contractor's fixed pricing (lump sum or unit price) shall include costs normally required for the performance of the Work; such as activities performed prior to the start of the regular shift, during the lunch period, or after the end of a regular shift.
- 1.3.4 Firm lump sum priced proposals shall be based on Contractor's estimates of Work, shown on the drawings, specifications, or visual inspection; or on Owner's estimated quantities when they are provided. Owner estimated quantities on Bills of Material shall not be considered Owner estimated quantities for firm price proposals unless otherwise explicitly stated in the Scope of Work document or Appendices. Bills of Materials are provided as a technical supplement to the bid drawings; a general reference indicating the types of materials to be used for the Work.
- 1.3.7 Contractor shall provide its cost-plus, time and material rates and/or hourly rates plus expenses with its proposal. The rates will be the basis for costs associated with extra Work or changes in Work during the construction phase of the project. The rates for craft labor shall be based on the applicable union provisions of Form A

1.5 Form A - Mark-Up Percentages for Cost-Plus Work

- 1.5.1 Contractor shall submit with its proposal its markup percentages for craft labor, non-manual rates, per-diem and other pricing markups as requested on Form A. Details for filling out this form are included on Form A.

PUBLIC VERSION

Proposal Requirements
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 4 of 7
Rev. 0, 11/2/2018

- 1.5.2 Reimbursement for Cost-Plus Work shall be in accordance with the General Terms and Conditions.
- 1.5.3 One Form A shall be filled out and submitted with Contractor's proposal for Contractor and one Form A for each subcontractor performing Work. The total mark-up for overhead and profit for each sub-contractor shall not exceed that for Contractor. All rates shall be Contractor's or subcontractor's documented rates in active Blanket Contracts, if applicable.
- 1.5.4 Items that appear on the Small Tools, Consumables and Personal Protective Equipment List on Form A shall not be included on Form B as rental items.
- 1.5.5 Labor and services performed by subsidiary or affiliated companies of Contractor shall be billed at cost with no additional markup.
- 1.5.6 No mark-ups for Overhead, Profit or Comprehensive General Liability Insurance are allowed on Premium Time Wages.
- 1.5.7 The percentages entered for Overhead, Profit and Comprehensive General Liability Insurance shall be firm for the duration of the Work for firm lump sum price contracts.

1.6 Form B – Rental Equipment

- 1.6.1 Contractor shall submit with its proposal its Construction Equipment Rentals for Cost-Plus Work and/or Changes in Work on Form B. Contractor shall submit monthly and hourly rental rates for construction equipment it plans to utilize for the performance of Work. Rental rates, when applicable, will be billed to Owner under the cost-plus Work provisions of the Contract. Details for filling out this form are included on Form B.
- 1.6.2 Reimbursement will not be allowed for any item listed on Form B if said item is named on Form A as a small tool.

1.7 Form C - Subcontractor Information

- 1.7.1 Contractor shall submit with its proposal Form C to identify and list subcontractors to be utilized for the Work. All subcontractors shall be listed; or if none, state "none". If more than one subcontractor is being considered for a specific portion of the Work, Contractor shall list all subcontractors being considered by the Contractor.

1.8 Form D (Part D1 & Part D2) - Exceptions, Deviations and Clarifications

- 1.8.1 Contractor shall submit with its proposal its exceptions, deviations and clarifications to Owner's commercial documents, including the General Terms and Conditions, on Form D, Part 1.
- 1.8.2 Contractor shall submit with its proposal its exceptions, deviations and clarifications to Owner's technical documents on Form D, Part 2.
- 1.8.3 Contractor shall clearly state the document and corresponding section being addressed and shall provide clear and concise statements to describe the exception, deviation or clarification.
- 1.8.4 Contractor shall insert the word "None" on the form if it takes no exceptions, deviations or clarifications to the specifications. Exceptions, deviations and clarifications to Owner's documents might result in rejection of Contractor's proposal.

PUBLIC VERSION

Proposal Requirements
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 5 of 7
Rev. 0, 11/2/2018

1.10 Form S - Safety Statistics Form

- 1.10.1 Contractor shall submit a completed Form S - Safety Statistics Form with its proposal. Contractor shall also submit this form for each of its subcontractors it intends to utilize on the project.
- 1.10.2 The safety statistics shall be submitted for the most current three-year period for which they are available.
- 1.10.3 Contractor and its subcontractors are required to have an interstate experience modification rate (EMR) of 1.0 or less at the time of submitting a bid proposal. If during the performance of the Work, Contractor or its subcontractor's EMR does exceed 1.0, Contractor shall promptly notify Owner of such for Owner's review and disposition.

1.11 Diversity Vendor Information Forms

- 1.11.1 Contractor shall complete the AEP Diverse and Small Business Self Certification Form and include it with its proposal.

2.0 SUPPLEMENTAL PROPOSAL REQUIREMENTS

2.1 Supplemental Submittals

- 2.1.1 Contractor shall include the following additional information with its proposal:
- Site organization charts along with the resume(s) of key personnel;
 - Certificates or documentation for rates on state unemployment insurance, Workers' Compensation, experience modification rate, General Liability & Property Damage Insurance;
 - Documentation can include copies of the state rate notification or other appropriate documents such as pages from Contractor's insurance policy.
 - Contractor shall provide documentation of its current rates annually and when a change occurs.
 - Other work licenses and certifications;
 - Manpower loadings and cumulative workhours;
 - Safety Manual (includes Health and Safety Plan, OSHA10 and OSHA30 or MSHA training requirements, heat stress policy, drug testing policy);
 - Quality Assurance/Quality Control Plan;
 - Environmental Plan;
 - Must include the following:
 - SWPPP
 - Environmental Work Compliance Plan
 - Vegetation Management Plan
 - Work Schedule Bar Chart utilizing day 0 as contract award date;
 - The schedule shall clearly indicate all milestone dates
 - Construction Execution Plan including a sequence of Work discussion;
 - Technical Submittals;
 - Quantity estimates for Work;
 - Name, email and telephone contact information for the person responsible to submit the Contractor Liability Form;
 - Vaisala Solar Client Data Review Form;
 - Bidder's Response Summary Form;
 - Annual Energy Production Form;
 - Design Performance Factor Form; and
 - Contractor Acquired Permits Form.

PUBLIC VERSION

Proposal Requirements
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 6 of 7
Rev. 0, 11/2/2018

2.2 Disposal Site

- 2.2.1 Contractor shall state in its proposal the disposal site it has chosen. The use of any landfill is subject to change by Owner.

3.0 PROPOSAL SUBMITTAL

- 3.1 The Submittal of a proposal shall establish prima facie evidence that Contractor has read and accepts the terms and conditions of the specifications.
- 3.2 Proposals shall be submitted in accordance with the requirements, provisions and instructions contained in Ariba.
- 3.3 Late proposals will not be accepted unless unusual and extraordinary circumstances exist.
- 3.4 Proposals will not be accepted by telephone, facsimile, electronic mail, U.S. Mail or other courier services.

4.0 PRE-BID MEETING

- 4.1 A formal Pre-Bid Meeting may be scheduled at the discretion of the Owner. Date, place and time will be indicated in the Ariba Sourcing Event. Owner initiated changes to bidding documents may be presented during the pre-bid meeting. Items which may be covered at this meeting are:
- Owner initiated changes to bidding documents may be presented during the pre-bid meeting, if scheduled;
 - Work to be Performed, Tour of Work Areas;
 - Safety/Environmental/Housekeeping;
 - Scheduling and Progress Reporting;
 - Pricing and Proposal Requirements; and,
 - Proposal Submittal Requirements.

5.0 POST-BID MEETING

- 5.1 A post-bid meeting(s) might be held to review Contractor's proposal and/or the Scope of Work.
- 5.2 Owner might elect to negotiate with Contractor to resolve any questions related to its proposal and to arrive at a final price.
- 5.3 Revisions to bid amounts shall be justified and documented by Contractor.
- 5.4 Owner will issue post-bid meeting minutes, which shall become a part of any future contract, which may be entered into for the Work.

6.0 SELECTION CRITERIA

- 6.1 Proposals will be evaluated on the following criteria (in no particular order):
- Cost
 - Project Plan
 - Performance
 - Quality and Reliability
 - Contractor Experience
 - Schedule
 - Adherence to RFP

PUBLIC VERSION

Proposal Requirements
South Bend Solar Project RFP
Specification AEP-LC-2672

Page 7 of 7
Rev. 0, 11/2/2018

7.0 RIGHT TO REJECT PROPOSAL

6.1 Owner reserves the right to reject, with or without cause, any or all proposals submitted.

7.0 COMMENCEMENT OF WORK

7.1 Contractor shall not perform Work until the following conditions have been met:

- Owner authorizes Contractor to start Work;
- A duly countersigned Contract has been received by Owner; and,
- Contractor's Certificate of Insurance has been received satisfying the insurance requirements of the terms and conditions.

8.0 DISCLOSURE

8.1 After a Contract is awarded, all unsuccessful contractors shall be promptly notified in writing by Owner.

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PUBLIC VERSION

**PPROPOSAL FORMS THAT WOULD BE UNDER APPENDIX 1 HAVE BEEN
FILLED IN BY CONTRACTOR AND ARE NOW UNDER EXHIBIT B.**

PUBLIC VERSION



**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 2
AEP General Terms and Conditions for Engineering,
Procurement, and Construction Work
Revision 3 dated 06/14
as modified by the WC AEP South Bend Solar Form D
Commercial Exceptions Deviations Clarifications
FINAL 08/2/19**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 13, AUGUST 2, 2019

PUBLIC VERSION

AMERICAN ELECTRIC POWER

AEP GENERAL TERMS AND CONDITIONS FOR ENGINEERING, PROCUREMENT AND CONSTRUCTION WORK

March 2009 Rev. 3 dated 6/14

PUBLIC VERSION

TABLE OF CONTENTS

<u>ARTICLE NO.</u>	<u>HEADING</u>	<u>PAGE NO.</u>
1.0	DEFINITIONS.....	1
2.0	CONTRACTOR'S OBLIGATIONS.....	2
3.0	TERM AND EFFECTIVE DATE.....	3
4.0	RELATIONSHIP OF THE PARTIES.....	3
5.0	ASSIGNMENT AND SUBCONTRACTING.....	3
6.0	LABOR RELATIONS.....	4
7.0	SAFETY AND SECURITY.....	4
8.0	EQUIPMENT.....	7
9.0	INSPECTION AND ACCEPTANCE.....	8
10.0	SHIPMENT AND DELIVERY.....	9
11.0	TITLE AND RISK OF LOSS.....	9
12.0	SCHEDULE.....	9
13.0	TERMS OF PAYMENT.....	10
14.0	CHANGES IN WORK AND EXTRA WORK.....	10
15.0	REIMBURSEMENT FOR COST-PLUS WORK.....	11
16.0	BACKCHARGES.....	12
17.0	TAXES.....	12
18.0	INSURANCE.....	13
19.0	INDEMNIFICATION	15
20.0	LIMITATION OF LIABILITY.....	16
21.0	LIENS.....	16
22.0	INTELLECTUAL PROPERTY.....	16
23.0	DRAWINGS AND DATA.....	17
24.0	CONFIDENTIALITY.....	17
25.0	DEFAULT.....	18
26.0	DAMAGES FOR DELAY.....	18
27.0	FORCE MAJEURE.....	19
28.0	SUSPENSION.....	19
29.0	TERMINATION.....	20
30.0	EQUIPMENT AND WORKMANSHIP WARRANTY.....	20
31.0	REPORTING OF COMPLAINTS.....	21
32.0	RETENTION AND EXAMINATION OF INFORMATION, BOOKS AND RECORDS.....	21
33.0	COMPLIANCE WITH LAWS.....	22
34.0	PERMITS AND LICENSES.....	22
35.0	NOTICES.....	22
36.0	SEVERABILITY.....	22
37.0	WAIVER.....	23
38.0	NON-DISCLOSURE.....	23
39.0	HEADINGS.....	23
40.0	AFFILIATED COMPANIES.....	23
41.0	APPLICABLE LAWS AND JURISDICTION.....	23
42.0	ENTIRE AGREEMENT.....	24
43.0	BINDING EFFECT; NO THIRD-PARTY BENEFICIARIES.....	24
44.0	EXECUTION; COUNTERPARTS; ELECTRONIC SIGNATURES.....	24
45.0	SURVIVAL.....	24

AFFIDAVIT OF COMPLETION

Exhibit 1

PUBLIC VERSION

Page 1

**AEP GENERAL TERMS AND CONDITIONS
FOR ENGINEERING, PROCUREMENT AND CONSTRUCTION WORK**

1.0 DEFINITIONS

Subject to additional definitions contained in subsequent Articles, capitalized terms used in these General Terms and Conditions for Engineering, Procurement and Construction Work have the meanings set forth below:

- 1.1 Business Day: “Business Day” means any calendar day, other than a Saturday or Sunday or a calendar day on which U.S. commercial banking institutions are authorized or required by law to close.
- 1.2 Change Order: “Change Order” means a written order as defined and issued in accordance with Article 14.0.
- 1.3 Contract: “Contract” means collectively the Contracting Instrument and all documents referenced in the Contracting Instrument and any Change Orders, amendments or addenda.
- 1.4 Contract Price: “Contract Price” means the price to be paid to the Contractor for the performance of Work as set forth in the Contracting Instrument.
- 1.5 Contracting Instrument: “Contracting Instrument” means the contractual document that identifies the parties, the nature of the Work, the Contract Price, documents to be included as part of a Contract, and other matters relating to a Contract. The Contracting Instrument may be in the form of a contract letter, blanket purchase order, purchase order or other similar documents.
- 1.6 Contractor: “Contractor” means the entity contracting with Owner for the performance of Work.
- 1.7 Direct Cost: “Direct Cost” means the actual costs and charges incurred and payments made by Contractor, its Subcontractors for Site Equipment, materials, services and labor (including payroll burden and expenses) which are directly attributable to the performance of Contractor’s Work hereunder. Direct Cost includes Contractor’s home office or Site labor to the extent Contractor’s home office or Site labor is directly assignable to the Work which must be demonstrable under the circumstances. Direct Cost shall not include corporate, general and administrative costs including home office functions, sales, marketing, accounting, human resources, information technology, payroll, profit, research, development, quality assurance and control, purchasing, safety, management, administration, warranties, insurances, offsite or other unabsorbed costs.
- 1.8 Equipment: “Equipment” means all goods, materials and accessories to be purchased under the Contract, including all documentation required by the Contract.
- 1.9 Final Acceptance: “Final Acceptance” means Owner’s determination that the Work has been completed in accordance with the Contract requirements.
- 1.10 Initial Acceptance: “Initial Acceptance” means Owner’s determination prior to final inspection and testing that the Work conforms to the Contract requirements for purposes of receipt.
- 1.11 Owner: “Owner” means any one or more of the companies of the American Electric Power System as may be specified in the Contract Instrument.
- 1.12 Site: “Site” means Owner’s property or such other premises (including adjacent bodies of water and property owned or controlled by a third-party) upon which the Work is to be performed.

PUBLIC VERSION

Page 2

1.13 Subcontractor: “Subcontractor” means vendors, suppliers, consultants, and subcontractors of any tier, materialmen, professionals, laborers, and all other persons providing equipment, materials or services directly or indirectly to Contractor in connection with the Work.

1.14 Work: “Work” means all of Contractor's obligations under the Contract.

2.0 CONTRACTOR'S OBLIGATIONS

2.1 Contractor shall at its expense provide everything necessary for the complete, proper and timely execution of the Work including, but not limited to, home office support, labor, supervision, and technical field assistance; engineering, design, construction and start-up services; safety equipment, construction equipment, temporary utilities and facilities, equipment to be installed, materials, tools and supplies; fabrication and manufacturing; transportation; drawings and documentation, unless explicitly excluded in the Contract. Contractor's performance of the Work shall include everything requisite and necessary to comply with prudent electric utility industry standards and to complete the Work, notwithstanding the fact that every item necessarily involved may not be specifically mentioned. Details and items not indicated by the Contract documents shall be adequately and properly performed by Contractor at no extra cost if such details and items are necessary to complete the intent of the Contract or otherwise to complete the Work.

2.2 Contractor is responsible for considering the conditions affecting the Work including, but not limited to, conditions affecting the transportation, disposal, handling and storage of materials; the availability and cost of labor, water, electric power, utilities, and roads; the uncertainties of weather, river stages, and similar physical conditions at the Site; the conformation and condition of the ground; and the character of equipment and facilities needed. Contractor shall take into account the character, quality and quantity of surface and subsurface materials or obstacles to be encountered to the extent this information is reasonably ascertainable from the Contract documents or an inspection of the Site.

2.3 Contractor shall immediately and before such conditions are disturbed notify Owner of: (a) subsurface or latent physical conditions at the Site which differ materially from those indicated in the Contract; (b) unusual geologic conditions at the Site which differ materially from conditions ordinarily encountered or from conditions addressed in the Contract; or (c) artifacts or articles which appear to have archaeological or historical significance. Owner shall promptly investigate such conditions and, if such conditions do materially differ and cause an increase or decrease in Contractor's cost of, or the time required for, performance of any part of the Work, the parties shall agree to amend the Contract. No claim of Contractor under this clause shall be allowed unless Contractor has given immediate notice as required above and confirmed such notice in writing within ten (10) days of discovery.

2.4 Contractor shall have an authorized representative at the Site to whom Owner may give instructions at all times when Work is being performed.

2.5 Contractor shall assign qualified and competent supervision and personnel to perform the Work and have qualified and competent supervision at the Site at all times to direct and observe the Work. Key personnel shall not be removed or replaced without prior consent of Owner which shall not be unreasonably withheld. Contractor will investigate and take appropriate action with respect to any personnel problems brought to its attention by Owner.

2.6 Contractor shall confine all of its operations and personnel to those areas of the Site to which Owner authorizes access.

2.7 Contractor's personnel may not operate Owner's tools, vehicles, materials or equipment (“Owner's Equipment”) without Owner's prior authorization. If Contractor borrows Owner's Equipment, Contractor (a) agrees that Owner has provided the Owner's Equipment AS IS, with no representations or warranties; (b) assumes full responsibility for the protection of the borrowed Owner's Equipment; (c) assumes all liability for injuries or damages resulting from the use of the

PUBLIC VERSION

Page 3

borrowed Owner's Equipment; and (d) agrees to return the borrowed Owner's Equipment to Owner in the same condition as when it was borrowed, or, if repairs are necessary, to cause such repairs to be performed promptly at Contractor's expense before the Owner's Equipment is returned to Owner. Owner has no obligation to lend Owner's Equipment to Contractor.

- 2.8 Contractor shall cooperate with Owner and others working at or near the Site. Contractor shall promptly report to Owner any defects in the work of others which affects the Work. Failure to report such defects constitutes acceptance of the conditions by Contractor. Contractor shall properly fit, connect and coordinate its Work with that of Owner and other contractors.
- 2.9 Contractor shall keep all of its work areas free from trash and debris, and keep its work areas "broom clean" on a continuous basis.
- 2.10 Contractor shall secure and protect its materials, tools, equipment and the Work, including Owner's Equipment.
- 2.11 As requested by Owner, Contractor shall provide Owner with periodic reports concerning the progress of the Work.
- 2.12 Contractor is responsible for the proper execution of the Work with respect to any base lines and bench marks established by Owner.
- 2.13 If the Work is subject to prevailing wage requirements, Contractor agrees to comply with such requirements.
- 2.14 Contractor, its Subcontractors, and their respective employees and agents involved in the Work shall adhere to the provisions contained in Owner's Code of Business Conduct which can be found at Owner's website.

3.0 TERM AND EFFECTIVE DATE

- 3.1 The Contract shall commence as of the effective date and, unless earlier terminated as provided in Article 29.0, shall terminate on the termination date set forth in the Contract. Unless specified elsewhere in the Contract, the effective date of the Contract shall be the earlier of the date on which Contractor begins performance hereunder or the date of the latter signature on the Contract.

4.0 RELATIONSHIP OF THE PARTIES

- 4.1 Contractor and all of its employees and Subcontractors are, with respect to Owner, independent contractors. Contractor will be solely responsible for the supervision, direction, and control of its employees and Subcontractors. Contractor is responsible for the payment of all compensation, benefits, and employment taxes with respect to the Contractor's employees.

5.0 ASSIGNMENT AND SUBCONTRACTING

- 5.1 Contractor shall not assign or otherwise dispose of the Contract, or any obligations hereunder, without the written consent of Owner. Any assignment or disposal without the written consent of Owner shall be null and void.
- 5.2 Prior to entering into any subcontract, Contractor shall submit to Owner a subcontractor data sheet that includes the name and address of the Subcontractor and the scope of work proposed to be included under such subcontract. Within five Business Days of receipt of a Subcontractor data sheet, Owner may reject such Subcontractor without cost or contract extension by giving written notice of such rejection to Contractor.

PUBLIC VERSION

Page 4

- 5.3 Contractor is responsible for the selection of any Subcontractor and for the Subcontractor's proper performance of the Work assigned to it. If the work of a Subcontractor is not in compliance with the Contract requirements, Contractor shall take immediate steps to bring the Subcontractor's work into compliance and, at Owner's written request, terminate its contractual relationship with the Subcontractor as it relates to the Work at no cost to Owner.

6.0 LABOR RELATIONS

- 6.1 Contractor shall comply with any project, national or local labor agreements that are applicable to the Work or Site. Contractor shall cooperate with Owner and other contractors in establishing and maintaining labor work rules and practices.
- 6.2 When the Work is performed by building and construction trades labor, a pre-job conference shall be held with local labor representatives prior to starting Work. Owner shall be afforded the opportunity to attend and participate in pre-job conferences.
- 6.3 Contractor shall provide immediate notice to Owner of any actual or potential labor dispute that may delay the timely, efficient and productive performance of the Work.
- 6.4 Contractor shall inform and cooperate with Owner on labor matters. Contractor shall consult with Owner prior to rendering its decision(s) on labor matters that may impact the timely, efficient and productive performance of the Work.
- 6.5 Contractor shall exercise its management rights contained in applicable labor agreements to establish, maintain, and enforce work rules conducive to timely, efficient, productive and harmonious work operation. Contractor shall take the necessary steps available to resolve grievances, jurisdictional disputes, or other violations of collective bargaining agreements.

7.0 SAFETY AND SECURITY

- 7.1 Contractor shall perform the Work in a safe and careful manner, provide first aid facilities and transportation, and use such safety devices and methods as are necessary to protect its employees, agents, Subcontractors, Owner's employees and agents, other contractors and the public from bodily injury and property damage.
- 7.2 Contractor shall comply with and enforce all laws, rules and regulations applicable to safety and health standards, including, but not limited to, the Occupational Safety and Health Act of 1970 ("OSHA") and any revisions of OSHA or successor legislation.
- 7.3 Contractor shall comply with project and Site safety and security rules and all procedures issued by Owner, provided that such rules and procedures do not conflict with OSHA or other safety laws, rules or regulations. Contractor shall assign a competent person at all times to manage, coordinate and enforce its safety program during performance of the Work.
- 7.4 Contractor shall provide Owner with Material Safety Data Sheets ("MSDS") for all applicable materials prior to delivery to Owner's Site.
- 7.5 Contractor shall obtain Site permits or approval from Owner for its vehicles, any excavation, use of explosives, access to restricted areas, use of Owner's Equipment, tools and facilities, and other similar activities.
- 7.6 Owner will arrange all necessary clearances on energized equipment, electrical and communications circuits, piping systems or other operational equipment. Contractor shall notify Owner requesting the clearances prior to the scheduling of such Work. Contractor shall comply with Owner's clearance permit system regarding tagout and lockout of electrical and mechanical systems and other equipment.

PUBLIC VERSION

Page 5

- 7.7 Contractor shall fully inform Owner in writing regarding the types, quantities and use of any hazardous materials brought on the Site; the types and quantities of hazardous wastes being generated from the Work; and Contractor's program for proper storing, handling and disposal of such materials in a safe and secure manner.
- 7.8 Contractor shall immediately inform Owner of all regulatory, safety, health and environmental inspections, citations and penalties associated with the Work. Contractor shall provide Owner with written reports and copies of all documents submitted to or by regulatory agencies and insurance companies.
- 7.9 Contractor shall promptly inform Owner of any injuries to its employees, agents, Subcontractors, or other persons arising out of the Work that require medical treatment.
- 7.10 Contractor shall obtain, maintain, and properly complete all record keeping required by regulatory agencies. Upon request, Contractor shall provide Owner with copies of all logs, reports and other records.
- 7.11 Contractor shall investigate all accidents resulting in personal injury, property damage, or near misses to determine root cause(s) and corrective action(s). Upon request, Contractor shall provide Owner with a copy of investigative reports, including all documents submitted to insurance companies.
- 7.12 All of Contractor's employees, agents, Subcontractors, vehicles, trailers, etc. entering or leaving the Site are subject to inspection at any time by Owner.
- 7.13 If a safety violation or other unsafe condition causes imminent danger, Owner may immediately shut down the Work involved without advance written notice.
- 7.14 Contractor and all Subcontractors performing Work at the Site must have a substance abuse program. This program must apply to all personnel of Contractor and its Subcontractors. Minimum requirements of this program shall include pre-hire testing, testing for cause and if requested, random testing. Screening substances and their associated cut-off limits are listed below.

Drug Classes	Screening Cut-Off Limit (ng/ml)	Confirmation Cut-Off Limit (ng/ml)
Amphetamines	1,000	500
Benzoylcegonine	300	150
Cannabinoids	50	15
Opiates	2,000	2,000
Phencyclidine	25	25

Blood & Breath alcohol content: .02% per Department of Transportation.

Testing shall be performed by a testing facility certified by Department of Health & Human Services. Personnel must have evidence of having tested negative within a year prior to employment. Owner will accept conditional employment predicated upon (a) employee(s) furnishing evidence that they have submitted to testing within forty-eight (48) hours of initial employment and (b) employee(s) furnishing evidence of negative test results within five (5) Business Days of initial employment. Contractor shall ensure personnel are "drug free". Owner reserves the right to examine evidence outlined herein. Contractor's program shall incorporate reciprocity on "drug free" employee verification to minimize Owner's economic impact and employee(s) recertification while maintaining the program's intent.

- 7.15 If required by Owner, Contractor must meet certain security criteria set forth herein.

PUBLIC VERSION

Page 6

- 7.15.1 Contractor shall submit to Owner a copy of its background investigation process for Owner's review and file. If Owner, in its sole discretion, determines that Contractor's background investigations do not meet certain specific requirements, then Contractor, at its expense, must perform a background investigation that does meet Owner's certain specific requirements on each individual designated by Contractor to perform Work, or is performing Work on behalf of Contractor, for Owner (referred to herein for purposes of this Article, as an "individual"). Notwithstanding anything to the contrary stated herein, Owner reserves the right to conduct a background investigation on each individual at Contractor's expense.
- 7.15.2 Owner's certain specific requirements of background investigations include the following: (i) determination of whether an individual has been convicted of a felony crime in each state where the individual has resided during the past seven years; (ii) performance of the background investigation at the state level (in other words, to only search the records of the county in which the individual has resided during the past seven years is not a sufficient background investigation); and (iii) if the individual is to operate a motor vehicle while performing Work for Owner, then a state operator's license abstract must be completed in the states where the individual has been licensed as a vehicle operator during the past seven years.
- 7.15.3 If any background investigation reveals or indicates that an individual has been convicted of a felony crime, then the Contractor must notify the Owner prior to the individual commencing Work. Owner in its sole discretion shall have the option of barring from any Work Site any individual who has a reported felony conviction. Owner may audit or review specific Contractor screening files to ensure compliance with this Contract.
- 7.15.4 If an individual requires unescorted access to Owner's critical cyber assets, then Owner will conduct its own background investigation, which will include a Social Security Number verification. Additional specific provisions or requirements related to any Owner conducted background investigation pursuant to this Section 7.15.4 will be communicated to Contractor prior to implementation of such background investigation.
- 7.15.5 Contractor shall not perform any screening activities that violate the federal Fair Credit Reporting Act, Title VII of the Civil Rights Act of 1964 or any other applicable law in any circumstances. Contractor shall ensure that the substance and manner of any and all background investigations performed by Contractor conform fully to applicable law.
- 7.16 "Personally Identifiable Information" or "PII" means any information to which Contractor is provided access that could identify an individual either directly or indirectly including, without limitation to, the individual's name, credit card numbers, social security number, biometric, bank account numbers, passport numbers, computer passwords or health, financial or employment information and other individual confidential information.
- 7.16.1 To the extent that Work under the Contract requires Contractor to be given access to PII gathered and/or maintained by or on behalf of Owner, or in the event Contractor acquires access to or encounters any PII during performance of the Work, Contractor shall after receipt thereof, treat such PII as confidential and safeguard such PII from unauthorized use and disclosure. Upon request of Owner, Contractor shall have its employees execute a confidentiality agreement protecting PII. Contractor agrees not to appropriate such PII for its own use or to disclose such PII to third parties unless specifically authorized by Owner in writing. Contractor shall ensure that its employees will not discuss, divulge or disclose any such PII to any person or entity except those persons directly concerned with and only to the extent necessary to complete the performance of the Work. Contractor shall access, use and process PII and other data on behalf of Owner only for the purposes specified in the Contract.

PUBLIC VERSION

Page 7

- 7.16.2 Contractor shall comply with (i) NERC Reliability Standards as applicable, including without limitation, those relating to Critical Infrastructure Protection, (ii) Owner's security standards, and (iii) such further instructions as Owner may provide regarding the processing of such PII. Contractor shall inform Owner promptly if it has reason to believe that applicable law (or changes in applicable law) prevents Contractor from fulfilling the obligations relating to treatment of PII or other data under Owner's security standards and/or the Contract.
- 7.16.3 To the extent permitted by law, Contractor shall notify Owner promptly and act only upon Owner's instruction concerning: (a) any request for disclosure of PII or other data by law enforcement or other governmental authority; (b) any request by law enforcement or other governmental authority for information concerning the processing of PII or other data in connection with the Contract; or (c) any request received directly from an individual concerning his/her PII.
- 7.16.4 Contractor may not store PII, on computers, mobile devices, including but not limited to a cellular telephones and/or personal digital assistants, servers and/or storage devices including removable media (any of which, hereinafter known as a "Computer"), unless required for the performance of Work. Any such information must be deleted from a Computer, in a manner that ensures that it cannot be accessed or read, as soon as such storage is no longer required for the performance of Work.
- 7.16.5 Upon termination of the Contract or upon Owner's request, Contractor must promptly (a) return all PII in written form to Owner, and (b) delete all PII in Contractor's possession or control (on computer or in whatever other form or media) in a manner that ensures that this information cannot be accessed or read.
- 7.16.6 Contractor shall administer a monitoring process to ensure compliance with Section 7.16 and the related subsections hereof, promptly report any breaches to Owner, and implement immediate, appropriate corrective actions to contain and prevent recurrence. Contractor shall report to Owner immediately upon discovery of a real or suspected loss of PII. In the event of a breach of this provision or the occurrence of any other event regarding PII that requires notification under applicable law, Contractor agrees to assume responsibility for informing all such individuals in accordance with applicable law.
- 7.16.7 In addition to any remedy available to Owner under the Contract, Contractor acknowledges that any breach of Section 7.16 or the related subsections hereof by Contractor or its Subcontractors may subject Contractor to civil and criminal penalties. Contractor shall include the full text of Section 7.16 and the related subsections 7.16.1 through 7.16.7 in all appropriate subcontracts. However, including such provision in the subcontracts shall not relieve Contractor of its obligation to ensure compliance with the provisions of Section 7.16 and the related subsections 7.16.1 through 7.16.7.

8.0 EQUIPMENT

- 8.1 All Equipment shall be new and meet the requirements of all applicable codes. Equipment which will not become a part of the permanent installation is not required to be new. Owner reserves the right to reject Equipment which has not been previously used but which has been in storage for an unreasonable period of time. Title to the Equipment shall be free and clear of all liens and encumbrances.
- 8.2 Contractor shall not substitute Equipment specified in the Contract unless authorized by Owner in writing. Unless substitution has been so authorized, Contractor shall, at its expense, remove and replace any improperly substituted Equipment.

PUBLIC VERSION

Page 8

- 8.3 Upon Owner's request, Contractor shall, at its expense, submit to Owner samples of Contractor-furnished Equipment. Contractor must obtain Owner's written approval before performing Work involving the use of Equipment for which samples have been requested. Approval by Owner shall not relieve Contractor from responsibility for complying with the requirements of the Contract and all applicable codes. Equipment used shall conform to the approved samples. Contractor shall remove and replace nonconforming Equipment at its expense.

9.0 INSPECTION AND ACCEPTANCE

- 9.1 Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the Work performed conforms to the Contract requirements. Owner reserves the right to review and approve the adequacy of Contractor's inspection system. Contractor shall provide all quality control and quality assurance program information requested by Owner.
- 9.2 Owner shall have free access to the Work for inspection purposes. Owner's inspectors and expeditors shall be admitted at all reasonable times to the shops of Contractor, its Subcontractors for inspection purposes. Owner's inspection, receipt or Initial Acceptance of the Work shall not relieve Contractor of its obligation to comply with the terms of the Contract.
- 9.3 Each party shall bear its own expenses in performing inspections, except that (a) Owner may use Contractor's facilities, ladders and scaffolds to perform inspections of the Work; (b) Contractor shall pay Owner's expenses in re-inspecting Work which was rejected as non-conforming to the Contract requirements in an earlier inspection; (c) Contractor shall pay the costs of uncovering and re-covering Work for Owner's inspection if Contractor failed to give Owner reasonable notice that the Work was ready to be covered; and (d) prior to Final Acceptance, if Owner requests an inspection of Work already completed which requires removing and tearing out Work, and the Work is found to be materially defective, Contractor shall pay the expenses of inspection and reconstruction, but if the Work is found to be in conformance with the Contract requirements, Owner shall pay the expenses of inspection and reconstruction.
- 9.4 Owner will not pay for defective work. Contractor shall repair or replace all defective work at its expense. Contractor shall promptly remove from the Site any Equipment that does not comply with the requirements of the Contract. If Owner's Equipment has been used in any defective work, the cost of such Owner's Equipment shall be backcharged to Contractor.
- 9.5 Contractor shall, at its expense, furnish to Owner certificates of shop inspection as required by laws or regulations, or by the National Board of Fire Underwriters, or by any company insuring the Equipment for the benefit of Owner.
- 9.6 Owner shall have the right to take possession of or use any part of the Work. Owner's possession or use shall not constitute Initial Acceptance or Final Acceptance of the Work.
- 9.7 Contractor shall make all production and shop tests at its expense. Owner shall have the right to have a representative present at such tests, including those at Contractor's suppliers' shops, and notice shall be given to Owner at least two weeks prior to any scheduled test. Contractor shall give Owner copies of certified test results promptly upon request.
- 9.8 Unless otherwise provided in the Contract, Final Acceptance by Owner shall be made as soon as practicable after all Work has been completed and inspected. Any part of the Work not rejected by Owner following Final Inspection shall be deemed to have achieved Final Acceptance.

PUBLIC VERSION

Page 9

10.0 SHIPMENT AND DELIVERY

- 10.1 Contractor shall coordinate shipment so that Equipment arrives at the Site on schedule and during Site receiving hours. Contractor shall provide shipping notices to Owner prior to shipment of the Equipment. Owner's storeroom at the Site where the Equipment is to be delivered shall be notified at least 48 hours in advance of the arrival of the Equipment, or as required by the Contract. Notification to Owner's storeroom and all shipping notices shall include special unloading and storage directions and a list of equipment required to unload the Equipment.
- 10.2 Contractor shall provide a complete bill of materials for each separate shipment. Every part that is not preassembled shall be identified on the bill of materials.
- 10.3 Contractor must attach metal tags with corrosion resistant tie wire, and waterproof markings and labels, to each piece and package, making reference to the bill of materials and Contract number.
- 10.4 Owner reserves the right to refuse shipments that do not contain proper markings, bills of materials, or for which proper shipping notices were not received. The return and redelivery will be at Contractor's expense.
- 10.5 Contractor shall deliver all Equipment F.O.B. Site, with freight prepaid and included in the Contract price.

11.0 TITLE AND RISK OF LOSS

- 11.1 Title and risk of loss shall pass to Owner upon Final Acceptance of the Work. Contractor agrees that title shall vest in Owner free and clear of all liens and encumbrances. If the Work is rejected as non-conforming, title and risk of loss shall remain with Contractor.
- 11.2 If the Work requires warranty work, title shall remain at all times with Owner, except that if the Work is replaced rather than repaired, Owner's title shall vest in the replacement Work.
- 11.3 If any part of the Work requires warranty work at Contractor's facility or any other off-Site location, risk of loss to that part of the Work shall pass to Contractor upon delivery by Owner of that part of the Work to a common carrier. Risk of loss to that part of the Work shall pass back to Owner upon delivery to Owner, installation at the Site and successful acceptance testing of the repaired or replaced Work.

12.0 SCHEDULE

- 12.1 Contractor shall perform the Work to meet the schedule date(s) set forth in the Contract documents. Contractor shall not commence Work until authorized by Owner to do so.
- 12.2 In a format acceptable to Owner, Contractor shall develop, update, maintain and provide to Owner a written schedule for execution of the Work. The schedule shall be time scaled, complete, and accurate in detail depicting Contract milestone dates, work activities and durations. Upon review and approval by Owner, this schedule shall become the Contract schedule. Updates to the Contract schedule shall be provided to Owner on at least a monthly basis. Updates shall depict actual progress measured against planned progress.
- 12.3 Contractor shall notify Owner within 24 hours of the first knowledge that any completion date(s) will not be met and shall, within five (5) Business Days thereafter, submit a detailed program depicting the plans and actions being taken to regain the lost time. The notice shall not limit any other rights or remedies afforded Owner under the Contract or by law.

PUBLIC VERSION

Page 10

13.0 TERMS OF PAYMENT

13.1 Except as otherwise provided in the Contract, the following terms of payment shall apply:

13.1.1 The Contract Price set forth in the Contract shall constitute full and complete payment for all Work.

13.1.2 Contractor shall submit invoices with proper documentation to Owner for the Work completed or for milestones achieved during the prior month. Owner may withhold all or any part of payment in an amount necessary to protect Owner from loss due to the occurrence, or imminent occurrence, of (i) Contractor's breach or failure to perform in accordance with the Contract, (ii) defective Work, (iii) Contractor's failure to pay any Subcontractor, (iv) other claims by Owner against Contractor, including indemnity claims, and (v) damages for delay or any agreed upon liquidated damages.

13.1.3 Owner shall pay [REDACTED] of each properly submitted and accepted invoice within [REDACTED] days of receipt. The release of retention shall become due and payable [REDACTED] days after the date of Final Acceptance of the Work.

13.1.4 Each invoice shall contain a statement that all bills for material and labor relating to the Work have been paid in full by Contractor, and there are no unpaid bills for which a lien could be filed. If requested by Owner, Contractor shall provide evidence of such payments. The final invoice for the Work shall be accompanied by a satisfactorily completed Affidavit of Completion in the form attached as Exhibit 1. Payment of the final invoice and retention constitutes a full and final release of Owner from all claims, damages, liabilities and obligations under the Contract.

13.2 Contractor shall promptly pay all of its Subcontractors.

14.0 CHANGES IN WORK AND EXTRA WORK

14.1 Change in Work

14.1.1 "Change Order" means a written order issued in accordance with this Article 14.0 documenting an addition to, deletion from, or other modification to the Work, including a change in the scope of Work, the Contract Price, the payment schedule, the completion dates, or the schedule for the Work.

14.1.2 Owner may issue a Change Order: (i) at Owner's option, or (ii) if requested by Contractor due to the occurrence of an event that entitles Contractor to a Change Order as determined by Owner.

14.1.3 If Owner issues a Change Order, Contractor shall perform the changed Work in accordance with the terms of the Contract and the issued Change Order.

14.1.4 No order, statement or other conduct of Owner shall be treated as a change in Work until such change is authorized in writing by Owner.

14.1.5 Contractor shall not be entitled to a Change Order for conditions such as, but not limited to, (i) work which is of such a nature as to be normally included in the Work or is reasonably inferable from the Contract; (ii) any errors, omissions, non-performance, negligence, deficiencies or improper or defective work on the part of Contractor (including miscalculations, incorrect estimates, or other errors in Contractor's proposal for the Work); (iii) changes relating to refinement, minor correction and detailing of the Work or

PUBLIC VERSION

Page 11

any part of the Contract; or (iv) other unallowable claims such as cost impacts not due to Owner and cumulative impact claims.

14.1.6 With respect to Contractor claims for additional compensation, Owner shall pay only incremental Direct Costs associated with the proposed changes and only to the extent that Contractor can demonstrate that the changes actually increased its costs of performance. Any claims for additional compensation based on a change to the Work or extra work must be material in nature, and Contractor must provide full documentation supporting all elements of such claims. For a reduction in the scope of Work or a change which reduces Contractor's costs, the Contract Price shall be adjusted downward. The payment for changes to the Work shall be complete compensation to Contractor for performing such changes, including any schedule or cost impacts on the Work.

14.1.7 If Owner requests in writing that Contractor furnish materials or Equipment to be permanently incorporated in changed work, extra work or cost-plus work, Owner shall reimburse Contractor for such materials or Equipment at its incremental Direct Cost plus a percentage mark-up to be agreed upon by the parties. Requests for payment for materials and equipment shall be accompanied by copies of receipted invoices. Owner has the right to audit Contractor's requests for changes and the financial basis therefor.

14.1.8 If Contractor and Owner disagree on whether any particular work is within the scope of Work and such work must be completed to insure timely progress, Owner will issue a disputed Change Order to cover the disputed work. Contractor shall diligently proceed with the disputed work. By noon on the work day following performance of the disputed work, Contractor shall submit to Owner for review timesheets itemizing all labor and equipment hours expended on the disputed work and an itemized listing of Contractor furnished materials. Such review is not an admission of liability by Owner. Prior to Final Acceptance, each disputed Change Order will be resolved to the mutual agreement of the parties.

14.2 Extra Work

14.2.1 "Extra work" is work which is beyond Contractor's scope of Work. At Owner's request, Contractor shall perform extra work at the applicable prices set forth in the Contract. If the Contract prices are not applicable to the type of extra work to be performed, Contractor shall promptly submit a proposal to perform the extra work, which proposal shall become an amendment to the Contract upon acceptance by Owner. If Owner directs Contractor to perform extra work on an overtime basis, Owner shall reimburse Contractor the actual payroll cost of premium time for direct job labor. Contractor shall invoice and maintain separate cost records for each extra work authorization issued by Owner.

14.2.2 If Owner elects, Contractor shall perform extra work on a cost-plus basis. Cost-plus extra work shall be paid in accordance with Article 15.0.

14.3 Contractor waives all claims for additional compensation for changes in work and extra work not made strictly in accordance with the terms of this Article 14.0.

15.0 REIMBURSEMENT FOR COST-PLUS WORK

15.1 Direct labor costs will be reimbursed at the actual payroll costs of direct labor wages, fringe benefits, payroll taxes and insurance required by collective bargaining agreements or by law, plus an agreed wage mark-up. Copies of certified payrolls and time sheets shall be provided to Owner for review and approval. Contractor shall not invoice Owner for social security, unemployment, workers' compensation, or other federal, state or local taxes or insurance at rates which exceed Contractor's actual costs.

PUBLIC VERSION

Page 12

- 15.2 Owner will pay Contractor actual invoice costs for subcontracted work, provided Owner has approved payment terms in advance of performing the work plus an agreed mark-up.
- 15.3 Contractor-furnished Equipment costs will be reimbursed at actual invoice costs plus an agreed mark-up.
- 15.4 Construction equipment costs will be reimbursed based on actual usage time during the performance of Work and established rental rates not to exceed monthly rates set forth in the "Rental Rate Blue Book for Construction Equipment" adjusted for geographical region as published by Dataquest or other basis acceptable to Owner. Hourly rates shall be established by taking the monthly rate divided by 176 hours per month.
- 15.5 Small tools and consumables costs will be reimbursed based on agreed rates.
- 15.6 Field supervision, clerical, safety and other non-direct labor costs will be reimbursed at agreed billing rates, except that reimbursement for these costs for cost plus extra work shall require the prior review and approval of Owner.
- 15.7 Project management, engineering, design, procurement, and other home office services will be reimbursed at billing rates contained in the Contract.
- 16.0 BACKCHARGES
 - 16.1 Owner may impose backcharges against Contractor or deduct backcharges from monies owed to Contractor for performance or reperformance by Owner or others of Work, including but not limited to, costs associated with defective work, nonperformance by Contractor, termination for cause, clean-up and disposal of debris, damages to Owner's tools and equipment and warranty repairs. Contractor will be responsible for the cost of such performance or reperformance plus a [REDACTED] administrative charge.
- 17.0 TAXES
 - 17.1 The Contract Price shall include, and Contractor shall pay, all taxes and assessments for unemployment insurance, workers' compensation, social security and disability benefits, and other taxes which are based upon the compensation paid to persons employed by Contractor or its Subcontractors for the performance of any Work under the Contract.
 - 17.2 Except as provided below, the Contract Price shall include all applicable foreign, federal, state and local taxes payable by Contractor with respect to the Contract.
 - 17.2.1 Contractor Purchases. If Owner specifies that tangible personal property to be incorporated into real property as defined for sales and use tax purposes or taxable services to be purchased by Contractor from Subcontractors qualify for exemption from sales or use taxes, Contractor shall not include sales or use taxes on such exempt tangible personal property or services in the Contract Price. Unless otherwise specified: a) consumable materials and supplies or Contractor's tools and equipment that are not incorporated into the Work or the overall project are not eligible for exemption and the Contract Price shall include, and Contractor shall pay, any sales or use taxes on such items; and b) Contractor will use its own properly-executed exemption or resale certificate, and not Owner's direct pay permit, to make exempt purchases of tangible personal property or services from Subcontractors.
 - 17.2.2 Owner Purchases from Contractor. With respect to any Owner purchases from Contractor of tangible personal property not incorporated into real property as defined for sales and use tax purposes or taxable services, Owner shall provide to Contractor its

PUBLIC VERSION

Page 13

direct pay permit (if Owner has been issued a direct pay permit) or an appropriate exemption certificate required to relieve the Contractor of its responsibility to collect sales or use tax from the Owner. If Owner provides Contractor such direct pay permit or exemption certificate, sales or use taxes on Owner purchases from Contractor of tangible personal property or taxable services shall not be collected from Owner or included in the Contract Price. Unless otherwise approved or directed by Owner in writing, Contractor shall not use Owner's direct pay permit to make exempt purchases of tangible personal property or taxable services from Subcontractors.

- 17.2.3 Contractor Cooperation. Contractor shall take all steps reasonably necessary to ensure that Contractor's purchases from Subcontractors of items of tangible personal property or services are exempt from sales and use tax pursuant to any applicable exemption pursuant to the law of any U.S. jurisdiction or its political subdivisions.

18.0 INSURANCE

- 18.1 Contractor shall, at its sole expense, procure and maintain, and shall cause its Subcontractors to procure and maintain, throughout the term of this Contract except as set forth in Section 18.5, the following types of insurance with the following, minimum limits:
- 18.1.1 Workers' compensation insurance limits in accordance with all jurisdictions where Contractor has operations including where the Work is to be performed. If Contractor is a non-subscriber to workers' compensation, evidence of insurance equivalent to workers' compensation must be provided.
- 18.1.2 Employer's liability in an amount not less than \$1,000,000.
- 18.1.3 Business automobile insurance covering all owned, non-owned and hired autos in an amount not less than \$5,000,000 per occurrence.
- 18.1.4 Commercial general liability insurance covering claims of bodily injury and property damage in an amount not less than \$5,000,000 per occurrence.
- 18.1.5 Aircraft liability insurance with a combined limit of not less than \$10,000,000. Such insurance shall be required only if the Contractor or its Subcontractors shall utilize an aircraft in the performance of the Work.
- 18.1.6 If Contractor (or any of its Subcontractors) are engaged in operations which use marine vessels or floating equipment, or which are subject to maritime jurisdiction, the following insurance shall be required: Marine Liability insurance (including Jones Act and maritime employer's liability if operations are subject to federal jurisdiction) and pollution liability (under terms equivalent to current W.Q.I.S. policy provisions if operations are subject to federal jurisdiction) in amounts not less than \$10,000,000 per occurrence.
- 18.1.7 Professional liability insurance and/or errors and omissions insurance in an amount not less than \$5,000,000. Such insurance shall be required only if the Work includes professional liability exposures.
- 18.1.8 "All risk" property insurance covering the full replacement cost of Contractor's personal property.
- 18.2 To the extent permitted by law, Contractor shall waive, and shall cause each of its insurers to waive, any and all rights of recovery, by subrogation or otherwise, against Owner and its affiliates,

PUBLIC VERSION

Page 14

officers, directors, employees, agents and assigns of any type. Each of Contractor's insurance policies shall be primary to and non-contributory with any insurance or self-insurance of Owner.

- 18.3 The commercial general liability, the business automobile, and (if applicable) the aircraft liability and Marine Liability insurance shall include Owner as an additional insured with respect to Owner's liability arising out of the operations of Contractor. Such coverage shall also include blanket contractual coverage and contain no exclusion for explosion, collapse, or underground property damage (XCU coverage).
- 18.4 The insurance required by this Article 18.0 is in addition to and separate from any other obligations contained in the Contract.
- 18.5 Products and/or completed operations coverage shall be maintained for a period of five (5) years after the completion of the Work. If any of the policies indicated above are placed on a "claims-made" basis, such coverage shall be maintained for a period of not less than five (5) years following the completion of the Work.
- 18.6 Any deductibles or retentions on any of the policies required herein shall be the sole responsibility of the Contractor.
- 18.7 The above referenced limit requirements may be met by any combination of umbrella or excess and primary policies so long as the total limit of insurance requirement is met. The required coverages referred to herein shall in no way affect, nor are they intended as a limitation of, Contractor's liability with respect to its performance of the Work. The limits of insurance indicated herein are minimum requirements and are in no way intended to limit Contractor's liability.
- 18.8 In all cases where Contractor's employees (defined to include Contractor's direct, borrowed, special, or statutory employees) are covered by the Louisiana Worker's Compensation Act, La. Rev. Stat. Ann. 23:1021 et seq., Owner and Contractor agree that pursuant to Section 23:1061 (A) (1) all Work performed by Contractor and its employees under the terms and conditions of the Contract is an integral part of Owner's operations and is essential to Owner's ability to generate its goods, products and services. Additionally, Owner and Contractor agree that for purposes of Section 23:1061 (A) (3) Owner is the principal or statutory employer of Contractor's employees. Irrespective of Owner's status as the statutory employer or special employer of Contractor's employees, pursuant to Section 23:1031 (C), Contractor shall remain primarily responsible for the payment of Louisiana Worker's Compensation benefits to its employees, shall indemnify Owner from any and all claims of Contractor's employees or its Subcontractor's employees and shall not be entitled to seek contribution for any such payments from Owner.
- 18.9 Upon inception of the Contract and prior to the commencement of Work, Contractor shall provide Owner with an acceptable certificate of insurance evidencing the insurance required under Article 18. Contractor will not be permitted to bring its employees, materials or equipment onto the Site until Owner receives such evidence of insurance. Contractor also must provide an updated certificate of insurance at any time during the Contract term upon Owner's request. Contractor shall immediately notify Owner of cancellation or any material changes in the insurance policies required herein. If such insurance policies are subject to any exceptions to the terms specified herein, such exceptions shall be explained in full in such certificates. Owner may, at its discretion, require Contractor to obtain insurance policies that are not subject to non-standard exceptions.
- 18.10 In lieu of Sections 18.1 thru 18.9, the Owner may elect to implement an Owner Controlled Insurance Program ("OCIP"). If an OCIP is implemented, all Contractor(s) and Subcontractor(s) of any tier and such other persons or entities as the Owner may designate as enrolled parties, may, at Owner's option, be required to enroll and participate. Owner shall procure and maintain at its own expense during the performance of this Contract and a stipulated completed operations period, such

PUBLIC VERSION

Page 15

insurance coverage as Owner deems appropriate on behalf of enrolled parties. Eligible Contractor(s) and Subcontractor(s) must submit all necessary enrollment forms for acceptance into the OCIP, and agree to the terms of the Owner's project safety standards. Owner and Contractor agree that the terms of the OCIP as contained in amendments to this Contract and the OCIP Contractor Manual shall control. The OCIP does not relieve any Contractor or Subcontractor from its obligations to procure coverage for offsite operations or coverages not included in the OCIP. In the event an OCIP is implemented, amended insurance requirements for enrolled parties will be provided.

- 18.11 The furnishing of insurance by Owner through an OCIP will in no way relieve or limit any enrolled party of any responsibility, liability, or obligation imposed by the contract documents or by law, including without limitation any indemnification obligations which any enrolled party has to the Owner thereunder.

19.0 INDEMNIFICATION

- 19.1 The laws of the state where the Work giving rise to the claim is performed shall apply to this Article 19.0.

- 19.2 **TO THE EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY, DEFEND AT ITS EXPENSE, AND SAVE OWNER HARMLESS FROM, ANY LIABILITIES, COSTS AND CLAIMS, INCLUDING JUDGMENTS RENDERED AGAINST, AND FINES AND PENALTIES IMPOSED UPON, OWNER AND REASONABLE ATTORNEYS' FEES AND ALL OTHER COSTS OF LITIGATION (COLLECTIVELY, "LIABILITIES"), ARISING OUT OF THE CONTRACT, INCLUDING INJURIES, DISEASE OR DEATH TO PERSONS, OR DAMAGE TO PROPERTY, AND ENVIRONMENTAL CLAIMS AND LIABILITIES, CAUSED BY CONTRACTOR, ITS EMPLOYEES, AGENTS OR SUBCONTRACTORS, OR IN ANY WAY ATTRIBUTABLE TO THE PERFORMANCE OF THE CONTRACT, EXCEPT THAT CONTRACTOR'S OBLIGATION TO INDEMNIFY OWNER SHALL NOT APPLY TO ANY LIABILITIES ARISING FROM OWNER'S SOLE NEGLIGENCE. TO THE EXTENT PROVIDED IN THIS SECTION, IN STATES OTHER THAN OHIO, MICHIGAN, KENTUCKY, TENNESSEE, MISSOURI, OKLAHOMA, VIRGINIA, AND WEST VIRGINIA, CONTRACTOR AGREES TO INDEMNIFY OWNER FOR LIABILITIES ARISING FROM OWNER'S ACTS AND OMISSIONS, NEGLIGENT OR OTHERWISE. OWNER SHALL HAVE THE RIGHT TO SELECT ITS OWN COUNSEL AND TO HAVE COUNSEL SEPARATE FROM CONTRACTOR, ALL AT CONTRACTOR'S EXPENSE.**

- 19.3 **WITH RESPECT TO CLAIMS AGAINST OWNER BY CONTRACTOR'S EMPLOYEES, CONTRACTOR UNDERSTANDS AND AGREES THAT THIS INDEMNIFICATION OBLIGATION SHALL NOT BE LIMITED IN ANY WAY BY, AND CONTRACTOR EXPRESSLY WAIVES, ITS IMMUNITY AS A COMPLYING EMPLOYER UNDER ANY APPLICABLE WORKERS' COMPENSATION LAW, BUT ONLY TO THE EXTENT THAT SUCH IMMUNITY WOULD BAR OR AFFECT RECOVERY UNDER OR ENFORCEMENT OF THIS INDEMNIFICATION OBLIGATION.** With respect to the State of Ohio, this waiver applies to Section 35, Article II of the Ohio Constitution and Ohio Rev. Code Section 4123.74.

- 19.4 **CONTRACTOR SHALL BE LIABLE FOR REASONABLE ATTORNEYS' FEES AND ALL COSTS OF LITIGATION ASSOCIATED WITH ENFORCEMENT OF ALL INDEMNITY OBLIGATIONS SET FORTH IN THE CONTRACT.**

PUBLIC VERSION

Page 16

20.0 LIMITATION OF LIABILITY

20.1 Except as expressly provided herein, neither party shall be liable to the other for any incidental, indirect, special, punitive or consequential damages. Contractor must bring any cause of action arising under the Contract within one year from the time the cause of action accrues.

21.0 LIENS

21.1 To the extent permitted by law, Contractor shall not file or permit to be filed any lien with respect to the Work and hereby expressly waives any right to file or cause to be filed a lien. Contractor, in its subcontracts, shall require all Subcontractors to expressly waive the right to file any liens against Owner's property, and, if requested, provide Owner with copies of such waivers.

21.2 In the event any claim is asserted or any lien filed against Owner or its property, or notice of lien is provided to Owner in violation of this provision, further payment to Contractor shall not become due under the Contract until the claim is satisfied or the lien released without cost to Owner and Contractor shall provide Owner with evidence of payment relating to such claim or lien. If Contractor fails to settle any claim or secure the release of any lien, Owner may take whatever steps it deems necessary to settle the claim or release the lien, including bonding off the lien. Owner may deduct its costs and expenses for settling any claim or securing the release of any lien filed by Contractor or its Subcontractors from any money due or to become due to Contractor under the Contract. If final payment has been made, Contractor shall reimburse to Owner its costs to settle any claim or secure the release of any lien arising out of the Contract.

22.0 INTELLECTUAL PROPERTY

22.1 Contractor warrants that its performance of the Work will not infringe upon or violate any trademarks, patents, copyrights, trade secrets or other third party property rights. If the performance of Work is held in any action to constitute infringement, or the use of the Work is enjoined, Contractor, at its expense, shall procure for Owner the right to continue use of the Work, or replace the Work with non-infringing materials or methods satisfactory to Owner, or modify the Work in a manner satisfactory to Owner so that the Work becomes non-infringing. Contractor agrees to indemnify and save Owner harmless from and against any liability or damages, including attorneys' fees, arising out of any alleged infringement or violation.

22.2 All inventions, discoveries, documents, works of authorship, methods, and the derivative works thereof, resulting from the Work, including patents, patent applications, copyrights, trade secrets and other intellectual property (collectively "Intellectual Property"), shall be the sole and exclusive property of Owner. Contractor shall promptly inform Owner of the development of any such Intellectual Property and does hereby assign and transfer the entire right, title and interest, together with all rights of priority, in and to such Intellectual Property to Owner. Contractor shall promptly cooperate with Owner in signing any additional documentation necessary to assign and perfect ownership of such Intellectual Property in Owner or to allow Owner to register its property rights therein. Contractor warrants that it has obtained written agreements from its employees and agents as necessary to effectuate the purpose of this Section. The Intellectual Property assigned and transferred to Owner shall be the Confidential Information of Owner.

22.3 Contractor grants Owner a nonexclusive, nonrevocable, perpetual, fully paid license to utilize Contractor's intellectual property existing separate from the Contract, including inventions, discoveries, works or authorship, methods, and trade secrets, regardless of whether such are the subject of patents, copyrights or other intellectual property protection, to the extent necessary for Owner to achieve the full benefit of the Work.

22.4 Contractor shall not use Owner's name or logo in marketing, endorsements, or other business purposes without prior written consent from Owner.

PUBLIC VERSION

Page 17

23.0 DRAWINGS AND DATA

- 23.1 Contractor shall furnish for Owner's review, prior to commencement of Equipment manufacture or fabrication, general and detailed drawings of the Equipment in the format requested. Such drawings shall be certified as to accuracy and completeness and shall show information adequate to enable Owner to design and provide suitable clearances. If required by the Contract or any code, law or agency, Contractor will provide professional engineer or architect sealed drawings and reports for the state where the Equipment is to be finally installed. Figures shall take precedence in all cases over scaled measurements on drawings. Where obvious discrepancies exist, Contractor shall consult with and follow the instructions of Owner. Owner's approval of Contractor's drawings shall not relieve Contractor of its obligation to comply with the contract requirements.
- 23.2 All written data, such as drawings, plans, reports, designs and specifications, prepared by Contractor for Owner during the performance of Work shall become the property of Owner. Such data, together with all data furnished by Owner and lent to Contractor for return, shall be delivered to Owner upon request, or upon completion of the Work or termination of the Contract. For clarification purposes, Owner shall have the unrestricted right to use, release, disclose, copy and reproduce such data for purposes of operation, maintenance, analysis, testing, cleaning, erection, improvement or modification of any facilities owned or operated by Owner. Contractor shall cooperate with Owner by executing such documents as are necessary to assign and perfect ownership in Contractor provided data to Owner.

24.0 CONFIDENTIALITY

- 24.1 "Confidential Information" means any confidential or proprietary information, whether written, oral, or visual, whether or not it constitutes a trade secret under applicable law. "Confidential Information" includes, but is not limited to, business plans and methods; customer information; engineering, operating and technical data; and the dates of Owner's outage schedule, information concerning the Work, and Owner's activities. "Confidential Information" does not include information that (a) has become part of the public domain other than by acts or omissions of the recipient; (b) has been furnished or made known to the recipient by a third person as a matter of legal right and without restriction on use; (c) was in the recipient's possession prior to disclosure by the disclosing party without restriction on use; or (d) is independently developed by the recipient without access to the Confidential Information.
- 24.2 Subject to Section 24.5, each party agrees (a) to protect the Confidential Information of the other with at least the same degree of care used to protect its own Confidential Information; (b) not to use (except for the purpose described herein), publish or disclose to third parties such Confidential Information; and (c) upon the request of the disclosing party, to promptly deliver to the disclosing party all written copies of its Confidential Information. Notwithstanding the foregoing, a recipient shall be entitled to disclose Confidential Information to its officers, employees, affiliates (including any joint ventures of which Owner or any of its affiliates are a member and the other members of such joint ventures), agents, lenders, attorneys and other advisors (collectively, "Representatives"), provided that the Representatives shall be informed of the confidentiality obligations provided herein.
- 24.3 If either party is required pursuant to applicable law or otherwise becomes legally compelled to disclose any of the Confidential Information, such party shall promptly advise the disclosing party in order that the disclosing party may seek a protective order or such other remedy as the disclosing party may consider appropriate in the circumstances. In any event, the compelled party may disclose only that portion of the Confidential Information which such party is legally required to disclose in the judgment of the party's legal counsel without any liability to the disclosing party hereunder and such disclosure shall not be a breach of this Section.

PUBLIC VERSION

Page 18

- 24.4 Contractor shall require its Subcontractors, if any, to expressly comply with the confidentiality provisions as set forth herein.
- 24.5 All documents prepared by Contractor for Owner during the performance of Work that incorporate, in whole or in part, information owned or provided by Owner shall not be marked or designated in any way as the confidential or proprietary information of Contractor without also stating that Owner has rights in such documents. Owner shall have the right to question the designation of Confidential Information by Contractor and Contractor agrees to provide Owner with reasonable cooperation in explaining such designation. Contractor agrees that Owner's acceptance of documents containing the Confidential Information of Contractor shall not be construed as a restriction on Owner's rights to use, release, disclose, distribute, copy or reproduce the documents.

25.0 DEFAULT

- 25.1 The occurrence of any of the following shall constitute an "Event of Default":

25.1.1 Contractor files a petition in bankruptcy, or if its creditors file an involuntary petition in bankruptcy, or if it makes a general assignment for the benefit of its creditors, or if a receiver is appointed on account of its insolvency.

25.1.2 Contractor (a) fails to maintain the schedule set forth in the Contract, or (b) fails to promptly pay Subcontractors for material or labor, or (c) commits repeated or substantial violations of laws, rules, regulations or policies, or (d) fails to perform in accordance with the Contract, and Contractor fails to take corrective action or submit an acceptable plan within two (2) Business Days after the receipt of a notice of non-conformance from Owner.

- 25.2 Upon an Event of Default, Owner may take any or all of the following actions without affecting the Contract Price or schedule:

- (a) Owner may direct Contractor to cease performance on all or part of the Contract until satisfactory corrective action has been taken;
- (b) Owner may have others take corrective action necessary to achieve compliance with the Contract. Owner may deduct the cost of such corrective action by others from any monies due to Contractor. Corrective action by others shall be taken when, in the judgment of Owner, the noncompliance threatens safety, unreasonably interferes with or delays the work of others, or otherwise creates a situation the resolution of which cannot be delayed without adversely impacting quality, cost or timely completion;
- (c) Owner may pursue damages for delay under the terms of Article 26.0;
- (d) Owner may suspend the Contract under Article 28.0; and/or
- (d) Owner may terminate the Contract under the terms of Section 29.1

- 25.3 Each of Owner's rights set forth above shall be cumulative and additional to any other rights or remedies provide in law or equity or otherwise.

26.0 DAMAGES FOR DELAY

- 26.1 Contractor shall be liable for any direct damages incurred by Owner arising out of Contractor's failure to perform on time.

PUBLIC VERSION

Page 19

- 26.2 In lieu of Section 26.1, if the parties have agreed to liquidate the amount of direct damages resulting from Contractor's delay, the parties agree that such damages which might be incurred by Owner as a result of Contractor's delay in performance are uncertain and would be difficult to calculate. The parties agree that the liquidated damages contained in the Contract would be reasonable and fair compensation for late performance. Contractor commits to pay and Owner agrees to accept such sum as liquidated damages and not as a penalty in the event of late performance.

27.0 FORCE MAJEURE

- 27.1 Neither party shall be in breach of the Contract to the extent that any delay or default in performance is due to a Force Majeure Event. The term, "Force Majeure Event" shall mean any cause beyond the reasonable control of the delayed or defaulting party, including, but not limited to, acts of God including unusually adverse weather, fire, and epidemic; acts of public enemy including war, acts of terrorism, riot, and civil disturbance; and national labor strikes, which by exercise of due foresight such party could not have been expected to avoid or overcome. Contractor's inability to obtain adequate and sufficient labor in order to maintain progress of the Work shall not constitute a Force Majeure Event. No delay in performance resulting from a Force Majeure Event shall result in any liability on the part of Owner. Notwithstanding the preceding sentence, in the event of a delay caused by any act or failure to act on the part of Owner, Contractor's sole remedy shall be as set forth in Article 14.0.
- 27.2 The delaying party shall immediately notify the other party of the beginning of a delaying event, and shall confirm the notice in writing within ten (10) Business Days of the beginning of the event. The notice shall contain a detailed account of the delay, including the cause of the delay, an estimate of the duration of the delay, an estimate of the delay's impact to the schedule, and the plan to mitigate the effects of the delay.
- 27.3 If Contractor is the delaying party, and the delay is a Force Majeure Event as defined in Section 27.1, Owner shall grant Contractor an extension of the time for performance, to be mutually agreed upon by Contractor and Owner. The extension of time granted as a result of a Force Majeure Event shall in no case exceed the length of the delay and such extension may be withheld or reduced to the extent Contractor does not provide notice in accordance with Section 27.2. If Owner so requests, Contractor shall expedite its schedule to mitigate the effects of the excusable delay. Owner shall pay incremental, Direct Costs incurred by Contractor for expediting at Owner's request.

28.0 SUSPENSION

- 28.1 Owner may at any time suspend all or any part of the Work. Owner shall provide Contractor written notice verifying the suspension date. Immediately upon receipt of the suspension notice, Contractor shall take the necessary actions to comply with the suspension notice.
- 28.2 Owner shall pay Contractor in accordance with the terms of payment set forth in the Contract for the Work completed prior to the time of suspension and for the incremental, Direct Costs that result from Contractor's compliance with the suspension notice.
- 28.3 Owner may, at any time during the suspension period, either terminate the Contract in accordance with Section 29.2, or authorize the Work or any portion thereof to be restarted. Owner shall pay Contractor the incremental, Direct Costs associated with the restart of the Work and shall resume payments to Contractor in accordance with the terms of payment under the Contract thirty (30) days after the restart of Work.
- 28.4 The schedule shall be adjusted to provide for a reasonable extension of time for Contractor's performance.

PUBLIC VERSION

Page 20

29.0 TERMINATION

29.1 Termination for Cause

- 29.1.1 Upon an Event of Default, Owner may terminate the Contract upon written notice to Contractor.
- 29.1.2 In the event of such termination, Contractor shall immediately prepare and submit to Owner an itemization of the Work completed by Contractor. Owner may require Contractor to leave the Site. Owner may take over such Work and complete it, or have the Work completed by others. Owner may take possession of and utilize in completing the Work Contractor's materials, Equipment to be installed, supplies, tools and equipment at the Site.
- 29.1.3 Contractor shall not be entitled to further payment until all of the Work is completed in its entirety and Final Acceptance has been achieved. If the cost of completion exceeds the unpaid balance under the Contract, Contractor shall pay the difference to Owner within thirty (30) calendar days of demand.
- 29.1.4 In the event that a court determines that the termination was not properly a termination for cause, pursuant to Section 29.1.1, Contractor's remedy shall be limited to the payments permitted in accordance with Section 29.2.

29.2 Termination for Convenience

- 29.2.1 Owner may terminate this Contract, in whole or in part, for its convenience. Owner will give Contractor written notice of termination specifying the extent to which the Contract is terminated and the date, immediately or otherwise, on which termination becomes effective.
- 29.2.2 Upon termination for convenience, Contractor will comply with instructions in the notice of termination regarding delivery to Owner of all Work in progress and all completed Work, which shall become the property of Owner upon delivery.
- 29.2.3 In the event of such termination, Contractor shall receive payment, including the retained percentage, for the Work satisfactorily performed up to the time of such termination. In addition, Owner shall reimburse Contractor for incremental, Direct Costs resulting from the termination, provided that compensation was not otherwise made for such costs. Final payment shall be made upon the parties' agreement of the amount of the final invoice and Owner's receipt of an Affidavit of Completion in the form of Exhibit 1. Owner shall not be responsible for Contractor's lost profit on the terminated portion of the Contract.

30.0 EQUIPMENT AND WORKMANSHIP WARRANTY

- 30.1 Beginning upon Final Acceptance and for a period of one year thereafter, or for such period as may be specified elsewhere in the Contract, Contractor warrants that (a) it will perform the Work in accordance with the accepted standards of care and competence found in the engineering or other applicable profession as such standards relate to and are commonly used in the electric utility industry, and (b) all Equipment and workmanship shall be free of any and all defects and shall be in conformity with the requirements of the Contract.
- 30.2 Subject to the provisions of Section 30.3, in the event that the Equipment or workmanship does not comply with the warranty, Contractor shall, at no cost to Owner, promptly repair or replace such nonconforming Equipment or workmanship with as little disruption to Owner's operations as

PUBLIC VERSION

Page 21

practicable. Contractor shall be responsible for the total cost of correcting any defects, including but not limited to, the costs of engineering, design, materials, labor, any necessary equipment removal, disassembly, shipping, reinstallation and retesting of the installation. Owner shall give Contractor notice of observed defects with reasonable promptness. If nonconforming Equipment or workmanship causes an outage or other delay of operations, Contractor shall make the repair or replacement on an overtime, maximum effort basis, at Contractor's expense.

- 30.3 If Owner directs Contractor to repair or replace any defect and Contractor fails to do so within a reasonable time, or if an emergency exists rendering it impracticable for Contractor to perform the repair or replacement, Owner may make or cause to be made such repair or replacement without affecting the validity of the warranty. Owner's cost for making the repair or replacement shall be deducted from the Contract Price or any unpaid portion thereof. If the unpaid portion of the Contract Price is insufficient to cover such cost, Contractor shall reimburse Owner.
- 30.4 Owner will not pay for any defective portion of the Equipment or workmanship until remedied by Contractor at Contractor's expense in accordance with the Contract requirements.
- 30.5 Owner must approve any proposed correction or alteration by Contractor of the Equipment or workmanship, or parts thereof, made at any time or at any location, before such correction or alteration is undertaken. Approval by Owner shall not relieve Contractor from responsibility for complying with the requirements of the Contract and all applicable codes.
- 30.6 Any Equipment or workmanship which are repaired or replaced pursuant to this Article 30.0 shall be warranted for a period of one year from the date of completion and acceptance of such repair or replacement, or for the remainder of the original warranty period, whichever is longer.
- 30.7 Contractor shall obtain, for the benefit of Owner, all available warranties from Subcontractors of Contractor. Such warranties shall be in addition to the warranties set forth in this Article. If such warranties are in written form, Contractor shall provide Owner with the original warranties.

31.0 REPORTING OF COMPLAINTS

- 31.1 Contractor shall immediately report to Owner, in accordance with Article 35.0, the complete details of all complaints, including any OSHA violations and complaints received from governmental authorities, Subcontractors, laborers, other third parties or members of the public relating to the Work.

32.0 RETENTION AND EXAMINATION OF INFORMATION, BOOKS AND RECORDS

- 32.1 Owner reserves the right to audit records necessary to permit evaluation and verification of (i) claims submitted, (ii) Change Orders, and related overhead and general and administrative costs, and (iii) Contractor's compliance, in the performance of the Contract and its dealings with Owner with (a) the Contract requirements; and (b) Owner's Code of Business Conduct governing business ethics. Owner's right to audit shall not extend to fixed, lump-sum or unit pricing.
- 32.2 Contractor shall cooperate with Owner and provide Owner with information and records ("information") pertaining to the Work as requested by governmental agencies, Owner, or courts of law.
- 32.3 Contractor shall retain for a period of three years after Contract termination or expiration all information relating to the Work. Owner may audit and copy such information at Contractor's premises during regular business hours. If requested by Owner, Contractor shall submit to Owner a copy of each of its subcontracts. Contractor shall include in its subcontracts a provision granting Owner the rights against Subcontractors contained in this Article 32.0.

PUBLIC VERSION

Page 22

33.0 COMPLIANCE WITH LAWS

- 33.1 Contractor warrants that all materials and Equipment supplied and all Work performed will comply with, and be manufactured, priced, sold and labeled in compliance with all applicable federal, state and local laws, rules, regulations, orders and ordinances, including, without limitation, environmental protection, energy, safety and health, and labor laws and regulations and applicable industry codes and standards.
- 33.2 Unless exempted, **Contractor shall abide by the requirements of 41 C.F.R. § 60-1.4(a)(7), 41 C.F.R. § 60-300.5(a), and 41 C.F.R. § 60-741.5(a). These regulations prohibit discrimination against minorities, females, qualified protected veterans, and qualified individuals on the basis of disability and require affirmative action by covered prime contractors and subcontractors to employ and advance in employment minorities, females, qualified protected veterans, and qualified individuals with disabilities.** Contractor represents that it does not, and shall not for the term of the Contract, provide or maintain for its employees facilities that are segregated on the basis of race, color, religion, sex, national origin, veteran status or disability status. Contractor represents that it will not assign its employees to perform any work related to the Contract at a location where facilities are segregated on the basis of race, color, religion, sex national origin, veteran status or disability status. Contractor agrees that it will not enter into any agreement to obtain goods or services relating to the Contract with any entity that provides, maintains or assigns its employees to work at locations where facilities are segregated on the basis of race, color, religion, sex or national origin. As used herein, “facility” means waiting rooms; work areas; restaurants and other eating areas; time clocks; locker rooms and other storage or sleeping areas, except as necessary to ensure privacy between male and female employees; parking lots, drinking fountains; recreation or entertainment areas; and transportation. If not otherwise exempted by Title 48 and to the extent applicable, Contractor will comply with 48 CFR §52.219-8, Utilization of Small, Small Disadvantaged, and Women-Owned Small Business Concerns, and 48 CFR §52.219-9, Small, Small Disadvantaged, and Women-Owned Small Business Subcontracting Plan. If not otherwise exempted by 41 CFR §60-1.5, Contractor represents that it will file all reports or other required information specified in 41 CFR §60-1.7. Contractor shall also abide by the requirements of 29 CFR Part 471, Appendix A to Subpart A, which is incorporated by reference, as applicable.
- 33.3 Contractor shall indemnify and save Owner harmless from any and all costs or expenses arising out of any violations of such laws, ordinances and regulations.

34.0 PERMITS AND LICENSES

- 34.1 Contractor shall obtain all permits and licenses required by any regulatory authority for the performance of any portion of the Work, except that Owner shall obtain permits and licenses for all structures which are to become a permanent part of the Site. Before starting Work, Contractor shall submit to Owner a copy of all permits and licenses required by any such regulatory authority.
- 34.2 Contractor shall obtain and maintain all professional licenses necessary to perform the Work.
- 34.3 Contractor shall indemnify and save Owner harmless from any and all costs or expenses arising out of the failure of Contractor to obtain such permits and licenses.

35.0 NOTICES

- 35.1 Each party shall designate in writing a representative to receive any and all notices required under the Contract. Notices shall be in writing and shall be given to the representative designated to receive them, either by personal delivery, certified mail, facsimile, e-mail (with confirmation of receipt) or any similar means, properly addressed to such representative. All notices shall be effective upon receipt, or upon such later date following receipt as set forth in the notice. Either party may, by

PUBLIC VERSION

Page 23

written notice to the other, change the representative or the address to which such notices are to be sent.

36.0 SEVERABILITY

- 36.1 In the event that any of the provisions, or portions thereof, of the Contract are held to be unenforceable or invalid by any court, the validity and enforceability of the remaining provisions, or portions thereof, shall not be affected.

37.0 WAIVER

- 37.1 Either party's waiver of any breach of the Contract shall not be deemed to be a waiver of any other breach of the same or a different term of the Contract.

38.0 NON-DISCLOSURE

- 38.1 Except as required by law, regulation, or judicial or administrative order, neither party shall disclose the terms of the Contract without the consent of the other party. Notwithstanding the foregoing, Owner may disclose the terms of the Contract without the consent of Contractor (a) to any of its affiliated companies (including any joint ventures of which Owner or any of its affiliates are a member and the other members of such joint ventures); and (b) to any prospective transferee or purchaser of assets of Owner or any of affiliates.

39.0 HEADINGS

- 39.1 Headings are provided for the convenience of the parties, and shall not affect the interpretation of any provision.

40.0 AFFILIATED COMPANIES

- 40.1 Any indemnification of Owner or any limitation of Owner's or Contractor's liability under this Contract shall to the same extent apply to Owner's or Contractor's directors, officers, employees, agents, and affiliated companies (including any joint ventures of which Owner or any of its affiliates are a member and the other members of such joint ventures), including any directors, officers, employees and agents thereof.
- 40.2 The affiliated companies (including any joint ventures of which Owner or any of its affiliates are a member and the other members of such joint ventures) of the American Electric Power System are severally and not jointly liable for obligations arising hereunder.

41.0 APPLICABLE LAWS AND JURISDICTION

- 41.1 Except for Article 19.0, the rights and obligations of the parties arising out of the Contract shall be governed in all respects by the laws of the State of Ohio, excluding any conflict-of-law rules. Any reference herein to the laws of other states is made only to the extent that the laws of that state might apply, notwithstanding the intent of the parties that the laws of the State of Ohio should apply.
- 41.2 Contractor agrees that all actions and proceedings brought by Owner against Contractor may be litigated in courts located in the State of Ohio or the state where work was performed. Contractor agrees that such courts are convenient forums and irrevocably submits to the personal jurisdiction of such courts. Contractor waives personal service of process and consents to service of process by certified or registered mail at the address designated for receiving notices under this Contract.

PUBLIC VERSION

Page 24

42.0 ENTIRE AGREEMENT

42.1 The Contract constitutes the entire agreement between the parties and supersedes all previous and collateral agreements or understandings with respect to the subject matter of the Contract. No waiver, alteration, amendment or modification of any of the provisions of the Contract shall be binding unless in writing and signed by duly authorized representatives of the parties.

43.0 BINDING EFFECT; NO THIRD-PARTY BENEFICIARIES

43.1 Subject to the restrictions on assignment in Section 5.1, this Contract shall be binding upon and shall inure to the benefit of the parties of their respective successors and permitted assigns.

43.2 No provision of the Contract is intended or shall be construed to be for the benefit of third party other than as set forth in Article 38.0.

44.0 EXECUTION; COUNTERPARTS; ELECTRONIC SIGNATURES

44.1 The Contract shall not be binding or effective until properly executed by each of the parties hereto. The Contract may be executed in any number of counterparts, each of which shall be deemed to be an original, and all of which, taken together, shall constitute but one and the same Contract, which may be sufficiently evidenced by one counterpart.

44.2 Each party agrees that any electronic signatures, whether digital or encrypted, of the parties included in this Contract are intended to authenticate this writing and to have the same force and effect as manual signatures. Electronic signature means any electronic sound, symbol or process attached to or logically associated with a record and executed and adopted by a party with the intent to sign such record.

45.0 SURVIVAL

45.1 All of the terms of the Contract which by their nature extend beyond the expiration or termination of the Contract, including indemnification obligations, confidentiality obligations, limitations of liability, shall survive expiration or termination of the Contract and remain in full force and effect.

PUBLIC VERSION

EXHIBIT 1
Page 1 of 1

AFFIDAVIT OF COMPLETION

State of _____

County of _____

_____, being duly sworn, states that:
(Name of Affiant)

1. S/He is the _____ of
(Office held by Affiant)

(Legal Name of Contractor) (Contractor)

that has a contract with _____
(Legal Name of Owner)

(Owner) dated _____ (Owner's Contract No. _____)
(Contract Date) (Contract No.)

involving work on the Owner's property at _____
(Project Name)

located near _____
(City, State)

2. All of the Work required to be performed by the Contractor under said Contract has been performed. All bills and claims for material, labor and services to employees and Subcontractors covering the Work required to be performed under the Contract, have been paid in full by the Contractor. There are no unpaid amounts on the basis of which a lien has been filed, or can be filed, in connection with the Work performed under the Contract.

Signature of Affiant

Sworn to before me and subscribed in my presence this _____ day of _____, _____.

Notary

PUBLIC VERSION

WC AEP South Bend Solar Form D: Commercial Exceptions, Deviations and Clarifications FINAL 08/02/19

Reference Document	Section	Exception, Deviation or Clarification
Appendix 2 General T&Cs; SOW Rev 0	All	Any reference within Appendix 2 General T&Cs or the SOW Rev 0 that requires an acceptance, consent or approval by either Owner or Contractor, it is hereby agreed that such acceptance, consent or approval shall not be unreasonably withheld, conditioned, or delayed.
Appendix 2 General T&Cs; SOW Rev 0	All	Any reference within Appendix 2 General T&Cs or the SOW Rev 0 that references a term or condition subject to or pursuant to Owner's judgment, rejection, direction, order, instruction, or request, it shall be deemed to be made on a reasonable basis.
Appendix 2 General T&Cs	1	Insert the following new definitions: 1.15 <u>Balance of Plant</u> : "Balance of Plant" means those Work activities set forth in Appendix 2-A of the SOW under the heading "Balance of Plant (BOP); Progress Payments". 1.16 <u>Contract Interest Rate</u> : "Contract Interest Rate" means interest at a rate equal to the lesser of (i) the rate published in The Wall Street Journal as the "prime rate" from time to time (or, if more than one rate is published, the arithmetic mean of such rates), in either case determined as of the date the obligation to pay interest arises, or (ii) the highest rate allowed under applicable law. 1.17 <u>Major Equipment</u> : "Major Equipment" means the Equipment set forth in Appendix 2-A of the SOW under the heading "Major Equipment Procurement". 1.18 <u>Payment Schedule</u> : "Payment Schedule" means the Payment Schedule incorporated into the Contract as Appendix 2-A of the SOW.
Appendix 2 General T&Cs	2.3	Insert after the first sentence the following: "Notwithstanding the foregoing, in certain circumstances Contractor may not be able to avoid such disturbances of the conditions identified in (a), (b) and (c) above in its performance of the Work, provided, however Contractor hereby agrees to avoid causing further disturbance upon its discovery of the conditions identified in (a), (b) and (c) above."
Appendix 2 General T&Cs	2.5	In the second sentence, insert the following prior to the end of the sentence, ", however consent of the Owner is not required for removal of a Contractor's employee who voluntarily or involuntarily terminates their employment with Contractor and in such cases if an involuntary termination occurs that is related to the failure to adhere to Owner's drug policy, then Contractor shall provide notice to Owner of such reason for the termination of Contractor's employee".
Appendix 2 General T&Cs	5.1	Delete Section 5.1 in its entirety and insert the following in place thereof: "5.1 Contractor shall not assign or otherwise dispose of the Contract, or any obligations hereunder, without the written consent of Owner. Owner may assign its rights and interests or obligations under this Agreement to any Party without the written consent of Contractor, provided that if Owner assigns its rights and interests or obligations to any third party other than Indiana Michigan Power Company, Owner shall first either (i) provide Contractor with reasonable evidence of such unaffiliated third party's ability to financially and operationally perform Owner's obligations being assigned under the Agreement, or (ii) obtain written consent from the Contractor. Any assignment or disposal without the written consent of Owner or Contractor as required herein shall be null and void."
Appendix 2 General T&Cs	7.7	Insert at the end of this Section 7.7 the following, "Owner shall be responsible for and shall identify to Contractor any known pre-existing hazardous condition at the Site, or any hazardous material or hazardous waste brought onto the Site by Owner or a third party."
Appendix 2 General T&Cs	9.3(a)	Delete subpart (a) of Section 9.3 and insert the following: "(a) Owner may use Contractor's facilities, ladders and scaffolds to perform inspections of the Work, provided that Owner accepts to implement a reasonable standard of care in such use and provided that Owner inspections shall be arranged so as not to impede Contractor's schedule for the Work."
Appendix 2 General T&Cs	9.4	Delete the last sentence and insert in place thereof, "If Owner's Equipment has been incorporated or used in the performance of any identified defective Work, then the actual cost of such Owner's Equipment with no markup shall be backcharged to Contractor."
Appendix 2 General T&Cs	9.6	Delete this section in its entirety and insert the following in place thereof: "9.6 Not Used."
Appendix 2 General T&Cs	10.1	Insert at the end of this section the following: "In the event Contractor desires to arrange for delivery or storage of any Equipment to a location other than the Site, Contractor shall obtain Owner's prior written consent."
Appendix 2 General T&Cs	11.1	Delete this section in its entirety and insert the following in place thereof: "11.1 Title and risk of loss shall pass to Owner upon Final Acceptance of the Work, provided however where Owner takes possession of any of the Work as authorized under the Contract, or makes payment for any of the Work, then title and risk of loss of such Work shall transfer to Owner. Subject to Owner's payment for such Work, Contractor agrees that title shall vest in Owner free and clear of all liens and encumbrances. If the Work is rejected as non-conforming, title and risk of loss shall remain with Contractor."
Appendix 2 General T&Cs	Article 13.0	Insert the following new subparts 13.1.5 through 13.1.8: "13.1.5 Payment Schedule. Subject to the provisions of this Article 13.0, Owner shall make payments to Contractor on account of the Contract Price in accordance with Appendix 2-A of the SOW. Each payment set forth in Appendix 2-A of the SOW does not necessarily represent Contractor's cost to perform the Work included in the corresponding Work activity; accordingly, such payments do not necessarily represent an actual measure of the progress of the Work. 13.1.6 Limitations on Payments to Contractor. Except in the event of an early termination of the Contract, no payment shall be made for any partially completed Work. Owner shall have no obligation to make any payment to Contractor at any time when a Contractor Event of Default has occurred and is continuing, and interest shall not accrue on unpaid amounts until the subject Contractor Event of Default is cured. Such right to withhold payments due Contractor shall be limited to amounts reasonably necessary to cure the subject Contractor Event of Default and any such amounts held by Owner shall be released and paid to Contractor within ten (10) Business Days upon the end of the subject Contractor Event of Default. 13.1.7 Disputes Regarding Invoiced Payments. In the event Owner in good faith disputes an invoice amount, Owner shall provide notice to Contractor in writing of its dispute on or before the due date for such invoice, provided, however, Owner shall make payment to Contractor for the undisputed portion of the invoice by such due date. Failure by Owner to pay any amount disputed in good faith until resolution of such dispute in accordance with this Agreement shall not alleviate, diminish, modify, nor excuse Contractor's obligations to perform hereunder. Contractor's acceptance of any payment (including Final Payment) shall not be deemed to constitute a waiver of Contractor's claims to amounts that are then in dispute. No payment made hereunder shall be construed to be acceptance or approval of that part of the Work to which such payment relates or to relieve Contractor of any of its obligations hereunder. Owner and Contractor shall negotiate and work in good faith to settle disputes through negotiation between authorized members of each party's senior management with the power and authority to resolve any such dispute. Either party may, by written notice to the other party, request a meeting to initiate negotiations to be held within ten (10) Business Days of the other party's receipt of such request, at a mutually agreed time and place. If the matter is not resolved within fifteen (15) Business Days of the first meeting, then either party may, by notice to the other, refer the dispute to judicial resolution. All negotiations pursuant to this provision shall be deemed confidential and shall be treated as compromise and settlement negotiations for purposes of applicable judicial evidentiary requirements, unless a settlement is reached and agreed to in a writing signed by each party's representative. 13.1.8 Delinquent Payments. Any delinquent payment hereunder by either party shall incur interest at the Contract Interest Rate, which interest shall accrue from the date on which the payment was due until the date that the payment is made."
Appendix 2 General T&Cs	13.1.2	Delete the first sentence in its entirety and insert the following in place thereof: "Contractor shall submit invoices with proper documentation to Owner for payments due as provided in Appendix 2-A of the SOW". In the second sentence, delete reference to ", or imminent occurrence,".

PUBLIC VERSION

WC AEP South Bend Solar Form D: Commercial Exceptions, Deviations and Clarifications FINAL 08/02/19

Reference Document			Section	Exception, Deviation or Clarification
Appendix T&Cs	2	General	13.1.3	<p>Delete Section 13.1.3 in its entirety and insert the following in place thereof:</p> <p>“13.1.3 Owner shall retain a percentage of each properly submitted and accepted invoice as set forth in Section 15.3 of the SOW. The release of any retention held by Owner shall become due and payable [REDACTED] days after the date of Final Acceptance of the Work.”</p>
Appendix T&Cs	2	General	14.1.3	<p>Delete the language in this section and insert the following in place thereof, "If Owner issues a Change Order, upon agreement by Contractor in writing, Contractor shall perform the changed Work in accordance with the terms of the Contract and the issued Change Order."</p>
Appendix T&Cs	2	General	19.2	<p>Delete the language in this section and insert the following in place thereof:</p> <p>“TO THE EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY, DEFEND AT ITS EXPENSE, AND SAVE OWNER HARMLESS FROM, ANY LIABILITIES, COSTS AND CLAIMS, INCLUDING JUDGMENTS RENDERED AGAINST, AND FINES AND PENALTIES IMPOSED UPON, OWNER AND REASONABLE ATTORNEYS' FEES AND ALL OTHER COSTS OF LITIGATION COLLECTIVELY, “LIABILITIES”), ARISING OUT OF THE CONTRACT, INCLUDING INJURIES, DISEASE OR DEATH TO PERSONS, OR DAMAGE TO PROPERTY, AND ENVIRONMENTAL CLAIMS AND LIABILITIES, TO THE EXTENT CAUSED BY CONTRACTOR, ITS EMPLOYEES, AGENTS OR SUBCONTRACTORS. OWNER SHALL HAVE THE RIGHT TO SELECT ITS OWN COUNSEL AND TO HAVE COUNSEL SEPARATE FROM CONTRACTOR, ALL AT OWNER’S EXPENSE.”</p>
Appendix T&Cs	2	General	19.4	<p>Insert the word “CONTRACTOR” between the words “ALL” and “INDEMNITY”.</p>
Appendix T&Cs	2	General	Add 19.5	<p>Insert the following new Section 19.5:</p> <p>“19.5 OWNER'S LIMITED INDEMNITY. OWNER WILL PROTECT, DEFEND, INDEMNIFY AND HOLD HARMLESS CONTRACTOR, CONTRACTOR'S SUBCONTRACTORS AND SUPPLIERS, AND THEIR RESPECTIVE PARTNERS AND THEIR PARENT CORPORATIONS, SUBSIDIARIES, AFFILIATES, AGENTS, OFFICERS, DIRECTORS AND EMPLOYEES (EACH, A “CONTRACTOR INDEMNIFIED PARTY”) FROM AND AGAINST ANY AND ALL THIRD-PARTY SUITS, ACTIONS, LOSSES, DAMAGES, CLAIMS OR LIABILITY OF ANY CHARACTER, TYPE OR DESCRIPTION, INCLUDING, BUT NOT LIMITED TO, ALL EXPENSES OF LITIGATION, COURT COSTS AND ATTORNEYS' FEES, FOR INJURY OR DEATH TO ANY PERSON OR DAMAGE TO ANY PROPERTY, TO THE EXTENT CAUSED BY ANY NEGLIGENT ACT OR OMISSION (INCLUDING STRICT LIABILITY), GROSS NEGLIGENCE OR WILLFUL MISCONDUCT OF OWNER, ITS CONTRACTORS (BUT NOT INCLUDING CONTRACTOR) OR ITS SUBCONTRACTORS, AGENTS OR EMPLOYEES, ARISING OUT OF OWNER’S USE OF CONTRACTOR’S FACILITIES, LADDERS, AND SCAFFOLDS AS PROVIDED FOR IN SECTION 9.3(A).”</p>
Appendix T&Cs	2	General	Add 20.2	<p>Insert the following new Section 20.2 as follows:</p> <p>"20.2 Owner and Contractor agree that liquidated damages as provided in Section 6 of the SOW shall apply to this Agreement (collectively, the "<u>Liquidated Damages</u>")."</p>
Appendix T&Cs	2	General	Add 20.3	<p>Insert the following new Section 20.3 as follows:</p> <p>"20.3 Except for any Contractor's indemnification obligations as provided for under this Agreement, in no event shall Contractor be liable to Owner for any damages, claims, demands, suits, causes of action, losses, costs, expenses and/or liabilities (including any Liquidated Damages) under or in connection with the Agreement in excess of an amount equal to one hundred percent (100%) of the Contract Price, as adjusted for Change Orders, regardless of whether such liability arises out of breach of contract, guarantee or warranty, tort, product liability, contribution, strict liability or any other legal theory. Notwithstanding any of the foregoing, this limitation of liability shall not apply to damages for which insurance proceeds are received from insurance required to be provided pursuant to Article 18, it being the parties' specific intent that this limitation shall not relieve the insurers' obligations for such insured risks."</p>
Appendix T&Cs	2	General	21.1	<p>Delete the first word "To" of this Section 21.1 and insert in place thereof the following:</p> <p>"Except to the extent of Owner's failure to make proper payment to Contractor for undisputed amounts due, to".</p>
Appendix T&Cs	2	General	25.3	<p>Delete Section 25.3 in its entirety and insert the following in place thereof:</p> <p>"25.3 Owner Event of Default. In the event Owner (i) fails to make an undisputed payment to Contractor when due after fifteen (15) days from receipt of a notice of non-payment from Contractor; or (ii) commits repeated or substantial violations of laws, rules, regulations or policies, such occurrence shall constitute an “Owner Event of Default”. Upon such an Owner Event of Default, Contractor may pursue any or all of the following actions:</p> <p>(a) to terminate this Contract upon providing notice of such termination to Owner;</p> <p>(b) to seek equitable relief to enforce the provisions of this Contract;</p> <p>(c) to suspend the Work until such Owner Event of Default has been cured and, upon the resumption of the Work, as full compensation for any suspension under this Section 25.3(c), the Contract Price shall be adjusted and Contractor shall be entitled to any additional increased costs of Contractor directly resulting from any such suspension, as demonstrated by Contractor to Owner's reasonable satisfaction and shall be set forth in a Change Order, provided that (i) Contractor shall continue to protect and maintain the Work performed, including those portions on which Work has suspended, and (ii) Contractor shall promptly resume the Work upon the cure of such Owner Event of Default."</p>
Appendix T&Cs	2	General	Add 25.4	<p>Insert the following new Section 25.4:</p> <p>"25.4 Each of Owner's or Contractor's rights set forth above shall be cumulative and additional to any other rights or remedies provided in law or equity or otherwise."</p>
Appendix T&Cs	2	General	26.1	<p>Insert at the end of this sentence before the "," the following: ", provided, however, Contractor shall not be liable for such damages to the extent such failure to perform on time is caused by Owner or Owner's subcontractors".</p>
Appendix T&Cs	2	General	28.1	<p>Delete Section 28.1 in its entirety and insert in place thereof the following:</p> <p>"28.1 Owner may at any time suspend all of any part of the Work by providing Contractor with a minimum of three days' written notice. Notwithstanding the foregoing sentence, in the event Owner identifies any concerns for safety, security, or proper performance, Owner shall have the right to immediately suspend all or any part of the Work. Immediately upon the effective date of Owner's suspension as provided in its suspension notice, Contractor shall take the necessary actions to comply with the suspension notice."</p>
Appendix T&Cs	2	General	29.1.2	<p>Delete the last sentence of this Section and insert in place thereof:</p> <p>"Owner may take possession of and utilize in completing the Work Contractor's materials, Equipment to be installed, supplies, tools and equipment at the Site (including, but not limited to port-a-johns, trailers), provided that such materials Equipment, supplies, tools and equipment at the Site are not owned or subject to a lease (other than a short-term, Project-specific lease) by Contractor or its Subcontractors."</p>

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WC AEP South Bend Solar Form D: Commercial Exceptions, Deviations and Clarifications FINAL 08/02/19

Reference Document			Section	Exception, Deviation or Clarification
Appendix T&Cs	2	General	29.1.3	<p>Delete this section and insert the following in place thereof:</p> <p>"29.1.3 Upon such termination, Contractor shall only be paid for Work completed in accordance with the Contract as of the effective date of termination, which payment shall be due no later than thirty (30) days of such termination date. Contractor shall not be entitled to any other payment, including any retention, until all of the Work is completed in its entirety and Final Acceptance has been achieved. Notwithstanding the preceding, if Owner's completion of the Work, either by itself or through use of third parties, and Final Acceptance does not occur within 180 days of Contractor's completion date of the Work in accordance with the Project Schedule in effect at the time of Owner's termination of Contractor, then Contractor shall not be liable to Owner for any cost of completion that exceeds the unpaid balance of the Contract incurred by Owner after such date."</p>
Appendix T&Cs	2	General	29.2.1	<p>Delete the second sentence and insert in place thereof, "Owner will give Contractor prior written notice of termination for convenience specifying the extent to which the Contract is terminated and the effective date of such termination, which date shall not be earlier than three (3) days from Contractor's proper receipt of notice."</p>
Appendix T&Cs	2	General	29.2.2	<p>In Section 29.2.2, delete the first word "Upon" and insert the following in place thereof, "Except as provided in Section 29.2.4, upon".</p>
Appendix T&Cs	2	General	29.2.3	<p>In the first sentence of Section 29.2.3, delete the first word "In" and insert the following in place thereof, "In addition to the provisions set forth in Section 29.2.4, in..."</p>
Appendix T&Cs	2	General	Add 29.2.4	<p>In Section 29.2, insert a new subpart 29.2.4 as follows:</p> <p>"29.2.4 In the event Owner terminates this Contract pursuant to Section 29.2.1, the following shall apply in connection with the Module Supply Agreement:</p> <p>(a) Owner may elect to have Contractor cause the Module Supply Agreement to be assigned to Owner or an affiliate of Owner and Owner or Owner's affiliate shall then assume the rights and obligations under the Module Supply Agreement and Contractor shall have no further obligations or liability under it; or</p> <p>(b) Owner may elect to give Contractor the option to reimburse Owner the amount of the LNTP Payment plus interest at the Contract Interest Rate from the date of such LNTP Payment to the termination date, and such payment by Contractor to Owner shall be due thirty (30) days from receipt of Owner's notice of election. Contractor shall retain all further rights and obligations under the Module Supply Agreement. Should Contractor not elect this option, then Owner shall be required to elect subpart (a) above."</p>
Appendix T&Cs	2	General	29.3	<p>Insert the following new Section 29.3:</p> <p>"29.3 Contractor Termination for Cause.</p> <p>29.3.1 Upon an Owner Event of Default, Contractor may terminate the Contract upon written notice to Owner.</p> <p>29.3.2 Subject to Section 25.4, in the event of such termination of this Contract by Contractor, Contractor shall be entitled to keep all payments received and any amounts paid to Contractor for Work previously paid by Owner hereunder, and Owner shall pay to Contractor an amount (a "Contractor Termination Payment") equal to: [REDACTED]</p> <p>29.3.3 Contractor shall submit an invoice to the Owner within thirty (30) days after the termination effective date, which shall set forth all amounts due to Contractor pursuant to Section 29.3.2, together with such supporting information and documents as Owner may reasonably request."</p>
Appendix T&Cs	2	General	32.1	<p>In Section 32.1, at the end of the last sentence after "pricing" insert the following: "and any Subcontracts for Work performed on fixed price basis may have the pricing information redacted, provided, however, Contractor shall at Owner's request provide Subcontractor pricing data for any extra work being performed for Owner on a time and materials basis".</p>
Appendix T&Cs	2	General	32.4	<p>Insert the following new Section 32.4 to state as follows:</p> <p>"32.4 Documents provided in accordance to this provision shall be subject to Owner's confidentiality obligations as provided in Section 24.0."</p>
Appendix T&Cs	2	General	38.1	<p>Delete the second sentence and insert in place thereof the following, "Notwithstanding the foregoing, either party may disclose the terms of the Contract without the consent of the other party (a) to any of its affiliated companies (including any joint ventures of which a party or any of such party's affiliates are a member and the other members of such joint ventures); and (b) to any prospective transferee or purchaser of assets of a party or any of such party's affiliates."</p>
Appendix T&Cs	2	General	Article 41.1	<p>Delete all references to "State of Ohio" and insert in place thereof "State of Indiana".</p>
Appendix T&Cs	2	General	Article 41.2	<p>In the first sentence delete reference to "in the State of Ohio or the state where work was performed" and insert in place thereof "in the State of Indiana".</p>

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Indiana Michigan (I&M) Power Company South Bend Solar Project

APPENDIX 2-A

Payment Schedule Revision 1 dated August 2, 2019

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 13, AUGUST 2, 2019

PUBLIC VERSION



Appendix 2-A
Rev 1 dtd 8/2/2019
South Bend Solar Project
Contract 03065263X132

PAYMENT SCHEDULE						
Item No.	Schedule of Values	Estimated Invoice Date	Qty	U/M	Unit Price	Payment Amount
Major Equipment Procurement						
1	Module Procurement (LNTP Payment)	August-19	25,356,400	W		
2	Module Procurement	October-20	10,078,613	W		
3	Module Procurement	November-20	12,758,133	W		
4	Tracker Foundation Procurement	May-20	4,914	EA		
5	Tracker Foundation Procurement	September-20	4,914	EA		
6	Inverter / Padmount Procurement	May-20	4.2000	EA		
7	Inverter / Padmount Procurement	October-20	1.707810	EA		
8	Inverter / Padmount Procurement	November-20	0.0922	EA		
9	Tracker Procurement	May-20	6,339,100	W		
10	Tracker Procurement	October-20	19,017,300	W		
11	Switch Gear Procurement	July-20	1	EA		
Design and Engineering; Engineer Documents						
12	Engineering Kickoff	June-20	1	LS		
13	Civil Design IFC	July-20	1	LS		
14	Electrical Design IFC	October-20	1	LS		
15	Structural Design IFC	September-20	1	LS		
16	As Built Drawings	January-21	1	LS		
Balance of Plant (BOP); Progress Payments						
17	Control Building Furnish and Install	September-20	1.00000	EA		
18	Furnish Performance and Payment Bond	June-20	1	LS		
19	Mobilization	April-20	1	LS		
20	Laydown Yard	April-20	1	LS		
21	SWPP Installation	April-20	1	LS		
22	Perimeter Fencing	August-20	9,307.95	LF		
23	Perimeter Fencing	September-20	10,353.05	LF		
24	Access Roads	April-20	3,200	LF		
25	Access Roads	May-20	4,480	LF		
26	Tracker Foundation Install	July-20	3,931.20	EA		
27	Tracker Foundation Install	August-20	3,931.20	EA		

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Appendix 2-A
Rev 1 dtd 8/2/2019
South Bend Solar Project
Contract 03065263X132

PAYMENT SCHEDULE						
Item No.	Schedule of Values	Estimated Invoice Date	Qty	U/M	Unit Price	Payment Amount
28	Tracker Foundation Install	September-20	1,965.60	EA		
29	Tracker Install	September-20	2.530	MW		
30	Tracker Install	October-20	8.855	MW		
31	Tracker Install	November-20	10.120	MW		
32	Tracker Install	December-20	3.795	MW		
33	Module Install	October-20	14,750	EA		
34	Module Install	November-20	29,500	EA		
35	Module Install	December-20	14,750	EA		
36	Inverter Foundation Installed	November-20	6	EA		
37	Inverter Skid Installed	December-20	6	EA		
38	Combiner Boxes Furnish and Installed	October-20	12.632	MW		
39	Combiner Boxes Furnish and Installed	November-20	12.66842	MW		
40	DC Cable Furnish and Installed	August-20	2.63	MW		
41	DC Cable Furnish and Installed	September-20	4.21	MW		
42	DC Cable Furnish and Installed	October-20	10.53	MW		
43	DC Cable Furnish and Installed	November-20	7.93	MW		
44	DC Wire Harness Furnish and Installed	December-20	10.94	MW		
45	DC Wire Harness Furnish and Installed	October-20	10.94	MW		
46	DC Wire Harness Furnish and Installed	November-20	3.43	MW		
47	MV Cable Install	October-20	18.27	MW		
48	MV Cable Install	December-20	7.03	MW		
49	DC Homerun Terminations	December-20	6.0	MW		
50	DC Homerun Terminations	October-20	6.0	MW		
51	DC Homerun Terminations	November-20	6.0	MW		
52	DC Homerun Terminations	December-20	7.3	MW		
53	MV Terminations	December-20	25.3	MW		
54	Switchgear Install	October-20	1	EA		
55	Test & Commission	September-20	3.00	MW		
56	Test & Commission	October-20	4.00	MW		
57	Test & Commission	November-20	8.00	MW		

PUBLIC VERSION



Appendix 2-A
Rev 1 dtd 8/2/2019
South Bend Solar Project
Contract 03065263X132

PAYMENT SCHEDULE						
Item No.	Schedule of Values	Estimated Invoice Date	Qty	U/M	Unit Price	Payment Amount
58	Test & Commission	December-20	10.30	MW		
59	SCADA Installed	October-20	0.3019	LS		
60	SCADA Installed	November-20	0.3208	LS		
61	SCADA Installed	December-20	0.3774	LS		
62	Final Seeding / Restoration	October-20	6.3830	MW		
63	Final Seeding / Restoration	November-20	14.1844	MW		
64	Final Seeding / Restoration	March-21	4.7326	MW		
Total						

Contingencies Not Included in Base Contract Price

65	Tracker Foundation Increase to 25'	March-20	1.0000	LS	
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PUBLIC VERSION



**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 3
GENERATION CONTRACTOR SUPPLEMENTAL SAFETY &
HEALTH REQUIREMENTS
REVISION 9, DATED 10/02/2017

PRE-WORK HAZARD ASSESSMENT**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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**GENERATION CONTRACTOR SUPPLEMENTAL SAFETY &
HEALTH REQUIREMENTS
REVISION 9, DATED 10/02/2017**

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 1 of 17
---	--	------------------------------------	---------------------

TABLE OF CONTENTS

1.0	Definitions and Abbreviations	2
2.0	Introduction	3
3.0	Health and Safety Planning	4
3.1	Pre-Work Assessment (PWA)	4
3.2	Health and Safety Plan	4
3.3	Job Hazard Analysis (JHA)	5
3.4	Job Safety/Site Assessment (JSA)	5
3.5	Continuous Hazard Assessment	5
3.6	Safety and Health Coordinator	6
3.7	Working Hour/Day Limitations	6
4.0	Training and Qualification Requirements	6
4.1	Training	6
4.2	Training Administration	7
5.0	Administrative	7
5.1	Record Availability	7
5.2	Regulatory Inquiries	7
5.3	Incident Reporting and Investigation	8
5.4	Weekly Reporting	8
5.5	Individuals Restricted from Access to Owner's Work Sites	9
5.6	Communication	10
5.7	MSHA Inspections	10
6.0	Substance Abuse Program	10
7.0	Additional Health and Safety Requirements	12
7.1	Personal Protective Equipment	12
7.2	Industrial Hygiene Practices for Metals and Heavy Metals	13
7.3	Lead/Cadmium Based Paint	14
7.4	Asbestos Containing Material	14
7.5	Firearms, Alcohol, Drugs	15
7.6	Hazard Communication	15
7.7	Hazardous Materials Management	15
7.8	Tools	15
7.9	Additional AEP Safety and Health Requirements	16
7.10	Safety and Health Audits	16
8.0	Review and Revision History	16

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 2 of 17
---	--	------------------------------------	---------------------

1.0 DEFINITIONS AND ABBREVIATIONS

Unless otherwise defined below, capitalized terms shall have the same meaning as assigned to them in the Contract terms and conditions.

1.1 Health and Safety Plan (HASP) - A Health and Safety Plan is a written description of the manner in which Contractor will manage the Work under the contract in order to ensure the health and safety of all personnel involved in or affected by the work, including but not limited to Contractor and Subcontractor employees, Owner employees, other contractors' employees, visitors, vendors, and the general public.

1.2 Job Safety/Site Assessment (JSA) - A job briefing process that includes 5 main steps to prepare employees to work safely during the task. The five main steps include: 1) identifying and talking about the job scope; 2) identifying the hazards associated with the job and controls to protect employees; 3) considering the environmental aspects of the job, 4) visiting the job site and assessing hazards and; 5) cleaning up after the job.

1.3 Job Hazard Analysis (JHA) - A detailed 3-step analysis that helps eliminate and/or reduce risk. This 3 step process breaks each task down into basic job steps, identifies existing and potential hazards associated with each step and provides recommendations/procedures to eliminate, reduce or control hazards, and the option of assessing potential severity.

1.4 Pre-Work Hazard Assessment (PWhA) - Owner's initial hazard assessment for the Work to be executed by Contractor that identifies anticipated hazards as best as can reasonably be determined by Owner that may require elimination or mitigation. The PWhA will be provided to Contractor and is intended to provide a basis for initial planning purposes only and no warranty is expressed or implied that it is accurate, complete, comprehensive, or all-inclusive, or that items not listed will not be present or pose no threat to personnel safety or health.

1.5 Owner's Site Safety, Health and STAR/Zero Harm Orientation Training - Owner's site specific Safety and Health Orientation and any additional safety and health awareness training the site may require such as Stop Think Act Review (STAR) training.

1.6 Safety and Health Coordinator - Individual responsible for assisting Contractor supervision in carrying out its responsibilities for job site safety and health and other loss prevention programs associated with the Work.

1.7 Abbreviations:

1.7.1 ACM –Asbestos Containing Materials

1.7.2 HASP - Health and Safety Plan

1.7.3 JHA - Job Hazard Analysis

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 3 of 17
---	--	------------------------------------	---------------------

- 1.7.4** JSA - Job Safety/Site Assessment
- 1.7.5** SDS - Safety Data Sheets
- 1.7.6** OSHA - Occupational Safety and Health Administration
- 1.7.7** MSHA – Mine Safety and Health Administration
- 1.7.8** PACM - Presumed Asbestos-Containing Material
- 1.7.9** PWSHA - Pre-Work Hazard Assessment

2.0 INTRODUCTION

- 2.1** These Safety and Health Requirements shall be used in conjunction with the-applicable AEP System General Terms and Conditions for Work performed at AEP System Generation facilities. These Requirements convey Owner's minimum expectations regarding safety and health practices and may exceed the requirements of federal, state, and local regulatory agencies. Contractor shall submit to Owner or ISNetwork a copy of their Environmental, Health and Safety manual.
- 2.2** In the event Owner determines that an unsafe condition exists at the site, Owner shall have the absolute right to immediately order corrective measures or stop the Work until the unsafe condition is corrected by Contractor without advance written notice. To the extent Contractor or its subcontractors have caused the unsafe condition and subsequent delays or impacts to the Work, Contractor shall be solely responsible for any costs it incurs associated with the Work stoppage and shall not be allowed additional time to complete the Work. This provision does not relieve Contractor of its exclusive responsibility for safe work practices nor impose upon Owner any obligation to supervise Contractor's work practices.
- 2.3** These Safety and Health Requirements apply in their entirety to the Work unless Owner has waived the requirement for the Health and Safety Plan (HASP) described in Paragraph 3.2 in writing. In such case, the following highlighted paragraphs do not apply to the Work: 3.2, 3.6, 4.1.3, 4.1.4, 4.2.2, 5.4, and 6.1

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 4 of 17
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2.4 For MSHA regulated facilities, Contractor shall comply with and enforce all laws, rules and regulations applicable to safety and health standards, including, but not limited to, the Federal Mine Safety and Health Acts of 1977, and any revisions, amendments, and successor legislation, to the extent governing and applicable to the Work. To the extent that this Contract (and particularly within Generation Contractor Supplemental Safety & Health Requirements incorporated herein) references an OSHA definition or requirement(s), and there is an MSHA definition or requirement(s) that is reasonably comparable to such OSHA definition or requirement, then the comparable MSHA requirement shall control, if MSHA has jurisdiction over the referenced subject matter and/or location. Further, any MSHA requirements for which there are no comparable OSHA requirements, and which are applicable to the Work, shall apply. To the extent that this Contract requires compliance to OSHA requirements for which there are no comparable MSHA requirements, or to the extent that this Contract imposes safety and health requirements for which there are no comparable OSHA or MSHA requirements, and which are applicable to the subject matter and/or location, Contractor shall comply with the strictest of: (i) the OSHA requirement; (ii) any applicable Owner requirement; or (iii) any applicable Contractor rule or procedure. Generation Contractor Supplemental Safety & Health Requirements shall apply in addition to applicable OSHA and/or MSHA requirements.

3.0 HEALTH AND SAFETY PLANNING

Owner expects each Contractor to exercise planning and forethought regarding the safety and health aspects of all Work performed.

3.1 Pre-Work Hazard Assessment (PWH)

3.1.1 Owner will provide Contractor with Owner's completed PWH. Contractor shall consider the PWH and understand that the PWH is informational for initial planning purposes only. The PWH does not relieve Contractor of its obligation to conduct its own hazard assessments of the Work.

3.2 Health and Safety Plan

3.2.1 Contractor is required to prepare and submit a Health and Safety Plan (HASP) to Owner for review and discussion prior to the start of Work under the contract unless Owner waives or modifies this requirement in writing. The HASP shall cover the Work of Contractor and its subcontractors, agents and representatives. (See AEP Contractor Safety Site)

3.2.2 Proposed revisions to the HASP during the course of the Work require discussion and review with Owner.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 5 of 17
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3.3 Job Hazard Analysis (JHA)

- 3.3.1** If Owner requires a HASP, Contractor shall prepare Job Hazard Analyses in accordance with its HASP. Where a HASP is not required, Contractor shall prepare a JHA for the planned Work subject to review by Owner prior to starting Work. In either case, Owner may require Contractor to prepare additional JHAs. Contractor shall use and update JHAs to consistently apply proper safeguards. All Job Hazard Analyses are subject to review by Owner. (See AEP Contractor Safety Site) The HASP and JHA's shall be signed by the site superintendent to ensure clear understanding of the safety and health plan at the local level.

3.4 Job Safety/Site Assessment (JSA)

- 3.4.1** Before any Work begins at the start of each shift and whenever job scope, activity, procedures, or location changes, Contractor shall conduct a JSA utilizing Owner's JSA form or Owner-approved equivalent form. In the preparation of the JSA, Contractor shall consult applicable JHA's that may exist for the Work. (See AEP Contractor Safety Site)
- 3.4.2** Whenever a problem, circumstance, or result that was not covered in the JSA is encountered during the course of the Work, Contractor shall stop Work immediately, evaluate the situation, and conduct a new or revised JSA before resuming Work.
- 3.4.3** No work shall be performed without a JSA. Only persons signed onto the JSA may perform the Work covered by the JSA.
- 3.4.4** Contractor front line supervision and above shall attend at least one JSA discussion daily and audit at least two jobs in progress each shift for adherence to the JSA process requirements, including thoroughness and quality, and shall sign the JSA to document these actions. JSA's are subject to observation, review, and audit by Owner. (See AEP Contractor Safety Site)
- 3.4.5** Contractor is expected to take appropriate action for individuals who fail to comply with the JSA requirements including performing Work outside the parameters of the JSA.
- 3.4.6** Contractor shall retain completed JSA forms for at least 30 days or as directed by Owner. In the event of an OSHA-recordable injury, Contractor agrees to include the associated JSA with the accident investigation paperwork and retain it in accordance with applicable OSHA record retention requirements.

3.5 Continuous Hazard Assessment

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 6 of 17
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- 3.5.1** Owner expects all of Contractor's personnel to continuously assess their Work locations and activities for hazards throughout the work day including the start of the shift, before changes in work or locations, after breaks, and in some cases prior to performing certain routine or repetitive activities. As an aid in performing these assessments, some sites may require each employee to document their assessments using Owner-supplied checklists or equivalent means such as a STAR Card. (See AEP Contractor Safety Site for STAR Card and other tools.)

3.6 Safety and Health Coordinator

Contractor shall provide an on-site full-time Safety and Health Coordinator for each shift of Work in which the total of craft personnel (Contractor and its Subcontractors) exceeds 40 personnel. Contractor shall provide Owner with the resumes of proposed Safety and Health Coordinator personnel. While the Owner may not designate an individual or individuals to perform the role of Safety and Health Coordinator, qualification for these individuals shall include completion of the OSHA 500 or 510 training and satisfactory work experience as determined by Owner. Owner may request Contractor to provide a fulltime Safety and Health Coordinator for Work with fewer than 40 craft personnel per shift if Owner determines the nature of the Work justifies additional safety oversight.

3.7 Working Hour/Day Limitations

- 3.7.1** Contractor shall staff and plan in a manner that prevents any person from working more than 13 consecutive days without a 24 hour rest period. Exceptions shall be pre-approved in writing by Owner's representative at the Director level or above.
- 3.7.2** Contractor shall staff and plan in a manner that prevents any person from working more than 16 hours in any rolling 24 hour period. After working 16 hours a minimum of 8 hours of rest shall occur before returning to work. A two hour exception may be granted in order to arrange for relief if a job has gone longer than expected. Exceptions shall be pre-approved by Owner's representative at the Director level or above.

4.0 TRAINING AND QUALIFICATION REQUIREMENTS

4.1 Training

All personnel are required to successfully complete the following prior to being allowed to commence Work on site:

- 4.1.1** Owner's Site Safety, Health, and/or STAR/Zero Harm Orientation. Initial orientation takes up to two hours and an annual refresher is required. Additional training may be required as determined by Owner.
- 4.1.2** Contractor's own Asbestos Awareness Training in addition to specific safety and health training required to complete the Work.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 7 of 17
---	--	------------------------------------	---------------------

- 4.1.3** All superintendents are required to have OSHA 30-Hour Construction Training. A two-week grace period may be granted at Owner's sole discretion for those who have successfully completed the OSHA 10-Hour Construction Training.
- 4.1.4** For all supervision/workers below the level of superintendent, OSHA 10-Hour Construction Training, or equivalent training deemed acceptable to Owner, is required. A two week grace period may be granted at Owner's sole discretion.
- 4.1.5** Some sites may require Supervision to attend Owner's "Supervisors' Responsibilities and Expectations Briefing" program. If required the program must be completed within two weeks after arrival at Owner's site and takes approximately one hour.
- 4.1.6** Contractor shall utilize Owner's briefing on procedures and controls in addition to Contractor's own written procedures for Work activities involving confined space entry, clearance permits, work on or near energized circuits, etc.

4.2 Training Administration

- 4.2.1** Contractor shall maintain up-to-date documentation of training and have it readily available on site for Owner's inspection upon request.
- 4.2.2** Contractor is responsible for the cost of all OSHA 10- and 30-Hour Training or equivalent training.
- 4.2.3** For MSHA regulated facilities, contractor is responsible for the cost of all MSHA Surface Certification, New Miner and Miner Refresher Training.
- 4.2.4** Owner will reimburse Contractor the cost of its personnel attending Owner required training specified in Paragraphs 4.1.1, 4.1.5, and 4.1.6.
- 4.2.5** Owner, at its sole discretion based on Work observations or for other reasons, may at any time withdraw its acceptance of any previously approved or completed training and require personnel to repeat the training.

5.0 ADMINISTRATIVE

5.1 Record Availability

- 5.1.1** Documentation of training/inspection records must be kept on site for the duration of the job.

5.2 Regulatory Inquiries

- 5.2.1** Contractor shall provide Owner, for Owner's review, all written reports and copies of all documents 24 hours prior to submittal to a regulatory agency.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 8 of 17
---	--	------------------------------------	---------------------

5.3 Incident Reporting and Investigating

- 5.3.1** Contractor shall promptly notify Owner of all safety related events. These include near-miss incidents; self-aid, first-aid, and minor incidents; exposure incidents; OSHA recordable injuries and illnesses; and vehicle accidents.
- 5.3.2** Contractor shall submit a written summary to Owner's representative by 8:00 a.m. each scheduled Work day listing all safety related events that occurred the previous scheduled Work day.
- 5.3.3** Contractor shall immediately secure the scene of an incident and not disturb the scene or items at the scene unless necessary to attend to injured personnel or to prevent additional injury or property damage. Work may not resume and no items at the scene may be moved or discarded until authorized to do so by Owner's designated Safety and Health representative.
- 5.3.4** The injured/involved person's immediate supervisor shall submit a completed Report of Injury or Illness Form PS-138A to Owner within 24 hours of the event. (See AEP Contractor Safety Site)
- 5.3.5** Owner and Contractor shall promptly initiate an investigation into the facts and circumstances leading up to the event and Contractor shall submit a report to Owner within 48 hours unless granted an extension by Owner. Contractor's Superintendent or most senior representative on site shall conduct or lead the investigation. The immediate supervisor may not serve on the investigation team unless no other supervisory personnel are available. Owner may choose to participate in the investigation. Based on the actual or potential severity of event, Owner may require Contractor to form an incident investigation committee, the makeup of which is subject to Owner's approval. Notwithstanding Contractor's obligations as specified herein, Owner reserves the right to conduct its own independent investigation, with support or input from the Contractor as requested by Owner.
- 5.3.5.1** Investigator(s) shall examine the scene of the event and promptly interview the injured/involved persons and witnesses.
- 5.3.5.2** The names of the injured/involved persons, supervisors, and witnesses, investigation findings, causal factors, and corrective/preventive actions shall be documented in the investigation report.

5.4 Weekly Reporting

- 5.4.1** Contractor shall report the following to Owner each week:
- **Direct and Indirect** hours worked weekly and year-to-date at Owner's worksite.
 - A summary of recordable injuries, first aids, near misses, etc. that occurred during the week.
 - Year-to date severity rate calculations on Owner's worksite.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 9 of 17
---	--	------------------------------------	---------------------

- Up to date list of employees with last four digits of their social security numbers in order for Owner to implement random drug testing.

5.5 Individuals Restricted from Access to Owner's Work Sites

- 5.5.1** Contractor shall provide to Owner a list of all individuals (whether Contractor's or its Subcontractor's personnel) which Contractor intends to use at Owner's sites. The list shall identify the individuals by name and the last four digits of their Social Security numbers.
- 5.5.2** Owner may provide Contractor with a list of persons that are restricted from Owner's worksite. Prior to commencement of the scheduled Work and during the duration of the Work, Contractor shall ensure that no person on the list shall be admitted to the site.
- 5.5.3** Owner may deny access to its work sites to any individual who fails to comply with the provisions set forth in these Generation Contractor Supplemental Safety & Health Requirements, or who, in Owner's discretion, otherwise demonstrates unsafe or unacceptable behaviors. Examples include, but are not limited to, the following:
- Unsafe job performance.
 - Failure to follow Owner's JSA process.
 - Failure to pass drug/alcohol test.
 - Displaying incompetence in performing their job.
 - Participating in pranks, horseplay or practical jokes.
 - Failure to report injuries and/or accidents.
 - Fighting or acts of aggression.
 - Making threats.
 - Theft or vandalism.
 - Violation of Life Saving Rules, which include risks associated with:
 - Fall Protection
 - Confined Space Entry (29 CFR 1910.146 and Owner's Confined Space Procedure)
 - Control of Hazardous Energy
 - Energized Work
 - Working Near Water
 - Seat Belt Use
 - Working Near Moving Machinery
 - Barricades
- 5.5.4** Contractor shall provide Owner with the name of each employee removed by Contractor from Owner's property and the reason(s) for their removal.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 10 of 17
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- 5.5.5** Contractor shall promptly notify Local Union Hall of any employee removed from Owner's property and the reason(s) for their removal.

5.6 Communication

- 5.6.1** Contractor shall ensure that its personnel clearly understand oral and written instructions, signs and labels associated with Work. This includes but is not limited to ensuring they understand the scope of Work they are to perform; Owner's Site Safety, Health and/or STAR/Zero Harm Orientation Training; the hazards associated with the Work; the necessary precautions to protect themselves from the Work hazards; site specific Hazard Communication plans; and Emergency Action Plans.

- 5.6.2** Contractor shall provide signage, such as, but not limited to, barricade signs and labeling (Caution, Danger, Asbestos, Arsenic, Radiation, Authorized Personnel only, etc.), hazardous material signs (Gasoline, Used Oil, Caustic, Acid, Oxygen, etc.), HazCom labels, key information signs (Exit, No Exit, High Noise Area, Wet Floor, Universal Waste, No Smoking, Wetlands-Keep Out, etc.), and all legally required employment posters. All signage, labeling and barricade tape shall be UV protected. Contractor shall routinely inspect and replace signage, labeling and barricade tape that is damaged, missing, etc.

- 5.6.3** When Contractor employs workers that are not fluent in or understand English, Contractor shall provide the following:

5.6.3.1 Barricade tape, signs and labeling that are either bilingual or pictorial for any areas it is working where there is a danger to any of its personnel or its Subcontractor's personnel.

5.6.3.2 A translator who is working or supervising in the immediate work area where there are workers not fluent in the English language. Additional translators will be required if ready communication cannot be established with any worker who is not fluent in English. Contractor's translator shall be easily identifiable by Owner such as by the color of their hardhat, clothing etc.

5.6.3.3 Protocols to assure a translator are immediately available to support nursing, EMT responses to injuries or accidents, and during site orientations.

5.7 MSHA Inspections

- 5.7.1** For MSHA regulated facilities, MSHA Surface Certified person to perform required on shift inspection, document, and sign MSHA on shift book.

6.0 SUBSTANCE ABUSE PROGRAM

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 11 of 17
---	--	------------------------------------	----------------------

6.1 Contractor and all subcontractors performing Work at Site must have a substance abuse program. This program must apply to all personnel.

6.2 Minimum requirements shall include pre-hire testing, post-accident testing for cause and when requested, random testing. Screening substances and their associated cut-off limits are listed below.

Drug Screening Classes	Screening Cut-Off Limit*** (ng/ml)	Confirmation Cut-Off Limit (ng/ml)
Amphetamines Methamphetamines	500*	250* 250**
MDMA MDA MDEA	500*	250* 250* 250*
Barbiturates	300	200
Benzoylcegonine (Cocaine Metabolite)	150*	100*
Cannabinoids (THC)****	50*	15*
Opiates Codeine Morphine Oxycodone Hydromorphone Hydrocodone 6-Acetylmorphine	2000* 2000 2000 100 300 300 10	2000* 2000 2000 100 300 300 10
Phencyclidine (PCP)	25*	25*
Benzodiazepines	300	300
Methadone	300	300
Propoxyphene	300	300
Breath alcohol content	.040g/210L	.040g/210L

* Cut-off limits established by the Department of Health and Human Services in their mandatory Guidelines for Federal Workplace Drug Testing Programs.

** To be reported positive for methamphetamine, a specimen must also contain amphetamine at a concentration equal to or greater than 100ng/ml.

*** In no event will the cutoff limits set forth in this paragraph be less than the cutoff limits set forth in the Technical Guidelines adopted from time to time by the United States Department of Health and Human Services.

**** The Medical Review Officer will not accept assertions that a positive THC resulted from the use of hemp oil or the injection of hemp products, and therefore verify a marijuana test negative. Individuals should avoid use of such products.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 12 of 17
---	--	------------------------------------	----------------------

- 6.3** Testing shall be performed by a third party testing facility certified by Department of Health & Human Services, Drug & Alcohol Testing Industry Association (DATIA) or the Substance Abuse Program Administrators Association (SAPAA). The analytical method for a confirmatory drug test must combine chromatographic separation and mass spectrometric identification (i.e. GC/MS, CL/MS). Alcohol testing shall be performed only by certified Breathalyzer equipment (appearing on the Department of Health and Human Resources conforming product list) and trained breath alcohol technician. All positive breath alcohol tests shall be confirmed by an Evidentiary Breath Test that provides a print out.
- 6.4** Contractor's personnel must provide evidence of having tested negative within a year prior to employment. Owner will accept conditional employment predicated upon (a) employee(s) furnishing evidence that they have submitted to testing within forty-eight (48) hours of initial employment and (b) employee(s) furnishing evidence of negative test results within five (5) workdays of initial employment. Contractor shall ensure personnel are "drug free". Owner reserves the right to examine evidence outlined herein. Contractor's program shall incorporate reciprocity on "drug free" employee verification to minimize Owner's economic impact and employee recertification while maintaining the program's intent.
- 6.5** Owner's reimbursement of the costs for testing shall be in accordance with the applicable Building Trades Council, Association or Craft program terms, whether based upon a per-hour contribution or unit price per test rate or at actual cost to Contractor, without additional markups, predicated upon Contractor's submittal of copies of the actual invoice(s) for the testing to Owner. Owner will recognize established area programs provided the aforementioned base line parameters are met.
- 6.6** For Work not covered by Paragraph 6.5 above, Owner will reimburse Contractor at its actual cost, without additional markups, predicated upon Contractor's submittal of copies of the actual invoice(s) for the testing to Owner.
- 6.7** If an instant drug test is requested by the contractor and the employees test results are positive, the employee will be removed from site until the result can be verified by laboratory analysis. If the result is confirmed positive, the employee will be placed on the ban list. If the result is confirmed negative, the employee may return to the site. The Owner will not be responsible for back pay to the employee under these circumstances.

7.0 ADDITIONAL HEALTH AND SAFETY REQUIREMENTS
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7.1 Personal Protective Equipment

Contractor shall provide Personal Protective Equipment to its employees appropriate for the hazards they may face. In addition, Contractor shall comply with the following:

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 13 of 17
---	--	------------------------------------	----------------------

- 7.1.1 Footwear:** With the exception of site office buildings, Contractors personnel shall wear appropriate safety toed work boots meeting minimum requirements for appropriate footwear means ASTM F2412-11 and ASTM F2413-11 approved footwear with a compression rating of C75, with sturdy upper portions, a defined heel, hard and heat resistant sole, sufficient to protect an employee's feet from normal work hazards unless owner agrees with Contractor's Job Hazard Analysis (JHA) which justifies otherwise.

Additional protection such as metatarsal guards, puncture resistant soles, etc. may be required based upon the job hazard assessment for certain work assignments or special environmental conditions.

The following footwear shall be prohibited except in office areas:

- Open-toed,
- Open-heeled, and
- Athletic/Tennis Shoes

- 7.1.2 Respiratory Protection:** Owner's respiratory protection and ventilation requirements for welding, cutting and other hot work are defined in the Welding, Cutting and Brazing Policy (see AEP Contractor Safety Site). Filtering face piece respirators may only be used on a voluntary basis (not OSHA required) and only in areas where there will not be an exposure above the Permissible Exposure Limits (PEL). Filtering face piece respirators include any fabric "dust mask" type respirators with filter efficiencies from 95 through 100.

7.2 Industrial Hygiene Practices for Metals and Heavy Metals

- 7.2.1** Unless directed otherwise, Contractor is responsible for personal industrial hygiene sampling for any contaminants that may pose an exposure hazard to their employee (e.g. arsenic, lead, mercury, hexavalent chromium, cadmium, crystalline silica, etc.). Contractor shall provide copies of industrial hygiene test results to Owner.
- 7.2.2** Contractor must comply with Owner's Negative Exposure Assessment Guidelines in determining when personal protective equipment and regulated area requirements can be removed.
- 7.2.3** Owner requires regulated areas for all work involving potential exposure to hexavalent chromium regardless of the type of work conducted (General Industry or Construction). Owner's competent person for hexavalent chromium shall be consulted regarding the appropriate size, location and demarcation of the regulated area.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 14 of 17
---	--	------------------------------------	----------------------


7.3 Lead/Cadmium Based Paint

- 7.3.1** Structural steel and equipment throughout Owner's facilities may have been coated with lead/cadmium based materials including galvanizing. Contractor shall treat all surfaces as containing lead/cadmium unless tested otherwise prior to performing any grinding, welding, sanding, heating, sandblasting or similar activity. Owner requires that any coating containing lead at a level of 0.05% (500 ppm) or more be treated as a lead-containing coating.
- 7.3.2** In nearly all cases, abatement of lead/cadmium-containing coatings is required before any hot work may be performed. Owner has a specific Post Abatement Hot Work (see AEP Contractor Safety Site) process that contractors must follow to either ensure abatement is effective or that contractor employees are properly protected while performing hot work after abatement.
- 7.3.3** Contractor shall submit to Owner, prior to beginning Work, its written lead/cadmium compliance program.
- 7.3.4** Contractor shall collect all removed lead/cadmium bearing paint and contaminated materials used for the removal of lead/cadmium bearing paint. These shall be placed in Owner-supplied DOT approved containers and properly labeled and stored per Owner instructions.

7.4 Asbestos Containing Material

- 7.4.1** Asbestos-containing materials (ACM) may exist in the form of insulating products, siding, coatings, gaskets and similar materials throughout Owner's facilities. Contractor shall conduct ACM Awareness training in accordance with Paragraph 4.1.2 to notify employees of the possibility of asbestos on the job and the appropriate response (STOP and report it immediately) if presumed asbestos-containing material is encountered. Contractor shall use care and diligence in the execution of its Work to avoid the disturbance of or damage to asbestos-containing material not specifically identified as a part of the Work. This may include, but is not limited to, the installation of protective barriers, temporary platforms or any other means deemed necessary by Contractor to comply with this requirement. Contractor personnel shall immediately report the observance of any ACM or PACM that is not intact to their supervision for immediate response. Contractor shall immediately notify Owner of any disturbance of or damage to asbestos-containing material, presumed asbestos-containing material (PACM) or unknown material. Contractor is responsible for ensuring that its personnel and the public are not exposed to ACM material due to Contractor's disturbance of or damage to the ACM.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 15 of 17
---	--	------------------------------------	----------------------

7.5 Firearms, Alcohol, Drugs

- 7.5.1** Firearms, alcohol, illegal drugs (marijuana, cocaine, etc.) or drugs taken for non-medicinal purposes are prohibited on all Owner sites. In certain States, firearms may be permitted to be secured in personal vehicles in accordance with State laws and plant security procedures.
- 7.5.2** Contractor is responsible for ensuring its personnel who are under the care of a physician or are taking medication are capable of performing their Work safely and within the terms of any restrictions issued by the treating physician.

7.6 Hazard Communication

- 7.6.1** Owner's Safety Data Sheets for generated products are located on the AEP Contractor Safety Site. Other non-Owner generated SDS are available for Contractor review.
- 7.6.2** Contractor shall provide a list of the chemicals, materials and products that Contractor intends to bring on-site and the corresponding Safety Data Sheets (SDS) for Owner's approval prior to delivery of the materials to Owner's site. The list and the SDS shall be kept up to date. Chemicals containing 1,1,1-Trichloroethane, methylene chloride, trichloroethylene, tetrachloroethylene (perchloroethylene), 1-bromopropane (N-propyl bromide), any confirmed human carcinogen, asbestos, lead or mercury will not normally be approved.

7.7 Hazardous Materials Management

- 7.7.1** Contractor shall have a program for proper storing, handling and disposal of hazardous materials in a safe and secure manner.
- 7.7.2** Contractor shall minimize the quantities of hazardous materials it intends to use and hazardous waste it expects to generate. Contractor shall keep Owner informed of all generated wastes and its disposal management practices.
- 7.7.3** Bulk storage (55 gallons) of hazardous materials shall be provided with adequate weather protection. Damaged or leaking containers are unacceptable.

7.8 Tools

- 7.8.1** When material needs to be cut in the work place, cutting tools other than a knife, i.e. wire cutters/strippers, side cutters, snips and other cutting tools shall be considered first. A safety utility knife with an automatic retracting blade or other means of blade protection would be the second selection. The use of a company issued pocket knife or non-safety utility knife is only permitted if a safety utility knife or other cutting tool cannot be used. In these cases, they can only be used in combination with wearing appropriate glove protection, as determined by the JSA.

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 16 of 17
---	--	------------------------------------	----------------------

7.8.2 No handheld grinder shall be used with a switch which is capable of being locked in the “ON” position unless a hazard analysis determines it is safer. Handheld Grinders 4 ½” thru 6” shall be equipped with a safety clutch to aid in preventing kickback and potential personal injury to the user. Contractor(s) shall have a grinder control procedure established to assure when grinders are being used for either grinding or cutting, front line supervision has determined that a grinder is the safest and best tool for the job.

7.8.3 Job site fabricated tools or tools with no Original Equipment Manufacturer shall be engineered for a specific task and approved by Owner prior to use.

7.8.4 Contractor shall furnish hand protection appropriate for the task in accordance with the Generation Glove and Sleeve Selection Matrix (see AEP Contractor Safety Site).

7.9 Additional AEP Safety and Health Requirements

7.9.1 In addition to OSHA requirements, AEP has special requirements for the following subjects:

- Lifting and Rigging (follow Owners specific Business Unit requirements, may vary by contract release)
- Suspended Scaffold
- Excavation
- Floor and Wall Opening
- 15’ Scaffold Access
- Arc Flash

7.10 Safety and Health Audits

7.10.1 Owner conducts random safety and health audits and observations. Contractor and its subcontractors shall cooperate fully with Owner’s representative during a safety and health audit. Owner may terminate any Contract, at its sole discretion, based on the results of any such safety and health audit.

8.0 REVIEW AND REVISION HISTORY			
DATE	REVISION #	COMMENTS	REVIEWER
8/1/11	8		
10/2/17	9	Complete Revision	Rev 9 Safety Ts & Cs Team

PUBLIC VERSION

	Generation Contractor Supplemental Safety & Health Requirements	Rev. # 9 Date: 10-02-17	Page 17 of 17
---	--	------------------------------------	----------------------

LIST OF AEP SPECIFIC DOCUMENTS ON AEP CONTRACTOR SAFETY SITE

- Generation Contractors Job Safety Analysis (JSA)
- Health and Safety Plan (HASP)
- Welding, Cutting and Brazing Policy
- Lead Exposure Control Post-Abatement Hot Work and Conducting Hot Work Without Abatement
- Negative Exposure Assessment Guidelines
- Scaffolding Safety Procedure
- 15' Scaffold Access Procedure
- Confined/Enclosed Space Procedure
- Confined Space Entry Permit
- Clearance Permit Policy Fossil/Hydro Generation
- Clearance Permit Procedure Fossil/Hydro Generation
- Clearance Permit Form Fossil/Hydro Generation
- Excavation Policy
- Floor and Wall Opening Permit Procedure
- Barricade Tape and Flagging Guideline (Generation Only)
- Arc Flash Protection Policy (Generation Only)
- C.OI-730.12.02 - Electric Lines and Equipment Clearance (PC&C)
- STAR Card(s)
- PS-138 A
- Generation Glove and Sleeve Selection Matrix
- Safety Data Sheets (S.D.S)
- AEP Lifting and Rigging Procedure (Plant/Business Unit specific)
- AEP Generation Culture Playbook

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PUBLIC VERSION



PRE-WORK HAZARD ASSESSMENT

Pre-Work Hazard Assessment (PWA)

Work Description:	Installation of Solar Facility
Work Location:	South Bend, Indiana; Harris Township (Latitude: 41°43'30.975"N Longitude: 86°6'34.929"W)
<p>The scope of this Work may involve certain hazards requiring Contractor to implement controls to eliminate or mitigate personnel exposures. The hazards and hazard-producing activities checked below are anticipated as best as can reasonably be determined by Owner to be those with the potential to pose risks to safety and health during the Work. This list has been developed by Owner for its and Contractor's initial planning purposes only. No claim or representation is expressed or implied that it is comprehensive, all-inclusive, accurate, or complete, or that items not listed will not be present or pose no threat to personnel safety or health. If selected below, ensure that the contractor and contractor oversight reads and understands the applicable AEP Policies and Procedures.</p>	

* May require site permit		** Reference AEP Contractor Safety Site	
Work Activities			
<input type="checkbox"/> *Numerous, deep, or complex excavation or trenching* <input type="checkbox"/> *Drilling, auguring, boring, or other soil disturbances in areas with congested buried utilities* <input type="checkbox"/> Working over water <input type="checkbox"/> Operating equipment under or near overhead power lines <input type="checkbox"/> Crane use Tons Reach Lift ** <i>C-OI - Rigging and Hoisting</i> <input type="checkbox"/> Multiple cranes operating simultaneously - ** <i>C-OI - Rigging and Hoisting</i> <input type="checkbox"/> *Exposed energized electrical lines or equipment ** <i>C-OI-Electric Lines and Equipment Clearance</i> <input checked="" type="checkbox"/> Working at heights - ** Fall Protection Requirement FAQ <input type="checkbox"/> Scaffolding _____ ft <i>**Gate Req/Suspended Scaffold Rigging/15' Procedure</i> <input type="checkbox"/> Stacked work (i.e., working above & below) <input type="checkbox"/> *Permit-required confined space entry* # _____ <input type="checkbox"/> Explosive use/blasting <input type="checkbox"/> Highly flammable gases or chemicals _____	<input type="checkbox"/> Diving operations <input type="checkbox"/> Prolonged work in tight or awkward locations (ergonomics) <input checked="" type="checkbox"/> Cutting: ** <i>Knife Policy Requirements</i> <input type="checkbox"/> *Open, installing, removing grating* <input type="checkbox"/> *Demolition* <input type="checkbox"/> Helicopter operations <input checked="" type="checkbox"/> Pile driving <input type="checkbox"/> Water impoundment (dam, dike, etc.) <input checked="" type="checkbox"/> Heavy earth-moving equipment <input type="checkbox"/> *High pressure (air, water, steam, gas)* <input type="checkbox"/> *Clearance Permit* # _____ <input type="checkbox"/> *Hot work* <input type="checkbox"/> Arc Flash	<input type="checkbox"/> Special PPE Requirements <input type="checkbox"/> Other items list below <input type="checkbox"/> Verify Underground Utilities <input type="checkbox"/> LOTO / When Applicable <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

Worksite Conditions	
<input type="checkbox"/> High water table, site subject to flooding, or heavy rains <input type="checkbox"/> Contaminated soil or water <input type="checkbox"/> Congested work site <input type="checkbox"/> Adjacent activities: <input type="checkbox"/> Combustible dust <input checked="" type="checkbox"/> High winds <input checked="" type="checkbox"/> Ice/snow/freezing temperatures <input type="checkbox"/> Rugged, uneven, treacherous terrain or site conditions <input checked="" type="checkbox"/> Animals/insects	<input type="checkbox"/> Abandoned-in-place utilities or equipment <input type="checkbox"/> Low lighting <input type="checkbox"/> Vehicular traffic <input type="checkbox"/> Working around Moving/Operating/Energized Equipment <input type="checkbox"/> Other items list below <input checked="" type="checkbox"/> Mobile equipment / Job site vehicles <input type="checkbox"/> The site is a greenfield site. There is a narrow strip that bisects the property that is within the 100 year floodplain/ floodway <input type="checkbox"/> There is currently a pivot style irrigation system on site that may have water well at the center.

Human Performance	
<input type="checkbox"/> First time evolution New/ Inexperienced Workforce Plan <input type="checkbox"/> Schedule ** "13 Day Rule" S&H T&C Section 3.8 <input type="checkbox"/> Non-English Speaking Employees Bilingual Action Plan <input type="checkbox"/> Confusion/Mix-up potential (labeling, look-alike equipment, etc) <input checked="" type="checkbox"/> Distractive environment	<input checked="" type="checkbox"/> Error Traps Overconfident / Complacency <input type="checkbox"/> Other items list below <input type="checkbox"/> <input type="checkbox"/>

Environmental/IH	
<input type="checkbox"/> Arsenic** <input type="checkbox"/> Asbestos <input type="checkbox"/> Chemical <input type="checkbox"/> Cadmium** <input type="checkbox"/> ** Negative Exposure Assessment/Weld fume Specifics <input type="checkbox"/> Heat stress <input type="checkbox"/> Hazardous Waste <input checked="" type="checkbox"/> Herbicide/pesticide <input type="checkbox"/> Hexavalent Chromium** <input type="checkbox"/> Anhydrous Ammonia** <input type="checkbox"/> Noise Current/existing _____ db <input type="checkbox"/> Noise created during work _____ db	<input type="checkbox"/> IDLH atmosphere <input type="checkbox"/> Legionella/biological – circulating water <input type="checkbox"/> PCB <input type="checkbox"/> Lead** <input checked="" type="checkbox"/> Plants/Weeds <input type="checkbox"/> Mercury <input type="checkbox"/> Radiation (ionizing & non ionizing) <input type="checkbox"/> Silica <input type="checkbox"/> Welding Fume** (Welding, Cutting, Brazing Policy Section) <input type="checkbox"/> Other items list below <input type="checkbox"/> <input checked="" type="checkbox"/> greenfield site that is currently being farmed



PUBLIC VERSION

Owner will use the Generation Guideline Implementation of Generation Contractor Supplemental Safety and Health Requirements to determine whether work requires the preparation of a HASP. If a HASP is determined to not be needed (per Decision Flow Chart), the selected contractor will be required to prepare a comprehensive Job Hazard Analysis (JHA) prior to starting work, in accordance with the Safety and Health Requirements. Owner, at its discretion, may waive the HASP requirement if all of the following conditions are met:

1. Low or Limited exposure to the following
 - a. Hazardous energy (such as electrical, pneumatic, hydraulic, etc)
 - b. Crane use or any rigging or hoisting
 - c. Excavation
 - d. Working at heights greater than 6' without primary fall protection (i.e., handrail)
 - e. Asbestos
 - f. Confined Space Entry
 - g. Lead or Heavy Metals, including fumes
 - h. Potential for high severity consequences
2. Contractor safety and health manual which adequately covers the scope of Work.
3. Contractor prepares a quality JHA for the Work.
4. Contractor demonstrates effective hazard control.
5. Contractor has an effective safety and health training program for its employees.

In accordance with the PWSHA and the above guidelines, the contractor who will be selected to perform this work:

- ☒ is required to prepare a Health and Safety Plan (HASP) and follow the Safety and Health Requirements in their entirety.
☐ may prepare a comprehensive Job Hazard Analysis (JHA) in lieu of a HASP and paragraph 2.11 applies.
☐ is exempt with management approval (see below)

The HASP and/or JHA(s) shall be submitted to Owner for review and discussion before Contractor may start work.

AEP Rep. Signature: Virgil A. Vanover II Date: 11/02/2018

----- ONLY REQUIRED IF EXEMPT -----

Name: _____

Signature: _____

Exemption Expiration Date: _____

Note: Any contractor waived from the Safety and Health Requirements Rev 9 shall be done so in writing by the Facility Manager or Department manager (i.e. Plant manager, EP&FS section or department manager) or designee.

PUBLIC VERSION

Services that could be considered for exemption may include;

ID	TYPE OF CONTRACTOR SERVICE
1	AERIAL SURVEYING
2	ASH SALES AGREEMENTS - Customer/Company has personnel reporting to a plant on a daily basis to perform service contract duties associated with buying/selling Combustion Coal Products.
3	ASH SALES AGREEMENTS - Customer/Company activities associated with Contractors entering plant on a short-term, daily basis for work that could include the plant loading of customer/company trucks.
4	ASH PICKUP BY LOCALS FOR BACKFILL OR BY COUNTY / CITY / STATE FOR USE ON ROADWAYS
5	COPIER, OFFICE OR JANITORIAL SERVICE IN OFFICE OR SERVICE BUILDING
6	ENGINEERING / DESIGN SERVICES
7	ENVIRONMENTAL/GENERAL CONSULTING, MONITORING, AND/OR INSPECTING SERVICES INCLUDING SURVEYING - Except for those activities that may disturb the earth through drilling, shoveling, and/or motorized vehicle traffic.
8	DELIVERY, INSPECTION AND REPAIR OF RENTAL EQUIPMENT
9	MATERIAL DELIVERY OR WASTE HAULING
10	LAWN OR LANDSCAPING SERVICE
11	ON SITE NURSING OR SECURITY SERVICES
12	ROAD MAINTENANCE INCLUDING SNOW REMOVAL EXTERIOR OF PLANT MAIN GATE AND PAVING
13	NO COST SERVICE AGREEMENTS TO ALLOW A VENDOR TO COME ONTO OUR SITES FOR A SITE VISIT, PRE-BID MEETING, ETC.
14	TRAINING PROVIDERS (ONSITE OR OFFSITE)

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**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 4
CONTRACTOR ENVIRONMENTAL REQUIREMENTS DOCUMENT
REVISION 2 DATED 10/20/2016**

**ENVIRONMENTAL WORK COMPLIANCE ASSESSMENT
DATED 11/02/2018**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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**CONTRACTOR ENVIRONMENTAL REQUIREMENTS DOCUMENT
REVISION 2 DATED 10/20/2016**

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	Contractor Environmental Requirements Document	PUBLIC VERSION Rev. # 2 Date: 10-20-2016	Page 1 of 21
<i>Christian Beam, VP</i> <i>Projects, Controls, & Construction</i> <i>(PC&C)</i> <hr/> Document Holder		<i>PC&C, F&H Plants, FEL, Generation Procurement,</i> <i>ES&H Management Systems, & Environmental</i> <i>Services</i> <hr/> Sponsoring Organizations	

TABLE OF CONTENTS

SECTION	HEADING	PAGE NO.
1.0	INTRODUCTION	2
2.0	ENVIRONMENTAL PLANNING	3
2.1	ENVIRONMENTAL WORK COMPLIANCE ASSESSMENT (EWCA)	3
2.2	OWNER'S ENVIRONMENTAL MANAGEMENT PLANS OR INSTRUCTIONS	4
2.3	ENVIRONMENTAL AUDITS AND INSPECTIONS	4
3.0	ADMINISTRATIVE	4
3.1	RECORD AVAILABILITY	4
3.2	COMMUNICATION	4
4.0	EMERGENCY PREPAREDNESS AND RESPONSE	4
4.1	DISCHARGES, SPILLS OR RELEASES	4
4.2	NOTIFICATION REQUIREMENTS	5
4.3	EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT REPORTING	5
5.0	ADDITIONAL ENVIRONMENTAL REQUIREMENTS	6
5.1	ENVIRONMENTAL TRAINING AND QUALIFICATION REQUIREMENTS	6
5.2	CHEMICAL MANAGEMENT PLANS	7
5.3	SPILL PREVENTION, CONTROL AND COUNTERMEASURES	8
5.4	STORM WATER POLLUTION PREVENTION	9
5.5	FUGITIVE DUST CONTROL AND AIR EMISSIONS	10
5.6	TEMPORARY SEWAGE PERMITTING AND OTHER REQUIREMENTS	11
5.7	WASTE MANAGEMENT	11
5.8	ENVIRONMENTALLY-SENSITIVE AREAS	12
5.9	SPECIES PROTECTION	13
5.10	PROTECTION OF ARCHEOLOGICAL AND CULTURAL RESOURCES	13
6.0	DEFINITIONS	13
7.0	REVIEW AND MINOR REVISION HISTORY	15
Attachment A: Environmental Work Compliance Assessment		16
Attachment B: Contractor Environmental Evaluation		19
Attachment C: Environmental Event Report		21

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

1.0 INTRODUCTION

- 1.1 Owner's philosophy is that no aspect of its operations is more important than the health and safety of people and that its customers' needs will be met in harmony with the environment. Owner is committed to social responsibility and sustainability. Owner is proactive in its efforts to protect people and the environment by committing to:
 - 1.1.1 Utilizing Contractors that maintain compliance with all applicable environmental requirements;
 - 1.1.2 Ensuring that Contractors performing Work for Owner understand and integrate environmental responsibilities into their business practices;
 - 1.1.3 Utilizing Contractors that support continuous process improvement of their environmental performance; and
 - 1.1.4 Utilizing Contractors that eliminate hazards through continual process improvement.
- 1.2 The **purpose** of this document is to convey Owner's minimum expectations to all Contractors on how to meet its philosophy and policy outlined in 1.1 above. This document is applicable to all of Owner's Fossil and Hydro Generation facilities; its Projects, Controls, and Construction work-sites; its Fuel, Emission, and Logistics - Operations and Mining facilities and work-sites, and Generation Procurement. Otherwise stated, Contractor shall exercise prudent planning and diligence regarding the environmental aspects of all Work to be performed.
- 1.3 Owner's environmental requirements are to be used in conjunction with the applicable General Terms and Conditions for Work performed at Owner's work-sites. These environmental requirements convey Owner's minimum requirements regarding environmental practices. These environmental requirements are in addition to any of Contractor's and its subcontractors own policies, procedures, guidance, instructions or other requirements. Contractor and its subcontractors shall comply with all project, outage, and/or facility environmental rules and all procedures issued by Owner; provided that such rules and procedures do not conflict with any other Federal, State, and/or Local agency's environmental laws, rules or regulations. However, if such a conflict does arise, precedence shall be given to the most stringent environmental laws, rules, regulations or procedures that apply.
- 1.4 Contractor understands that any environmental requirements as may be provided by Owner are not intended to (and do not) provide legal or other professional advice. Owner makes no representations or warranties that the information contained herein satisfies Federal, State, and/or Local laws or regulations. Contractor agrees that it shall consult with its own legal counsel or other qualified persons with respect to satisfying the requirements of any such laws as may be applicable to its Work. Contractor acknowledges and agrees that: (i) it is not relying on any claim or representation of Owner relative to any environmental requirement, (ii) Owner expressly disclaims any claim or representation that the information contained in any environmental requirement will produce any particular result, and (iii) Owner shall not be responsible for any errors or omissions in the design, implementation, and/or enforcement of any environmental requirements. Contractor remains completely responsible for its compliance with the requirements of Federal, State, and/or Local environmental laws.
- 1.5 Contractor shall designate an environmentally Competent Person(s) who represents Contractor and who shall have full and complete authority to act on behalf of Contractor to manage, assess, coordinate, and enforce its environmental compliance during performance of Work. Contractor shall provide Owner with the resumes of the proposed environmentally Competent Person(s). While the Owner may not designate an individual or individuals to perform this role, qualifications for these individuals shall include the proper training listed in section 5.1.1 and satisfactory work experience as determined by Owner. Contractor's environmentally Competent Person(s) shall be on-site or off-site, full-time or part-time at the discretion of the Owner, as indicated on the Environmental Work Compliance Assessment (EWCA) or Owner's localized, equivalent form. Environmentally Competent Person(s) shall notify Owner of any environmental issues to be remedied. Contractor's Workers are to immediately notify the environmentally Competent Person(s) of any environmental issues they observe.

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

- 1.6 If Owner believes that a non-compliant environmental condition exists at the work-site which is a failure to comply with this Contractor Environmental Requirements Document and/or a legal demand of a Federal, State, and/or Local law or regulation, Owner shall have the right to immediately order corrective measures or stop Work until the non-compliant condition is corrected. To the extent Contractor has caused the non-compliant condition and there are subsequent delays or impacts to the Work, Contractor will be responsible for any costs it incurs to bring the Work into compliance and costs associated with Work stoppage. This provision does not relieve Contractor of its responsibility for environmentally-compliant work practices nor imposes upon Owner any obligation to supervise Contractor's work.
- 1.7 Contractor's failure to comply with and enforce these environmental requirements and all Federal, State, and/or Local agency laws, rules, and/or regulations applicable to the Work may be cause for the Contract to be terminated and may prevent eligibility for future work.
- 1.8 Contractor shall remove from Owner's work-sites any worker(s) who repeatedly fail(s) to comply with this Contractor Environmental Requirements Document.

2.0 ENVIRONMENTAL PLANNING

2.1 Environmental Work Compliance Assessment (EWCA)

- 2.1.1 Prior to Contractor beginning Work, Owner will provide Contractor with an initial EWCA using the form located in Attachment A (or equivalent). The EWCA is an informational document for initial and subsequent environmental planning and communication purposes. No claim or representation is expressed or implied that the information provided is comprehensive, all-inclusive, accurate, complete or that items not listed will not be present or pose a threat to environmental compliance.
- 2.1.2 Contractor shall meet with Owner prior to commencing Work to inform Owner as to how it intends to implement the requirements listed in the supplied EWCA throughout the course of the Work. Contractor may invite its subcontractors to attend these meetings and in some cases may be required to do so by Owner. An EWCA may be required for subcontractors in addition to the Contractor's EWCA, as determined by the Owner.
- 2.1.3 With prior Owner approval, Contractor environmental plans, procedures or guidelines in response to the EWCA may be included in the Health and Safety Plan (HASP) as required by Owner's S&H Requirements Document. However, for larger or environmentally complicated projects, all such information should be provided as a separate document to Owner.
- 2.1.4 The EWCA does not relieve Contractor of its obligation to conduct continuous environmental assessments of the Work. If Contractor determines during the performance of its Work that there are negative environmental impacts, concerns, questions, etc. not listed on the original EWCA, Contractor shall immediately inform Owner and the EWCA will be updated jointly by Owner and Contractor. Owner shall then be informed by Contractor of how it will manage such Work related activities which could result in a negative environmental impact.
- 2.1.5 After Owner evaluates the Contractor's scope-of-work, Owner may waive any portion or all of the Additional Environmental Requirements listed in Section 5 of the CERD. Should this take place, the Section(s) waived will be documented on the EWCA or an Exemption Form will be filled out.
- 2.1.6 Contractor's environmentally Competent Person(s) shall communicate all initial and subsequent environmental aspects addressed in the EWCA to its employees, provide environmental training as required, and will oversee the implementation and management of each environmental aspect of the Work.

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

2.2 Owner's Environmental Management Plans or Instructions

- 2.2.1 Contractor shall comply with Owner's Environmental Management Plan(s) or Instructions, as provided. Contractor may also be required to participate in Owner's Environmental Management planning activities.

2.3 Environmental Audits and Inspections

- 2.3.1 Random and scheduled environmental audits or inspections may be conducted by Owner or Federal, State, and/or Local agency representatives. Contractor shall cooperate fully with all inspector/auditor representatives during an environmental audit or inspection. Contractor shall have available upon request, all applicable environmental records required as part of the Work, work-site permits or applicable environmental laws or regulations. Owner may conduct audit evaluations during the course of the Work at its facilities or work-sites. An example of a typical audit form that may be used is located in Attachment B.
- 2.3.2 For additional requirements on handling Regulatory Inquiries, refer to Owner's document on Contractor Safety & Health Requirements.

3.0 ADMINISTRATIVE

3.1 Record Availability

- 3.1.1 Prior to the start of Work, Contractor and Owner shall agree upon the appropriate means of maintaining on-site environmental records and documentation applicable to the Work. Contractor shall provide a copy of all applicable records and documentation (e.g. permits, training records, etc.) to Owner upon its request and at the completion of the Work.

3.2 Communication

- 3.2.1 Unless directed otherwise, Owner will be the single point of contact for all regulatory agency interaction for environmental communication (written or verbal) that is applicable to the Work. For **emergency communication** requirements, see section 4.1. For **non-emergency communication** requirements, see section 4.2.
- 3.2.2 Contractor shall ensure that its personnel clearly understand oral and written instructions, signs, and labels associated with the Work. This includes, but is not limited to ensuring they understand the scope of the Work they are to perform, Owner's Environmental Management Plans or Instructions (see section 2.2), Contractor's Environmental Plans, all other Owner and/or Contractor specific training, site specific environmental permits/plans, and/or Hazard Communication manuals, as they pertain to the Work.

4.0 EMERGENCY PREPAREDNESS AND RESPONSE
--

4.1 Discharges, Spills or Releases

- 4.1.1 Prior to commencing Work, Contractor shall review with Owner its work-site specific environmental emergency response plans involving potential discharges, spills or releases from substances, chemicals, materials or products that may be brought on-site. Owner and Contractor shall jointly agree who will be responsible for making immediate notifications to governmental entities of oil spills to water and releases of reportable quantities of hazardous substances to the environment. Additionally, Owner and Contractor shall jointly agree who will be responsible and to what extent for responding to an emergency situation based on personnel qualifications, availability, experience, etc. and the type of substances, chemicals, materials or products involved.
- 4.1.2 Owner's Environmental Coordinator, environmentally Competent Person or designee is responsible for assisting Contractor in carrying out its emergency environmental duties at the work-site and other associated issues with the Work. This person will verify the Contractor's

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

proper clean-up of all discharges, spills or releases that occurred during an Emergency Environmental Situation.

- 4.1.3 In the event of a discharge, spill or release that results in an Emergency Environmental Situation, Contractor shall identify the material and immediately notify Owner. The emergency responder, identified in 5.1.1, shall attempt to stop or contain the source from spreading, reaching a drain, and/or waterway; as long as conditions are safe and the persons are properly trained or qualified to do so in accordance with all applicable Federal, State, and/or Local laws and regulations.
 - 4.1.3.1 When possible, Owner will assist Contractor in conducting all required response actions and may perform the duties of the On Scene Incident Commander, if qualified to do so or until relieved by a qualified responding governmental agency or authorized response Contractor.
 - 4.1.4 Immediate agency notifications are required when certain thresholds are met for reportable discharges, spills or releases to the environment. 'Immediately' has been interpreted by AEP, based upon the monetary penalties outlined in EPA's 'Enforcement Response Policy', to be within 15 minutes of discovery of the discharge, spill or release. If the Owner's representative cannot be reached within the timeframe allowed by the EWCA and the Contractor has been designated to make any Federal, State, and/or Local agency notifications; the Contractor's eCP will conduct this task.
 - 4.1.4.1 If the Contractor has been authorized to conduct such official notifications, Owner will train the Contractor's eCP to conduct this important responsibility.
 - 4.1.4.2 If possible, Owner's immediate representative on-site shall have the opportunity to review and approve such notifications or to even conduct it on behalf of the Contractor. This requirement shall in no way impede or restrict the ability of the Contractor to provide such official notification within the required regulatory timeframe.
 - 4.1.4.3 For any Contractor-initiated agency notifications, Contractor shall provide Owner with all incident and reporting information immediately after this notification takes place or when the incident is under control.
 - 4.1.5 Contractor shall document all such Emergency Environmental Situations using the Environmental Event Report (EER) form located in Attachment C and shall submit the completed report to Owner the following work day. Equivalent spill reporting forms may be used. All spills of any quantity will be documented.
 - 4.1.6 Contractor may be required to participate in Owner's investigation into the facts and circumstances of an Owner or Contractor initiated agency notification that resulted from an environmental incident, spill, release, discharge, and/or event.
- 4.2 Notification Requirements for Non-Emergency Environmental Situations**
- 4.2.1 Contractor shall notify Owner as soon as possible of all non-emergency environmental situations. These can include, but are not limited to minor oil/chemical spills (as defined by Owner at each work-site), wastewater or process water discharges, sewage seepage, complaints from the general public/Owner's neighbors or events that do not trigger the immediate notification to a regulatory agency.
 - 4.2.2 Contractor shall document non-emergency events using the EER form located in Attachment C and shall submit the completed report to Owner the following Work day after notifying Owner as required in 4.2.1. Equivalent spill reporting forms may be used. All spills of any quantity will be documented.
- 4.3 Emergency Planning and Community Right-to-know Act Reporting**
- 4.3.1 Before storing fuel (diesel fuel or gasoline), black beauty (media blasting), sulfuric acid (batteries), ammonia and other EPCRA (Emergency Planning and Community Right-to-know Act) reportable chemicals on the Work site the Contractor shall provide a detailed list for evaluation to the Owner for inclusion with the Facilities EPCRA Section 311 (Safety Data Sheet Reporting) and Section 312 (Annual Chemical Inventory) report to the State Emergency

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

Response Commission (SERC), Local Emergency Planning Committee (LEPC), and Local fire department with jurisdiction over the Facility.

- 4.3.2 If the Contractor elects to store EPCRA reportable chemicals at the Work site the Contractor shall inform the Owner of the maximum amount that will be stored, as well as the type of storage container(s) that will be used, and where the storage container(s) will be located and maintained. If Contractor elects to store EPCRA reportable chemicals on site above the applicable threshold planning quantity (TPQ), which in most AEP states is 10,000 pounds (500 pounds in Louisiana), the Contractor shall provide all necessary information to the Owner for reporting.

5.0 ADDITIONAL ENVIRONMENTAL REQUIREMENTS
--

5.1 Environmental Training and Qualification Requirements

- 5.1.1 Environmentally Competent Person(s) shall have environmental training that is appropriate to the type of Work that the Contractor routinely performs, in addition to having the training specified in the EWCA. Training specified in the EWCA must be completed prior to mobilization or prior to start of work. Typical training that an environmentally Competent Person is expected to have may include, but is not limited to the following and shall be provided at Contractor's sole expense:
- 5.1.1.1 Training that meets the requirements of OSHA's HAZWOPER Standard (1910.120 or 1926.65) for First Responder - Awareness. The environmentally Competent Person(s) must be able to demonstrate to Owner that they meet these minimum requirements. The requirement to have this type of training or similar will be identified on the EWCA.
 - 5.1.1.2 If the type of Work that the Contractor routinely performs involves the use of Hazardous Materials or Wastes, they are expected to demonstrate their ability to the First Responder - Operations stage for spill response according to OSHA's HAZWOPER Standard. The requirement to have this type of training will be identified on the EWCA. The Contractor's environmentally Competent Person may also be required to complete training for:
 - 5.1.1.3 Storm Water Pollution Prevention
 - 5.1.1.4 Spill Prevention, Control, and Countermeasures
 - 5.1.1.5 Fugitive Dust Emissions and Control
 - 5.1.1.6 Solid and Hazardous Waste Management
 - 5.1.1.7 Other environmental training, as identified on the EWCA (e.g. wetlands, Ozone Depleting Substances, etc.)
 - 5.1.2 Contractor's employees and workers shall be trained and/or qualified by Contractor's environmentally Competent Person(s) for the environmental portion of the Work they will be performing, as identified within the EWCA. This training should focus on the worker(s) expected duties, especially those that could create environmental risk, and/or potentially create an environmental discharge, spill or release for which an emergency response may be necessary. Training must be completed as soon as possible but no later than 14 days of the worker(s) starting at the project site. Personnel working in, around or near environmentally sensitive areas shall have all training identified on the EWCA completed prior to starting work. General environmental training typically includes, but is not necessarily limited to the following training opportunities listed below depending on their specific work assignments.
 - 5.1.2.1 HAZWOPER First Responder - Awareness training may be required per the EWCA and will be provided by the Contractor's environmentally Competent Person(s) or its third party training provider. This training will meet the requirements of OSHA's HAZWOPER Standard (1910.120 or 1926.65). This training will be performed annually, but could be more often if required by Owner. This training is often site-specific so additional training

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

may be necessary for workers reassigned to other Work. The requirement to have this type of training will be identified on the EWCA. Contractor shall maintain all training records as stated in section 3.1.

- 5.1.2.2 If the type of work that Contractor's employees and craft routinely performs involves the use of Hazardous Materials or Wastes, then they are expected to demonstrate their ability to the First Responder - Operations stage for spill response according to OSHA's HAZWOPER Standard (1910.120 or 1926.65). The requirement to have this type of training will be identified on the EWCA. Additional training the Contractor's employees may be required to have includes the following:
 - 5.1.2.3 Storm Water Pollution Prevention Awareness
 - 5.1.2.4 Spill Prevention, Control, and Countermeasures Awareness
 - 5.1.2.5 Fugitive Dust Emissions and Control Awareness
 - 5.1.2.6 Solid and Hazardous Waste Management Awareness
 - 5.1.2.7 Other environmental training, as identified on the EWCA (e.g. wetlands, Ozone Depleting Substances, etc.)
- 5.1.3 Contractor is responsible for the cost of all HAZWOPER First Responder - Awareness training for its direct employees and workers, including contingent staff (i.e. those who typically travel from job to job for the Contractor).
- 5.1.4 Owner will reimburse Contractor the cost of all HAZWOPER First Responder - Awareness training for all non-direct (e.g. temporary union craft or non-union craft) workers. This HAZWOPER training should take up to, but not more than 2 hours to perform and this training is subject to review and acceptance by Owner.
- 5.1.5 Owner will reimburse Contractor for the cost of its worker(s) attending Owner-required training, as specified below. Contractor shall submit timesheets for Owner's review and approval for all such training.
 - 5.1.5.1 Owner's Environmental Management Plan(s) or procedures training, if applicable;
 - 5.1.5.2 Site-specific environmental orientation (e.g. waste storage practices, environmental emergency actions, Used Oil procedures, Avian Protection Program, etc.). Site-specific environmental orientation may take up to 1.5 hours in aggregate;
 - 5.1.5.3 A periodic refresher may be required (e.g. Storm Water Awareness, Universal Waste Awareness), per Owner or regulatory direction; and
 - 5.1.5.4 Additional training may be required, as determined by Owner, based on site specific issues (e.g. Process Water Spill Awareness, Wetlands Protection, etc.).
- 5.1.6 If on-going work observations indicate additional environmental hazards or if the scope of work changes, Owner may require Contractor to augment the training required in 5.1.1, 5.1.2, and 5.1.4.
- 5.1.7 If Contractor fails to comply with Owner's environmental requirements and/or fails to achieve environmental compliance as it relates to the Work, Owner may require that the environmentally Competent Person(s) and/or its employees be replaced or receive additional training at no additional expense to Owner.

5.2 Chemical Management Plans

- 5.2.1 This section applies to hazardous substances, chemicals, materials or products that Contractor may bring on Owner's work-sites (e.g. Two-Part Epoxy Resins, Gasoline, Ammonia, Polymers, etc.). These are substances or materials deemed hazardous by Federal, State, and/or Local regulations, where exposure may result in adverse effects on the health or safety of employees and/or contamination of the environment.
- 5.2.2 Prior to mobilization and if identified on the EWCA, Contractor shall prepare a Chemical Management Plan for all hazardous substances, chemicals, materials or products that will be

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

stored on-site in cumulative quantities equal to or greater than 55 gallons. Areas to address in the Chemical Management Plan include, but are not limited to:

- 5.2.2.1 Identifying all applicable hazardous substances, chemicals, materials or products and how they will be used;
- 5.2.2.2 Description of how all applicable hazardous substances, chemicals, materials or products (e.g. flammables, combustibles, caustics, etc.) will ultimately be containerized and stored (i.e. fire-rated storage unit);
- 5.2.2.3 Description of spill response resources that Contractor will have available (e.g. spill kits/materials, equipment, manpower, and Personal Protective Equipment) and how potential spills will be managed;
- 5.2.2.4 The frequency of Contractor's inspections of all applicable hazardous substances, chemicals, materials or products, a copy of the inspection form to be used, and who will perform these inspections;
- 5.2.2.5 Identification of Contractor's primary and alternate Chemical Management Plan points of contact; and
- 5.2.2.6 Any oil products to be used and stored on-site that are not covered under an applicable Spill Prevention Control and Countermeasures (SPCC) Plan shall be covered under the Contractor's Chemical Management Plan. This part of the plan shall include the location of all such oil product containers with an individual capacity equal to or greater than 55 gallons.
- 5.2.3 All chemical storage containers to include "Conex" boxes shall be marked on their exterior with appropriate labeling made of Ultra-Violet resistant material which will include Contractor identification, contact information, and chemical hazards.
- 5.2.4 Contractor may be required to submit an updated Chemical Management Plan if Owner requires revisions to the original based upon scope of work changes, etc. that require additional substances, chemicals, materials or products be brought on-site.
- 5.2.5 Contractors performing Work in Michigan or Louisiana may be required to follow Michigan's Rule 5 Pollution Incident Prevention Plan requirements or Louisiana's Spill Prevention and Control Plan requirements for chemicals at Owner's work-site(s).
- 5.2.6 Prior to Contractor demobilizing, any remaining substances, chemicals, materials or products (not yet determined to be a waste by Owner) must be removed by Contractor, including partially used containers. No substances, chemicals, materials or products shall be left on Owner's work-site without written authorization. Any substances, chemicals, materials or products found to be left on-site will be returned to Contractor and Contractor billed for shipping and handling.
 - 5.2.6.1 For any substances, chemicals, materials or products left behind without prior approval by Owner and are determined to be a waste incapable of being returned to Contractor because of Federal, State, and/or Local regulation or law; Owner will either properly dispose of this waste and Contractor will be billed for this service or else notify Contractor to come back and properly dispose of the waste itself. Owner will decide which option is in the best interest of the corporation.
- 5.2.7 For additional requirements on Hazard Communication and Hazardous Materials Management, refer to Owner's document on Contractor Safety & Health Requirements.

5.3 Spill Prevention, Control and Countermeasures

- 5.3.1 Owner will instruct Contractor on the need to develop and/or maintain a Spill Prevention, Control, and Countermeasures (SPCC) Plan or follow Owner's Plan, via the EWCA document. If required, the Contractor's plan must be reviewed and approved by Owner prior to oil/fuel being brought on-site. If Contractor is required to have and maintain a SPCC Plan, it must meet the requirements of the U.S. EPA (40 CFR 112). This is required if Contractor anticipates having greater than 1,320 cumulative gallons of oil/fuel storage capacity on-site

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

- counting all containers equal to or greater than 55 gallons, regardless of the potential to discharge to nearby navigable waters and adjoining shorelines.
- 5.3.2 Contractors performing Work in Virginia, West Virginia or Louisiana may be required to follow Virginia's Chapter 91 and 9 Virginia Administrative Code 25-91-10, Section 22-30 of the Code of West Virginia, or Louisiana's Spill Prevention and Control Plan requirements for Above-ground Storage Tanks at Owner's work-site(s).
- 5.3.3 Contractor shall document and perform, at a minimum, monthly visual inspections of all applicable oil/fuel containing equipment, containers, and storage areas as specified within their approved SPCC Plan. These inspections shall occur no sooner than 14 days and no later than 30 days from the date of the last inspection. Owner's site-specific policies and/or State/Local regulations may require more frequent inspections. Documented inspection reports shall be available for Owner review upon request.
- 5.3.4 Contractor shall provide all bulk storage containers of oil/fuel equal to or greater than 55 gallons capacity with secondary containment for the entire contents of the largest single container and sufficient freeboard for precipitation. Contractor shall remove accumulated rainwater to allow their secondary containment to function as designed. Contractor shall inspect all of its secondary containments for the presence of oil/fuel and/or sheens, and remove all oil/fuel and/or sheens prior to discharge and manage the removed materials in compliance with all applicable regulations, statutes, and Owner's requirements. Owner shall be notified if the presence of oil/fuel and/or sheens is observed.
- 5.3.5 Oil-filled equipment which has not been initially placed into service (i.e. not connected to Owner's facilities) fall under section 5.3.1 until it becomes actively connected (i.e. placed into service and connected for its designed purpose), unless otherwise directed by Owner. An example of this would be an oil-filled transformer that has not yet been energized or an oil-filled gearbox still sitting in the lay down yard.
- 5.3.6 Unless prior written permission is given by Owner, Contractor shall not perform any repairs, modifications, and/or maintenance activities on any bulk fuel tanks on-site if such activities relate to corrosion, damage, interior inspections, and/or pressure testing for integrity.
- 5.3.7 The filling of all bulk storage containers and all equipment refueling by Contractors shall be attended to at all times by an environmentally Competent Person and/or trained worker(s), to minimize the potential for spillage. All fuel storage containers shall be marked accordingly with appropriate labeling made of Ultra-Violet resistant material which will include Contractor identification, contact information, and chemical hazards. Contractor shall maintain adequate spill supplies onsite to respond to the largest potential spill.

5.4 Storm Water Pollution Prevention

- 5.4.1 Work performed on Owner's property may require a Storm Water Pollution Prevention Plan (SWPPP). Contractor may be required to develop and maintain a SWPPP, comply with, and/or obtain a storm water permit as indicated on the EWCA. If required to obtain a storm water permit, develop, and/or comply with a SWPPP; Contractor will coordinate all such activities within the required time frame before earthwork or other regulated activities commence.
- 5.4.2 If Owner develops a SWPPP, Contractor shall comply with Owner's plan. In addition, Contractor may be required to maintain the SWPPP as indicated on the EWCA.
- 5.4.3 Storm water and/or erosion and sediment control inspections are to be performed as specified within the SWPPP. These inspections may be initiated and be the responsibility of the Owner or Contractor, as defined in the scope of work documents.
- 5.4.3.1 The designated and/or chosen inspection frequency as allowed per the SWPPP shall be maintained by the responsible party and not deviated from.
- 5.4.3.2 If the Contractor does not have workers on site during or after a qualifying rain event per the approved SWPPP, then the Owner may elect to have the Contractor provide such

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

coverage in order to perform SWPPP inspection and/or maintenance work. Owner will pay Contractor for these additional inspections as they occur.

- 5.4.4 If any storm water and/or erosion & sediment control repairs and modifications are required, they shall be made in accordance with the SWPPP.
- 5.4.5 Storm water Best Management Practices (BMP) are physical, structural or managerial practices employed before, during, and/or after the Work that have been proven and accepted to help reduce or prevent pollution. BMP(s) may need to be implemented wherever possible to minimize potential environmental impacts to Owner's operations. BMP(s) can vary between sites and may be at the Owner's discretion.
 - 5.4.5.1 Owner will reimburse Contractor for the cost of any required storm water BMP(s) to be implemented resulting from a Federal, State, and/or Local agency inspection or as directed by Owner's Environmental Coordinator for the Work to be performed under an Owner-supplied Industrial or Construction SWPPP.
 - 5.4.5.2 Contractor shall be responsible for the cost of any required storm water BMP(s) to be implemented resulting from a Federal, State, and/or Local agency inspection or as directed by Owner's Environmental Coordinator for Work to be performed under a Contractor-supplied Construction SWPPP.
 - 5.4.5.3 Contractor shall be responsible for the cost of any required storm water BMP(s) to be implemented resulting from a Federal, State, and/or Local agency inspection or as directed by Owner's Environmental Coordinator when no SWPPP has been required for Work at Owner's work-site.

5.5 Fugitive Dust Control and Air Emissions

- 5.5.1 Owner and Contractor have a general obligation to minimize or eliminate fugitive dust/emissions in accordance with Federal, State, and/or Local air permits (e.g. Title V) or nuisance law requirements. At some of Owner's work-sites, Contractor may be required to comply with similar Mining Safety & Health Administration fugitive dust requirements as indicated on the EWCA.
- 5.5.2 Fugitive dust control shall be in accordance with the EWCA. All measures Contractor intends to use in the performance of its Work shall be approved by Owner prior to use, including the application of water. Contractor shall only apply enough water to control dust and to not generate uncontrolled run-off or discharge.
- 5.5.3 Fugitive dust is to be controlled throughout the performance of Work. Contractor shall be responsible for supplying and implementing all control measures for the fugitive dust it creates during the performance of its Work, unless otherwise indicated by Owner on the EWCA. Owner will notify Contractor if it will have additional dust control responsibilities for Work other than its own.
- 5.5.4 Contractor shall only use designated construction entrance/exits when performing Work at Owner's work-sites. In addition, when designated on the EWCA, Contractor shall be responsible for limiting the track-out of sediment on Owner or public roadways to reduce or eliminate fugitive dust.
- 5.5.5 Equipment such as, but not limited to batch plants, rock crushers, screeners, limestone/gypsum handling equipment, and in particular situations, large stockpiles of material; can require special air permits prior to their mobilization, setup, and/or usage. All intentions to use such equipment and/or any other large sources of fugitive emissions must be reviewed and pre-approved by Owner before mobilizing such equipment on-site. Contractor shall obtain and pay for all necessary permits prior to the on-site mobilization and operation of this equipment and shall follow all permit and/or exemption requirements to maintain environmental compliance.
- 5.5.6 Contractors shall provide Owner the liquid capacity of all bulk storage fuel containers in use or planned for use by Contractor. On a monthly basis, Contractor shall provide Owner the fuel quantities consumed that have been removed from these containers. Contractor shall ensure all

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

fuel storage containers are closed and sealed when not actively conducting filling operations per the requirements of 40 CFR Part 63 and other applicable regulations and statutes. Contractor shall also comply with all submerged filling (i.e. nozzle actually in liquid, fill tube at bottom of tank, etc.) requirements applicable to their temporary, bulk fuel containers per applicable state laws and regulations.

- 5.5.7 Prior to commencing any demolition activities of the Owner's permanent structures, Contractor and Owner shall jointly agree who will submit and pay for all inspections and notifications required by Federal, State, and/or Local agencies.
- 5.5.8 Contractor is not permitted to conduct any open burning activities until receiving written permission from Owner and any permits required by Federal, State, and/or Local agencies. Contractor and Owner shall jointly agree who will submit any required notifications or applications to Federal, State, and/or Local agencies, as well as pay for the permit.
- 5.5.9 Contractors performing Work in Michigan may be required to follow Michigan's Administrative Rules (336.1201) for air pollution control by tracking and reporting information on certain mobile equipment that produce air emissions.

5.6 Temporary Sewage Permitting and Other Requirements

- 5.6.1 Prior to beginning Work, Contractor shall review with Owner all site specific needs for temporary sewage systems such as septic tank systems, sewage holding tanks, Dropbox/Tankbox(s), portalets, office trailer restrooms, and temporary connections to Owner's Waste Water Treatment Plant (WWTP) or public sanitary sewer system. Additionally, this review will include who is planned to supply such sewage systems.
- 5.6.2 If Contractor is providing temporary sewage systems, Contractor shall provide Owner with a Sewage Waste Procedure or Guideline as part of its overall Waste Management Plan, as required below in section 5.7.2. This will be noted in the EWCA. This shall be provided upon mobilization and prior to the commencement of its use. Such a plan may include listing the Owner as part of its overall disposal process for such wastes (i.e. temporary connections to the WWTP, public sanitary sewer system, etc.), if such an agreement is reached.
- 5.6.3 If Contractor is providing temporary sewage systems, Contractor shall obtain any required temporary sewage permits as needed by the State or Local agencies prior to bringing such systems on-site. All requirements set forth in the permit shall be enforced by Contractor's environmentally Competent Person.
- 5.6.4 Whether or not a temporary sewage system permit is required for the sewage option implemented by Contractor, all associated sewage pumping and removal records shall be maintained on-site and copies shall be turned over to Owner upon completion of Contractor's Work.

5.7 Waste Management

- 5.7.1 Unless specified otherwise within the EWCA, Owner shall be considered the Generator for all waste (both hazardous and non-hazardous) produced at its work-sites and resulting from the Work. Contractor shall follow all of Owner's Waste Management Plans, procedures, and/or guidelines (e.g. Used Oil, Universal Waste, Construction & Demolition Debris, etc.). A waste includes, but is not limited to a discarded material or inherently waste-like material as defined by the EPA per 40 CFR 261.2. Wastes can be, but are not limited to hazardous or non-hazardous, solid, liquid, and/or containerized gaseous materials.
- 5.7.2 Before mobilization, Contractor shall provide Owner a copy of its plans, procedures, and/or guidelines detailing their intended waste management practices. This will include using Owner's facilities (if allowed) and any planned disposal/recycling vendors for wastes not expected to be handled by Owner. Contractor shall attempt to minimize quantities of hazardous waste generated through such practices as the segregation of materials, proper selection of raw materials and products, etc. Owner may accept or reject for revision Contractor's waste management practices at its discretion.

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

- 5.7.3 Contractor is responsible for compliance with all Federal, State, and/or Local requirements for all of its waste generation until Owner accepts it at a pre-approved transfer point. Contractor may be required by Owner to recycle certain waste streams, where practical.
- 5.7.4 If Contractor is designated by the EWCA to be the Co-Generator of any hazardous or non-hazardous waste, Contractor shall be responsible for managing all aspects of the waste compliance and disposal process. If Owner determines that the Contractor's environmentally Competent Person is not qualified to perform such duties, then Owner may require via the EWCA that a qualified waste management subcontractor be hired to perform such tasks. Owner's facility identification numbers and work-site address/name will be recorded on all tracking documentation. Additionally, all waste transporters, along with the final disposal facilities, will be reviewed and pre-approved by Owner. Documents shall indicate that the Contractor is acting as agent for Owner with respect to waste transportation and disposal.
 - 5.7.4.1 If any waste is determined to be hazardous, Contractor shall track and report to Owner the amount generated on a weekly basis.
 - 5.7.4.2 Contractor shall ensure all hazardous waste remains segregated from other forms of waste and do not become mixed, thus increasing the amount of hazardous waste to be disposed.
 - 5.7.4.3 Contractor shall review with Owner, prior to having any waste transported off-site, all draft transportation documentation (i.e. manifests, bills of lading, etc.).
 - 5.7.4.4 Contractor shall supply Owner with completed copies of all hazardous and non-hazardous waste transportation documentation at the completion of its Work.
- 5.7.5 Contractor shall supply all waste determination documentation that it initiates. Owner shall approve all waste determinations as to whether a waste is hazardous or non-hazardous in nature (i.e. using analytical data, process knowledge, Safety Data Sheets, etc.).
- 5.7.6 Contractor shall not mix its Used Oil with any solvents, chemicals or waste and will segregate them, as appropriate. Under no circumstance shall Contractor land-apply Used Oil on Owner's work-sites or anywhere else not authorized by law.
- 5.7.7 Contractor may be required to submit an updated Waste Management Plan if Owner requires revisions based upon scope of work changes, etc. that requires additional wastes be disposed of.
- 5.7.8 Prior to Contractor demobilizing, any remaining substances, chemicals, materials or products (not yet determined to be a waste by Owner) must be removed by Contractor, including any partially used containers. No substances, chemicals, materials or products shall be left on Owner's work-site without written authorization. Any substances, chemicals, materials or products found to be left on-site will be returned to Contractor and Contractor billed for shipping and handling.
 - 5.7.8.1 For any substances, chemicals, materials or products left behind without prior approval by Owner and are determined to be a waste incapable of being returned to Contractor because of Federal, State, and/or Local regulation or law; Owner will properly dispose of this waste and Contractor will be billed for this service or else notify Contractor to come back and properly dispose of the waste itself. Owner will decide which option is in the best interest of the corporation.
- 5.7.9 For additional requirements on Hazardous Communication and Hazardous Materials Management, refer to Owner's document on Contractor Safety & Health Requirements.

5.8 Environmentally-Sensitive Areas

- 5.8.1 All known jurisdictional wetlands or streams at Owner's work-site will be identified to Contractor. Contractor shall bring to Owner's attention any such areas which have not yet been identified and which may be impacted by the Work.
- 5.8.2 Contractor shall not disturb or impact a Jurisdictional Wetland, Stream, Critical Dune or other Environmentally-Sensitive Area, as identified in the EWCA, without the proper permit(s) in place. Contractor shall follow all such permit requirements as applicable to the Work.

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

- 5.8.3 Contractor shall ensure that all Owner site-specific protection requirements are maintained in regards to any Wetland, Stream, Critical Dune or other Environmentally-Sensitive Area.
- 5.8.4 Contractor shall ensure that environmentally sensitive areas such as wetland or stream areas, that are not permitted, are clearly marked in the field (e.g. orange fencing with signage) unless otherwise approved by Owner. Whenever temporary barricades are erected and/or maintained by Contractor near Environmentally-Sensitive Areas, Contractor shall post barricade signs around the perimeter that identify the nature of the environmental issue (e.g. NOTICE – Wetland Boundary Keep Out). This signage shall be made of Ultra-Violet and weather resistant material.

5.9 Species Protection

- 5.9.1 Contractor shall bring no harm to protected birds such as raptors, waterfowl, eagles, and other birds native to North America on the Owner's Work site. Contractor shall notify Owner if protected birds, nests, or dead or injured birds are identified on Owner's Work site. Contractor shall not touch or move any such active nest, large inactive nest, or dead or injured protected bird unless permission has been obtained from Owner's Avian Program Coordinator. Exemptions are available for situations of imminent danger or public safety.
- 5.9.2 Owner will notify Contractor if there is a known presence of a Protected, Endangered, Rare, Threatened species, and/or their dwellings and provide training on AEP's Avian Protection Plan as required by the scope of work. Contractor shall comply with all Federal, State, and/or Local rules and regulations if such a species and/or their dwellings exist on or near Owner's work-site, as identified on the EWCA. Contractor shall notify Owner immediately if such species and/or dwellings are observed so they can be documented and protective measures established, if necessary.

5.10 Protection of Archeological and Cultural Resources

- 5.10.1 Work on Owner's sites has the potential to uncover pre-historic, historic, and/or cultural artifacts. If during the performance of its Work, Contractor discovers pre-historic, historic, and/or cultural artifacts (e.g. arrow heads, pottery shards, bones, jewelry, etc), Contractor must immediately stop work, contact Owner, preserve and protect any items discovered to Owner's satisfaction while complying with all Federal, State, and/or Local requirements. If Contractor acquires knowledge of such an incident from a third party, Contractor shall immediately inform Owner so that Owner may investigate the legitimacy of such claims. Any impact to these areas is strictly prohibited, other than by archeological investigation and preservation activities that may be specifically included in Contractor's scope of Work.
- 5.10.2 For pre-historic, historic, and/or cultural areas already identified, as listed within the EWCA, additional requirements to protect these areas may be required from Contractor (e.g. fencing, signage, periodic inspections, training, restrictive work requirements, etc.). Contractor shall comply with all such requirements.

6.0	DEFINITIONS
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- 6.1 **Assessment** – A physical walk down of the work-site(s) using checklists or other methods to record compliance of the Work with environmental laws, policies, and Best Management Practices.
- 6.2 **Contractor Reimbursement** – The term "Owner will pay for" or "Owner will reimburse Contractor the cost of" will be in accordance with the "Extra Work" or "Cost-Plus Work" provisions of any resulting contract.
- 6.3 **Discharge** – Includes, but is not limited to any spilling, leaking, releasing, pumping, pouring, emitting, emptying or dumping of oil, chemicals or process waters, etc. into the environment (e.g., land, water or air).

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

- 6.4 **Emergency Environmental Situation** – An event that demands immediate action to protect the health, wellbeing, and/or condition of the surrounding environment and community including ground water, surface water, land, and air.
- 6.5 **environmentally Competent Person (eCP)** – Contractor-designated person(s) is one who by way of training and/or experience:
- 6.10.1 Is capable of identifying existing and predictable environmental risks in regards to the Work, surroundings or working conditions that may be non-compliant, unsanitary, hazardous or dangerous to employees, the public or the environment.
 - 6.10.2 Understands the required engineering controls to mitigate such risk and has the authorization to take prompt corrective measures to initiate, minimize, and/or remedy environmental issue(s).
 - 6.10.3 Has completed all of Owner required training as described in section 5.1, including any additional training as specified in the Environmental Work Compliance Assessment (EWCA). In addition, the environmentally Competent Person shall be able to clearly communicate to the workers, Owner's environmental requirements and the environmental controls they are expected to utilize in the performance of their Work.
- 6.6 **Environmental Event Report** – Owner's environmental incident reporting form that Contractor is required to complete in regard to environmental incidents, corrective actions and preventive actions jointly agreed upon, along with what will be or has been implemented to ensure a similar environmental incident will not be repeated.
- 6.7 **Environmental Management Plan** – A document prepared by Owner that outlines certain environmental activities, planning, responsibilities, practices, procedures, processes, resources or standards to be carried out to meet Owner's environmental policy and to achieve its compliance objectives.
- 6.8 **Environmentally-Sensitive Area** – Place where even minor disturbances to the natural order can impact the ecological balance and/or place the Owner at environmental risk. Such areas can include, but are not limited to wetlands, water bodies, designated conservation areas, parks, preserves, and recreational areas.
- 6.9 **Environmental Management System** – A series of plans or documents consisting of proven processes to conduct, monitor, and correct all environmental activities within an organization. These processes can either be written, verbal or a combination of both.
- 6.10 **HAZWOPER** – Training requirements under OSHA's Hazardous Waste Operations and Emergency Response regulation. For additional information on this requirement, reference 29 CFR 1910.120 and/or 1926.65. A summation of the training that Owner requires is outlined below:
- 6.10.1 **First Responder – Awareness** spill and emergency training; personnel may report a leak, release, spill, and/or suspicious puddle to their environmentally Competent Person who handles such calls, can identify the type of material if they can do so at a safe distance from it, can keep others from approaching the spill area, and who can do all of this without any additional Personal Protective Equipment (PPE).
 - 6.10.2 **First Responder – Operations** spill and emergency training; personnel may stop spills remotely by closing valves, turning off equipment, etc. and/or prevent the spread of spills by covering drains, placing dikes, booms or other absorbents at a safe distance. However, they may not approach the spill/release area unless it has been determined by authorized personnel in charge that it is safe to do so, have been taught, and are qualified to use PPE appropriate for the situation. First Responder - Operations training should take approximately 8 hours to perform depending upon knowledge of the chemicals being used and is subject to review and acceptance by Owner. Higher levels of HAZWOPER training may be requested by Owner, if deemed necessary.
 - 6.10.3 **On Scene Incident Commander** – An Owner, Contractor or government person who directs the emergency response options during an Emergency Environmental Situation. Topics addressed in this person's training to assume this position include Emergency Operations Centers, Incident Management System implementation, structure and function of a command,

PUBLIC VERSION
CONTRACTORS ENVIRONMENTAL REQUIREMENTS DOCUMENT, REV 2

communications, team leadership, managing responder safety, and site characterization. Per OSHA's HAZWOPER Standard, this person typically receives 24 hours training plus any additional training needed to achieve competency all other areas mentioned above.

- 6.11 **Jurisdictional Wetland or Stream** – Areas determined by the U.S. Army Corps of Engineers and/or U.S. EPA that are subject to Section 404 of the Clean Water Act of 1977 or Section 10 of the Rivers and Harbors Act of 1899. Isolated wetlands or streams subject to state environmental agency jurisdiction are included in this definition.
- 6.12 **Minor Spill** – A discharge of oil, chemicals or process waters to the environment in quantities below any regulatory reporting threshold amount. This threshold amount is dependent on the environmental media the spill occurs in and the type of material spilled.
- 6.13 **Negative Environmental Impact** – A determination that the Work is having a negative impact on the environment that might affect the local population, endangered species, biodiversity, archeological artifacts, historical significance, community beauty, environmentally-sensitive areas, etc.
- 6.14 **Oil** – Oil of any kind or in any form, as defined by 40 CFR 112.2, including, but not limited to fats, oils or greases of animal, fish or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits or kernels; and other oils and greases, including petroleum, fuel oil, sludge, synthetic oils, mineral oils, oil refuse or oil mixed with wastes other than dredged spoil.
- 6.15 **Records** – Documents of an environmental nature to record compliance with this specification and/or Federal, State, and/or Local rules and regulations. Records may include, but are not limited to permits, reports, studies, evaluations, logbooks, photographs, plans, employee training, and material classifications. The requirements to maintain this documentation are usually outlined within regulations, permits, training, etc.
- 6.16 **Waste Determination** – A recorded communication process by which a waste (i.e. solid, liquid or gas) is classified to be a Solid Waste or Hazardous Waste, and why, for the purpose of disposal in accordance with Resource Conservation and Recovery Act (RCRA) rules and regulations. A waste can also be excluded from this process and be specifically covered under other rules and regulations.

7.0 REVIEW AND MINOR REVISION HISTORY			
DATE	REV #	CHANGES (e.g. paragraph #, scope of change, etc.)	REVIEWER
3-6-13	1	Too numerous to list. Most were minor clarifications to CERD sections: 3.1.3 (new EWCA form), 3.3.1 (new audit form), 5.1.3.1, 5.1.4, 5.1.5 (new EER form), 6.1.1, 6.1.2, 6.2.6.1, and 6.7.8.1	S. Austin & M. McCallin
9/13/16	2	<ul style="list-style-type: none"> • Moved definitions from Section 1 to Section 6; • Added EPCRA reporting (4.3); • Specified timeframe for completing training requirements (5.1.1 & 5.1.2); • Defined time for submittal of contractor required plans; • Removed numeric value for HAZWOPER training; • Clarified SPCC requirements (5.3), Environmentally Sensitive Areas (5.8), and Species Protection (5.9) ; • Revised EWCA, Audit Form, and EER. 	Melinda Stahl

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PUBLIC VERSION
ATTACHMENT A - ENVIRONMENTAL WORK COMPLIANCE ASSESSMENT

AEP Generation's Environmental Work Compliance Assessment (EWCA)				
CONSULT THE PEC, CEC, AND/OR ENVIRONMENTAL SERVICES REPRESENTATIVES FOR MORE DETAILS ON ALL ITEMS LISTED BELOW The EWCA or any other equivalent forms are informational documents for initial and subsequent environmental planning purposes. No claim or representation is expressed or implied that the EWCA is comprehensive, all-inclusive, accurate, and complete or that items not listed will not be present or pose a threat to environmental compliance. The EWCA is a working document and may be revised throughout the term of the Contract.				
Location/Work-Site: Click here to enter text.		Start Date: Click here to enter a date.		End Date: Click here to enter a date.
Contractor/Work Description: Click here to enter text.				
Work Contacts (Owner & Contractor): Click here to enter text.				
Date Form Completed, Rev 0: Click here to enter a date.			Date Form Revised (Rev # <input type="checkbox"/>): Click here to enter a date.	
Signature Process				
EWCA Completed By: Click here to enter a date.		EWCA Completed By: Click here to enter a date.		
EWCA Reviewed By: Click here to enter a date.		EWCA Reviewed By: Click here to enter a date.		
Environmental Aspects and Impacts of the Work				
*Check mark the red N/A box in each section's Environmental Impacts Header to inactivate a whole segment if Not Applicable				Contractor &/or Owner to be Responsible?
Rev 0	Rev <input type="checkbox"/>	Air/Water/Land Aspects	Environmental Impacts N/A <input type="checkbox"/>	C / O
<input type="checkbox"/>	<input type="checkbox"/>	Soil: <input type="checkbox"/> Call Before You Dig (i.e. 811) <input type="checkbox"/> Excavation <input type="checkbox"/> Trenching <input type="checkbox"/> Grading	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Contaminated Media Removal <input type="checkbox"/> Soil <input type="checkbox"/> Water	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Drilling <input type="checkbox"/> Boring <input type="checkbox"/> Pile Driving	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Use of Explosives <input type="checkbox"/> Blasting	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Working on a Dam	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Working: <input type="checkbox"/> Over Water <input type="checkbox"/> On it <input type="checkbox"/> Near it	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Erosion <input type="checkbox"/> Sediment Controls	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Rock or Concrete: <input type="checkbox"/> Crushing <input type="checkbox"/> Screening <input type="checkbox"/> Washout	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Ozone Depleting Substances (ODS),	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Asphalt <input type="checkbox"/> Pesticides <input type="checkbox"/> Special Coatings	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Dust Control/s	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
Rev 0	Rev <input type="checkbox"/>	Oil & Chemical Aspects	Environmental Impacts N/A <input type="checkbox"/>	C / O
<input type="checkbox"/>	<input type="checkbox"/>	Used Oil: <input type="checkbox"/> Plant <input type="checkbox"/> Contractor Recycling	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Oil Storage (in gallons): <input type="checkbox"/> <1,320 <input type="checkbox"/> >1,320	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Chemicals: <input type="checkbox"/> Storage <input type="checkbox"/> Labeling <input type="checkbox"/> Use <input type="checkbox"/> Handling	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O

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PUBLIC VERSION
ATTACHMENT A - ENVIRONMENTAL WORK COMPLIANCE ASSESSMENT

Rev 0	Rev	Waste Aspects	Environmental Impacts	C / O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Construction & Demolition Debris	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Lead Abatement Waste	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Asbestos Waste	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Electrical Work: <input type="checkbox"/> PCB's <input type="checkbox"/> Oils <input type="checkbox"/> Wire <input type="checkbox"/> Transformer <input type="checkbox"/> Capacitor <input type="checkbox"/> Asbestos <input type="checkbox"/> Ballasts <input type="checkbox"/> Mercury Switches	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Grinding <input type="checkbox"/> Cutting <input type="checkbox"/> Drilling Waste	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Recycling of: <input type="checkbox"/> Wood <input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Vegetation <input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Special Notifications: <input type="checkbox"/> Demolition <input type="checkbox"/> Asbestos <input type="checkbox"/> Air Permit <input type="checkbox"/> Water Permit <input type="checkbox"/> Waste Permit	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Radioactive Materials	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Hazardous Waste: <input type="checkbox"/> PCB's (Paint, Caulk, Oil) <input type="checkbox"/> Hydrostatic Testing Water <input type="checkbox"/> Rinse Water <input type="checkbox"/> Chemical Cleaning <input type="checkbox"/> Spent Solvent <input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Non-Hazardous Waste: <input type="checkbox"/> Rinse Water <input type="checkbox"/> Hydrostatic Testing Water <input type="checkbox"/> Chemical Cleaning <input type="checkbox"/> Spent Solvent <input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Partially Used, Unused, and/or Expired Chemical Products Left Behind	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Universal Waste: <input type="checkbox"/> Lamps <input type="checkbox"/> Batteries <input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Aerosol Cans	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Pollution Prevention (P2)	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Sewage Concerns: <input type="checkbox"/> Portalets <input type="checkbox"/> Holding Tanks <input type="checkbox"/> Septic System <input type="checkbox"/> WWTP Hook-up <input type="checkbox"/> POTW Hook-up	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
Rev 0	Rev	Sensitive Aspects	Environmental Impacts	C / O
<input type="checkbox"/>	<input type="checkbox"/>	Species Protection: <input type="checkbox"/> Vertebrates (birds, mammals, fishes, reptiles, etc.) <input type="checkbox"/> Invertebrates (clams, snails, insects, etc.) <input type="checkbox"/> Plants (flowering plants, ferns, etc.)	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Protected Areas: <input type="checkbox"/> Cultural <input type="checkbox"/> Historical <input type="checkbox"/> Prehistoric <input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Preservation Areas: <input type="checkbox"/> Wetland <input type="checkbox"/> Stream <input type="checkbox"/> Woods <input type="checkbox"/> Dune <input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Other:	Click to Select	<input type="checkbox"/> C <input type="checkbox"/> O

PUBLIC VERSION
ATTACHMENT A - ENVIRONMENTAL WORK COMPLIANCE ASSESSMENT

Rev O	Rev <input type="checkbox"/>	Plans, Policies, Permits, & Permissions	Comments N/A <input type="checkbox"/>	C / O
<input type="checkbox"/>	<input type="checkbox"/>	Site Specific Operational Controls, Procedures, and/or Policies	<input type="checkbox"/> Yes <input type="checkbox"/> No; Notes:	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<p style="text-align: center;">AEP Safety Services</p> <p>Corporate Operational Controls, Procedures, & Policies</p> <p>ESH = Environmental, Safety & Health Policy</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No; Notes: <input type="checkbox"/> ESH0000013876 – Hex. Chrome Exp. Control <input type="checkbox"/> ESH0000013879 – Mercury Exposure Control <input type="checkbox"/> ESH0000014349 – Methylene Chloride Policy <input type="checkbox"/> ESH0000013825 – HAZWOPER/Emer. Resp. <input type="checkbox"/> Other: <input type="checkbox"/> ESH0000013995 – Asbestos Management <input type="checkbox"/> ESH0000013882 – Lead Exposure Control <input type="checkbox"/> ESH0000013821 – Cadmium Exp. Control <input type="checkbox"/> ESH0000013998 – Hazard Communication	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<p style="text-align: center;">AEP Environmental Services</p> <p>Corporate Operational Controls, Procedures, & Policies</p> <p>EP – Environmental Policy</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No; Notes: <input type="checkbox"/> EP-92-05 Archeological Artifacts Encountered <input type="checkbox"/> EP-92-07 PCB Management Policy <input type="checkbox"/> EP-92-8.5 Asbestos Management Policy <input type="checkbox"/> EP-93-09 Wetlands Policy <input type="checkbox"/> EP-95-11 Used Oil/Solvent Mixture <input type="checkbox"/> EP-97-12 Treated Wood Give-Away <input type="checkbox"/> EP-08-14 Avian Protection Policy <input type="checkbox"/> EP-08-15 PCB Insulation/Capacitors	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	AEP Environmental Documents Provided	<input type="checkbox"/> Yes <input type="checkbox"/> No; Notes: <input type="checkbox"/> 404 Permit <input type="checkbox"/> 401 Permit <input type="checkbox"/> Industrial NPDES Permit <input type="checkbox"/> Construction Storm Water Permit <input type="checkbox"/> Industrial Storm Water Permit <input type="checkbox"/> Pollution Prevention (P2) Plan <input type="checkbox"/> Title V Air Permit <input type="checkbox"/> Sewage Holding Tank Permit <input type="checkbox"/> Septic System Permit <input type="checkbox"/> Portalet Permit <input type="checkbox"/> Groundwater Protection Plan <input type="checkbox"/> Other:	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	Plans Required For Work	<input type="checkbox"/> Yes <input type="checkbox"/> No; Notes: <input type="checkbox"/> Site Drainage Plan <input type="checkbox"/> SPCC Plan <input type="checkbox"/> Hydrostatic Plan <input type="checkbox"/> Demobilization Plan <input type="checkbox"/> Archeological Evaluation <input type="checkbox"/> Erosion & Sediment Control (E&SC) Plan <input type="checkbox"/> Chemical Management Plan <input type="checkbox"/> Waste Management Plan <input type="checkbox"/> Sewage Management Plan <input type="checkbox"/> Spill Response Plan <input type="checkbox"/> Fugitive Dust / Emissions Plan <input type="checkbox"/> Other:	<input type="checkbox"/> C <input type="checkbox"/> O
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Other:	Notes:	<input type="checkbox"/> C <input type="checkbox"/> O
Special Instructions *Check this box to spell check document <input type="checkbox"/>				
Name of Contractor's eCP:		eCP Will Be: <input type="checkbox"/> Full-time <input type="checkbox"/> Part-time (<input type="checkbox"/> <input type="checkbox"/> /hr) <input type="checkbox"/> On-site <input type="checkbox"/> Off-site		
eCP Training Requirements: (to be completed prior to mobilization)		<input type="checkbox"/> Spill Response <input type="checkbox"/> Erosion & Sediment Control <input type="checkbox"/> SPCC <input type="checkbox"/> Fugitive Dust <input type="checkbox"/> Solid Waste: <input type="checkbox"/> Hazardous <input type="checkbox"/> Non-Haz <input type="checkbox"/> HAZWOPER Choose an item. <input type="checkbox"/> Other: <input type="checkbox"/> Department of Transportation / Materials of Trade <small>(For Transportation of Hazardous Materials)</small>		
Worker Training Requirements: (to be completed ASAP)		<input type="checkbox"/> Spill Awareness <input type="checkbox"/> E&S Awareness <input type="checkbox"/> SPCC Awareness <input type="checkbox"/> Fugitive Dust <input type="checkbox"/> Solid Waste: <input type="checkbox"/> Hazardous <input type="checkbox"/> Non-Haz <input type="checkbox"/> HAZWOPER Choose an item. <input type="checkbox"/> Other: <input type="checkbox"/> Department of Transportation / Materials of Trade <small>(For Transportation of Hazardous Materials)</small>		
Env. Event Notification Authority:		<input type="checkbox"/> Owner Only <input type="checkbox"/> Contractor, if Owner is Unavailable within: Enter time <input type="checkbox"/> hr/Min. <input type="checkbox"/> Owner to Provide Notification Training		
Spill Kits Required:		<input type="checkbox"/> Around the work-site <input type="checkbox"/> Vehicles <input type="checkbox"/> Equipment <input type="checkbox"/> Other: Notes:		
Solid Waste Generator Will Be:		<input type="checkbox"/> Owner <input type="checkbox"/> Contractor is Co-Generator – List special instructions:		
Week Day SWP3 Inspections:		<input type="checkbox"/> Owner <input type="checkbox"/> Contractor Week End SWP3 Inspections: <input type="checkbox"/> Owner <input type="checkbox"/> Contractor		
Sediment Track-out Clean-up:		<input type="checkbox"/> Owner <input type="checkbox"/> Contractor If Contractor – List other areas responsible for:		

ATTACHMENT B – CONTRACTOR ENVIRONMENTAL EVALUATION

**AEP Generation's Contractor Environmental Requirements Document (CERD)
Contractor Environmental Evaluation**

Date: _____ Contractor: _____

Project Name: _____ Superintendent: _____

eCP: _____ # of Contractor Employees On-Site Today: _____

Questions for Contractor's environmentally Competent Person (eCP):

A. CERD / EWCA		
1.	Is a copy of the AEP CERD available at the work site? (1.3)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2.	Is a copy of the EWCA at the work-site for Contractor to execute? (2.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3.	Was the EWCA jointly reviewed by AEP and Contractor prior to it being used in the field for planning and compliance purposes?(2.1.2)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
B. Training		
1.	Did the eCP receive training listed within the EWCA? (5.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2.	Is this training documented and available on-site? (3.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3.	Did the Contractor's employees/craft receive training that listed within the EWCA? (5.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
4.	Is this training documented and available on-site? (5.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
C. Procedures / Best Management Practices		
1.	Does the Contractor have a written disciplinary procedure for failing to follow environmental rules and regulations?(1.8)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2.	Has the Contractor's emergency notification procedure been reviewed and approved? (4.1.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3.	Does the eCP conduct documented Environmental Self-Assessments? (2.1.4)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
4.	Does the Contractor have spill kits on-site to respond to the largest potential spill? (5.3.7)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
5.	Are the Contractor's Conex boxes labeled per the CERD? (5.2.3)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
D. Environmental Plans		
1.	Has the Contractor submitted all of the Environmental Plans listed in the EWCA for review and comment? (2.1.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2.	Are copies of the Approved Plans available on-site?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3.	Has training been provided on the Plans to the personnel on-site?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
4.	Are the Plans being properly administered?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
5.	Has AEP provided the Contractor with copies of their written plans, policies or permits and allowed time for clarifying questions or comments? (2.2.1)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
6.	Are all the plans, permits and/or policies available for personnel to review to conduct their work? (2.1.6)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

ATTACHMENT B – CONTRACTOR ENVIRONMENTAL EVALUATION

E. Conduct a Work-Site Environmental Compliance Assessment:				
1.	Are there any non-compliance issues that need to be addressed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
2.	Does the EWCA need to be revised to address new or unidentified issues? (2.1.4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
3.	Are there any additional plans, procedures, or training needed for the Contractor to complete the work? (5.1.6, 5.2.4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
F. Questions for a Small Sample of Contractor's Employees/Craft:				
1.	Who is your Contractor's environmentally Competent Person?			
2.	Have you received environmental training for this work-site?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
3.	How long in total did this training last?			
4.	What were some of the environmental subjects covered in the training?			
5.	Do you know what to do if you have any environmental questions on how to deal with the issues you have been trained on?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
6.	Are the environmental procedures reviewed with you frequently?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
G. Corrective Action Plan:				
#	Description of Environmental Issue to be Addressed	POC Responsible	Due By	Completed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

AEP Coordinator's Name: _____ Title: _____

Signature: _____ Date: _____ Location: _____

ATTACHMENT C PUBLIC ENVIRONMENTAL EVENT REPORT

AEP's Environmental Event Report (EER)

Title of Event:	Click here to enter text.
Event Date & Time:	Click here to enter a date.
Point of Contact (include cell #):	Click here to enter text.
Location Name (i.e. Plant/Project):	Click here to enter text.
Operating Company (e.g. APCo):	Click here to enter text.
Environmental Discipline:	<input type="checkbox"/> Air <input type="checkbox"/> Land <input type="checkbox"/> Water <input type="checkbox"/> MESH
Environmental Aspect:	Click here to enter text.
Environmental Impact:	Click here to enter text.
Event Type:	<input type="checkbox"/> Enforcement Action <input type="checkbox"/> Permit Issue <input type="checkbox"/> Complaint <input type="checkbox"/> NPDES TSS <input type="checkbox"/> NPDES Chlorine <input type="checkbox"/> NPDES O&G <input type="checkbox"/> NPDES Metals <input type="checkbox"/> NPDES BOD <input type="checkbox"/> NPDES Flow <input type="checkbox"/> NPDES Temperature <input type="checkbox"/> NPDES Fecal Coliform <input type="checkbox"/> NPDES Other <input type="checkbox"/> NPDES pH <input type="checkbox"/> Oil Spill <input type="checkbox"/> Chemical Spill/Release <input type="checkbox"/> Near Miss <input type="checkbox"/> MESH Nonconformance <input type="checkbox"/> Lessons Learned <input type="checkbox"/> Stack Opacity Exceedance >2% <input type="checkbox"/> Describe Other: Click here to enter text.
ICP Metric Event:	<input type="checkbox"/> Check if this is a NPDES, Oil Spill or Chemical Spill/Release Reportable Event
Description of Event and Immediate Actions Taken:	Click here to enter text.
Root Cause or Event Analysis:	Click here to enter text.
Corrective Action or Mitigation Plan:	Click here to enter text.
Root Cause Codes:	<input type="checkbox"/> Roles/Responsibilities Not Defined <input type="checkbox"/> New Process, Procedure or Guidance <input type="checkbox"/> Budget <input type="checkbox"/> Change Management <input type="checkbox"/> Communication <input type="checkbox"/> Contractor <input type="checkbox"/> Emergency Planning <input type="checkbox"/> Operational <input type="checkbox"/> Software <input type="checkbox"/> Equipment Failure <input type="checkbox"/> Work Practices <input type="checkbox"/> Human Performance Improvement <input type="checkbox"/> Fitness for Duty <input type="checkbox"/> Work Planning/Scheduling <input type="checkbox"/> Management System <input type="checkbox"/> Training/Competency <input type="checkbox"/> Inadequate Documentation <input type="checkbox"/> Inadequate Procedure or Guidance <input type="checkbox"/> External Factors (e.g. weather, emergency, etc.) <input type="checkbox"/> Describe Other: Click here to enter text.
Human Performance Improvement (HPI) Error Traps Contributing to the Event (Check all that apply):	<input type="checkbox"/> Time Pressures <input type="checkbox"/> Half Hour After Waking Up or Meal <input type="checkbox"/> Distractive Environment <input type="checkbox"/> Vague or Incorrect Guidance <input type="checkbox"/> High Workload <input type="checkbox"/> Overconfidence / Complacency <input type="checkbox"/> 1st Time Evolution/Task Unfamiliarity <input type="checkbox"/> Imprecise Communication <input type="checkbox"/> Day Prior To/1st Day After Days Off <input type="checkbox"/> Work Stress / Fatigue
Which HPI Tools Could Have Prevented the Event? (Check all that apply):	<input type="checkbox"/> Pre-Job Briefing/JSA Process <input type="checkbox"/> Two-Minute Rule <input type="checkbox"/> S.T.A.R. (Stop, Think, Act, & Review) <input type="checkbox"/> Stop when Uncertain <input type="checkbox"/> Peer Checking & Coaching <input type="checkbox"/> Procedure Use <input type="checkbox"/> Questioning Attitude <input type="checkbox"/> Three-Way Communication <input type="checkbox"/> Qualify, Validate, & Verify (Q,V, &V) <input type="checkbox"/> Phonetic Alphabet
Other Links (e.g. attachments, file locations, web-sites, pictures, etc.):	Type in the web address/file location: Type in the link description: Click here to enter text.
AEP Corporate Comments: <i>Corporate Determination for ICP Metric</i>	<input type="checkbox"/> NPDES Controllable Event <input type="checkbox"/> Spill Controllable Event Comments: Click here to enter text.

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PUBLIC VERSION



ENVIRONMENTAL WORK COMPLIANCE ASSESSMENT DATED 11/02/2018

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PC&C's Environmental Work Compliance Assessment (EWCA)

This EWCA has been prepared for environmental planning purposes. No claim or representation is expressed or implied that the EWCA is comprehensive, all-inclusive, accurate, and complete or that items not listed will not be present or pose a threat to environmental compliance.

The EWCA is a working document and may be revised throughout the term of the Contract.

Consult with the PEC, CEC, and/or Environmental Services Representatives to review, clarify and approve.

Date: 2-Nov-2018

Location / Project: Granger, Indiana / South Bend Solar Project Contractor: TBD

Project Start Date: 1-Apr-2019

Project End Date: 31-Dec-2020

Work Description: Construction of 20 MW solar power generation facility and interconnect to substation

Contacts (Owner & Contractor):

Brandy Kellom, Melinda Stahl

EWCA Completed By: Ryan Vasel 2-Nov-2018

EWCA Reviewed By: Melinda Stahl, Brandy Kellom (emailed) 2-Nov-2018

Plans Required: (Prior to Mobilization)

Environmental Work Compliance Plan shall include spill response and waste management procedures.

Training (eCP): (Prior to Mobilization)

♦ Spill Response ♦ Erosion and Sediment Control ♦ SPCC ♦ Fugitive Dust ♦ Solid Waste (RCRA)

Training (Worker): (within 14 days)

♦ Spill Awareness ♦ Erosion and Sediment Control Awareness ♦ SPCC Awareness ♦ Fugitive Dust ♦ Solid Waste (RCRA) Awareness

AEP Plans and Permits: (Available on request) * Permit(s) maybe pending for the work - consult with CEC.

♦ Construction Stormwater Permit ♦ Storm Water Pollution Prevention Plan ♦ Seasonal Clearing Restrictions Apply to Project, please consult with CEC for more information.

AEP Policies: (Available on request)

See Additional Comments on next page

♦ CG 751.00.01 Controlling Fugitive Dust Emissions ♦ CG 751.00.02 Managing Universal Waste ♦ CG 751.00.04 Implementing Spill Prevention Control and Countermeasures ♦ CG 751.00.05 Preventing Storm Water Pollution ♦ CG 751.00.07 Protecting Wetland Resources ♦ CG 751.00.09 Managing Construction and Demolition Debris ♦ CG 751.00.10 Managing Hazardous Waste ♦ CG 751.00.11 Documenting Ozone Depleting Substances ♦ CG 751.00.13 Environmental Discharge, Spills or Releases during Construction or Commissioning Activities ♦ JA CG 751.00.04 AST Set Up ♦ JA CG 751.00.11 HVAC / MVAC ♦ JA CG 751.00.13 Cleaning Up Sewage Spills ♦ CE-007 Specifications for Erosion and Sediment Controls ♦ MEA Spoils from Hydro-excavation ♦ EP-93-09 Wetlands Policy ♦ EP-97-12 Treated Wood Give-away Policy

General Project Notes: The eCP is expected to dedicate 30% of their time to environmental duties at the project site.

-Spill kits are required to be kept: ♦ around the general work-site and Near fuel tanks

-The Contractor is the Co-Generator of Solid Waste generated from the work. Waste will be shipped off-site using both the host facility and the Contractors EPA ID numbers.

-The Project has an active Storm Water Pollution Prevention Plan (SWPPP). The Contractor is responsible for conducting and recording the inspections from the SWPPP. Copies of the inspection reports must be provided to AEP within 24-hours of the inspection. Weekend and rain event inspections will be conducted by the Contractor.

-The Contractor is responsible to monitor for and clean-up any sediment track-out from the project-site. Additionally the Contractor is responsible for: All public roadways

PUBLIC VERSION

- Additional Comments:**
- ◆ EPCRA reportable chemicals are anticipated to be used for this work. Please consult with the CEC or PEC to incorporate requirements with the requested environmental plans.
 - ◆ An Environmental Record Management Plan is required for this work. Please consult with the CEC to identify the records required for the project and process for turning them over to AEP. **No records are to be removed from the Project site without written authorization from the CEC or PEC.**
 - ◆ DOT/MOT training may be required, please discuss with the CEC.
 - ◆ The Contractor is to ensure that all aerosol cans are completely emptied prior to disposal. Check with the CEC for site specific instructions regarding the disposal of empty and defective aerosol cans, if available. Useable cans must be taken with the Contractor upon demobilization.
 - ◆ - The Contractor will alert AEP before any transformers are brought on site. An SPCC plan may be required for oil-filled transformers.
 - Any solar panels broken during construction shall be disposed of according to the manufacturers recommendation and in accordance to any local, state, and federal regulations.
 - ◆ No food containers shall be reused for chemical storage/use (e.g., soda/water bottles, milk jugs, etc.)

EWCA Questions and Comments

Air	
A1	Will the contractor bring any portable (oil, fuel or gas powered) equipment on-site? Mobile equipment includes, but is not limited to: portable generators, pumps of any kind, light plants, welders, etc. Yes: Contractor shall provide a complete list of all portable equipment prior to the mobilization of equipment on-site. Each piece shall have a unique equipment ID number and the location/usage tracked monthly by the ECP.
A2	Does the work require the use of any specialized equipment such as rock crushers, soil screeners, grout plants/mixers, or other types of equipment that may require an air permit to operate? No: N/A when issued. Notify the CEC if the scope changes or condition is applicable
A3	Will there be any activities that could potentially create fugitive dust (excavating, blowdowns, blasting, etc.)? Yes: Contractor is expected to minimize fugitive dust using approved best management practices. Chemical dust suppressants must be approved by AEP prior to use. Monitoring and water usage logs shall be maintained.
A4	Is there any brush/woody debris that would require open burning? No: N/A when issued. Notify the CEC if the scope changes or condition is applicable
A5	Is there any refrigerant (CFC) work or the potential for service on equipment (A/C, MVAC, water fountains, refrigerators, etc.)? Yes: Any work on ODS (A/C, MVAC, refrigerators, etc.) shall be done by a qualified technician and proper documentation on the
A6	Will the work activities involve the demolition of any structures? No: N/A when issued. Notify the CEC if the scope changes or condition is applicable
A7	Will blasting or the use of explosives be necessary for the work? No: N/A when issued. Notify the CEC if the scope changes or condition is applicable
Water	
W1	Are there any earth disturbance (clearing, grubbing, or excavation) activities associated with the project? Yes: Erosion and sediment controls are expected to be utilized and properly maintained.
W2	Has a Storm Water Pollution Prevention Plan for the project been developed? Yes: A copy of the SWPPP will be available for review. The Contractor is expected to comply with all conditions in the plan. The CEC will provide training to the eCP on the SWPPP.
W3	Does the Contractor need to develop an Erosion and Sediment Control Plan for the work? Yes: Submit the Erosion and Sediment Control Plan to the CEC for review and comment prior to mobilization.
W4	Is a Site Drainage Plan necessary for managing/controlling water discharges at the site? No: N/A when issued. Notify the CEC if the scope changes or condition is applicable
W5	Are there vacuum trucks or spray systems (pressure washers) involved that could leak waste water to drainage systems? Yes: Review process with CEC to determine if controls or further planning is necessary.
W6	Does the work involve hydro-excavating? Yes: Review process with CEC to discuss handling of spoils and to determine if controls or further planning is necessary.
W7	Will there be heavy equipment or other equipment involved with the work that can leak oil (oil, fuel, hydraulic fluid, etc.)? Yes: The potential for contaminated media exists with incidental spills associated with refueling and other construction activities. Care should be exercised to prevent any spills. The Contractor shall be ready to respond to such incidents, clean them up per CEC direction and report the incident using an EIB. Notify the CEC should any materials become contaminated.
W8	Will concrete be placed for the project? Yes: A wash-out pit is required to be installed (with signage), utilized, and maintained by the contractor. An area for the wash-out pit will be designated for the work. The eCP shall ensure that drivers understand the wash-out procedures at the site and comply.

PUBLIC VERSION

Water - Continued
<p>W9 Will raw materials (soil, fly or bottom ash, limestone, etc.) be hauled in or off-site for the work?</p> <p>Yes: Ensure all trucks are maintained and hydraulic hose connections checked for leaks. Leaky hoses or poorly maintained equipment are to be taken off-site. Trucks hauling raw materials may be required to cover or tarp the load to prevent fugitive emissions or the spilling of materials on the road.</p>
<p>W10 Is a laydown area needed for construction materials (steel, pipe, stockpiles, etc.)?</p> <p>Yes: Laydown areas are to be designed and maintained to minimize stormwater runoff pollution. Including tarping, silt fencing, renewal of gravels, and repair of traffic damage when job is completed.</p>
<p>W11 Will pesticides or herbicides be applied?</p> <p>Yes: The use of any pesticide or herbicide must be approved by AEP prior to use. Some applications may require licensed personnel.</p>
<p>W12 Does the work require working over, in or near waterways (river, stream, wetland, pond, etc.)?</p> <p>Yes: Review process with CEC to determine if controls or further planning is necessary.</p>
<p>W13 Will asphalt or special coatings be applied?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>W14 Will the project require any drilling, boring or pile driving?</p> <p>Yes: Review locations with the CEC, some may require the use of sediment and erosion control measures.</p>
<p>W15 Will any equipment/vehicles be washed at the project site?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>W16 Will hydrostatic tests be performed as a result of the work?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
Oil / Chemicals
<p>O1 Will oil (of any kind; e.g. petroleum, fuel oil, synthetic oil, grease, etc.) or chemicals (solvents, paints, acids or bases) be stored on site as a result of the activity?</p> <p>Yes: Provide SDS to CEC prior to mobilization. All containers shall be properly stored and labeled. Material usage information may be required to be submitted to the CEC monthly.</p>
<p>O2 Will any oil or chemical containers larger than 5 gallons need to be transported or moved to a different location once on-site?</p> <p>No: N/A when issued. Notify the CEC immediately if any containers will be relocated once placed at the job site.</p>
<p>O3 Will more than 55 gallons of oil (petroleum/fuel oil, etc.) be stored on site?</p> <p>Yes: An approved SPCC Plan is required prior to the mobilization of the tanks on site (see CG). Proof of tank registration with the State may be required, if applicable.</p>
<p>O4 Will more than 55 gallons of chemicals be stored on site?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>O5 Are any of the chemicals considered hazardous by DOT, OSHA, or the EPA?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>O6 Will there be any grinding, cutting or drilling that will use fluids as coolants or lubricants?</p> <p>Yes: Grinding, cutting, and/or drilling waste will be collected, containerized and properly disposed. Secondary containment shall be used</p>
<p>O7 Will any containers or tanks be drained of oil (e.g. booster fans, transformers, ASTs)?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>O8 Will chemical metal cleaning be required on any tanks, structures, equipment?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>O9 Will any surfaces need to be painted?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>O10 Will any special coatings be applied?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>O11 Has written permission been given to leave partially used or unused chemical products behind?</p> <p>No: The Contractor will not leave any unused, partially used or expired chemical or material product(s) behind without AEP's written permission. Any such products left behind after demobilization will be shipped back to the Contractor or disposed (if shipment is not an option) at the expense of the Contractor.</p>
Land - Waste / Recycling
<p>L1 Is the contractor responsible for disposal of general trash generated from the work?</p> <p>Yes: All trash should be promptly placed in appropriate collection bins and covered when not in use.</p>
<p>L2 Will the work activities generate any construction and demolition debris (C&DD)?</p> <p>Yes: C&DD shall only be disposed of in an AEP approved landfill.</p>
<p>L3 Does the work require the use of blasting media (blasting grit, sand, glass beads, aluminum oxide, corn cob, etc.)?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>
<p>L4 Will the work involve any known asbestos (caulking, tiles, fireproofing, insulation, wallboard, etc.) materials?</p> <p>No: N/A when issued. Notify the CEC if the scope changes or condition is applicable</p>

PUBLIC VERSION

Land - Waste / Recycling Continued	
L5	Will the work involve any known lead (batteries, building materials and plumbing (pipe/solder), lamps, paint, painted materials, blasting grit waste, etc.)?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L6	Will any work involve transformers, T/R sets, dielectric fluid filled equipment, or any known PCB containing equipment/materials (wires, caulking, paint, etc.)?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L7	Will any work occur on any known mercury containing devices (batteries, lamps, manometers, mercoide pressure switches, mercury-wetted relays, mercury-filled switches, site gauges, thermometers, thermostats, etc.)?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L8	Will the work involve Smoke Detectors, Tritium Exit Signs, Level Indicators (ash hoppers, belt lines, ash silos), Density Indicators (slurry lines, limestone piping), or Crossbelt Coal Analyzers?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L9	Will the work involve an Electrostatic Precipitator, Coal Yard Steel, or Flyash Piping?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L10	Is there the potential to generate non-hazardous waste (rinse water, hydrostatic test water, chemical metal cleaning waste, spent solvent, oily debris, etc.)?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L11	Is there the potential to generate hazardous waste (Listed or Characteristic: ignitability, reactivity, corrosivity, toxicity)?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L12	Will used oil be generated as a result of the work (equipment flushing, maintenance or repair)?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
L13	Will the Contractor be required to have an aerosol puncturing device for the disposal of aerosol cans?
Yes:	The Contractor will be responsible for the disposal of the hazardous waste generated from the residue of puncturing the cans. Please consult with the CEC and include details with the Waste Management Plan.
L14	Is recycling of metal, plastics or wood required?
Yes:	Containers shall be clearly labeled and designated for recycling. Recycling materials shall not be mixed with trash. The Contractor is expected to participate in the facilities recycling program (aluminum cans/plastic bottles), if applicable.
L15	Will the work activities generate universal wastes (batteries, spent pesticides, mercury thermostats, lamps/bulbs, etc.)?
Yes:	All Universal Waste will be managed in accordance with state law and any guidance provided. Check with the CEC for a State list of potential items. All such waste will be the responsibility of the Contractor to properly containerize, label and transfer to the Plant for disposal. Instances where there are no options for Plant disposal the Contractor shall properly dispose of the waste and provide proper documentation of the waste to the CEC.
Sanitary Waste	
S1	Will the Contractor be responsible for portalets at the project site?
Yes:	The Contractor is to provide and maintain portalets and hand washing facilities, as necessary. Documentation (Contract, dump letter, haul tickets) shall be provided to the CEC prior to demobilization. Grey water is prohibited from being discharged on-site.
S2	Can holding tanks be used at the project site?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
S3	Is there hookup available to WWTP or POTW?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
S4	Will a septic system be installed as a result of the project and can it be utilized during construction?
No:	N/A when issued. Notify the CEC if the scope changes or condition is applicable
Environmentally Sensitive Areas	
E1	Have any surface waters (rivers, streams, wetlands, ponds, etc.) been identified within or near the project limits?
Yes:	The Contractor shall coordinate work activities near environmentally sensitive areas with the CEC.
E2	Have any rare, threatened or endangered species or habitat been identified within or near the project limits?
No:	There are no known rare, threatened or endangered species are near the project site.
E3	Are there any known historic or culturally significant areas near the project site?
No:	There are no known archaeological sites are near the project site. Notify AEP Construction immediately in the event any artifacts are uncovered/discovered during the work.
E4	Are there any known preservation areas near the project site (prairie/meadow, woods, dune, stream, wetland, etc.)?
No:	There are no known preservation areas near the project site.
E5	Is there a risk of bird mortality (power lines, transformers, towers, structures that can support nests, etc.) with the work?
No:	Report any injured or dead animals to AEP construction.

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**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

APPENDIX 5

**SOLAR FACILITY TECHNICAL SPECIFICATION AND
DESIGN CRITERIA
GEN4550 REV 3 DATED 10/12/2018**

**GENERAL SPECIFICATION FOR POWER TRANSFORMERS
GEN-4018 REV 3 DATED 12/12/2013**

**FLEET CONTROL DATA COMMUNICATIONS DESIGN CRITERIA
DC-ICE-005 REV 0 DATED 3/26/2012**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

PUBLIC VERSION



NEW GENERATION ENGINEERING SPECIFICATION COVER SHEET

Specification Number: GEN4550
Revision: Rev 3
Date: 10/12/2018

TITLE: Solar Facility Technical Specification and Design Criteria

Scope of Changes:

☐

Revision (Full Procedure)

☐

Change Sheet, Affected pages: _____



P. E. Stamp, if required.

Summary of Changes: Added approved suppliers for solar panels and inverters

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Specification Owner (Organization): Electrical Systems & Equipment Eng.

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Date: 10/12/18
Date: 10/12/18
Date: 10/15/18
Date: 10/12/18

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REVISION HISTORY

REV.	SCOPE OF REVISION	APPROVAL
0	Initial Issue	
3	Added approved suppliers for panels and inverters	

PUBLIC VERSION



TABLE OF CONTENTS

1 PURPOSE..... 4

2 SCOPE..... 4

3 DOCUMENTATION AND REQUIRED EVIDENCE..... 5

4 DESIGN CRITERIA..... 6

5 ENVIRONMENTAL CRITERIA..... 7

6 ELECTRICAL SYSTEM/EQUIPMENT TECHNICAL REQUIREMENTS 7

7 CONTROL SYSTEM REQUIREMENTS..... 13

8 NERC REQUIREMENTS 14

9 ATTACHMENTS 15

PUBLIC VERSION



1 PURPOSE

This document establishes the minimum acceptable technical requirements determined by OWNER as essential design criteria, practices, and equipment characteristics for Solar generating facilities within the AEP system.

2 SCOPE

2.1 GENERAL

This guideline applies to solar generation projects that are being developed and constructed for the ultimate ownership by American Electric Power (OWNER) and/or affiliated subsidiaries. The major equipment, components and systems that make up these facilities are viewed as specialized items that require expertise already acquired and practiced by dedicated companies and organizations.

2.2 DEFINITIONS

“CONTRACTOR” shall mean the bidder submitting the Proposal to American Electric Power (“OWNER”) in response to OWNER’s Request for Proposal.

“PROJECT” shall include all equipment and systems, producing and transmitting power to the Point of Common Coupling (PCC) or Point of Interconnection (POI).

2.3 CODES, REGULATIONS, and STANDARDS

CONTRACTOR shall design and construct the PROJECT in accordance with the latest accepted edition of the following codes and standards, as applicable:

ACI - American Concrete Institute	IEEE - Institute of Electrical and Electronics Engineers (IEEE 1547 for Distributed Resources -DR)
AISC - American Institute of Steel Construction	IFC – International Fire Code 2012 or most recent Edition
ANSI - American National Standards Institute	ISA – Instrumentation Society of America
ASCE – American Society of Civil Engineers	NEC - National Electrical Code 2014 or most recent Edition
ASME – American Society of Mechanical Engineers	NEMA - National Electrical Manufacturers Association
ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers	NERC - North American Reliability Corporation
ASTM - American Society for Testing and Materials	NESC - National Electrical Safety Code
FERC - Federal Energy Regulatory Commission	NETA - National Electrical Testing Association
FM – Factory Mutual	NFPA – National Fire Protection Association
Applicable state building code	OSHA - Occupational Safety and Health Act
IBC - International Building Code	RTO – Regional Transmission Organization (e.g., PJM or SPP)
ICEA - Insulated Cable Engineers Association	UL – Underwriters’ Laboratories
	Project Site - Specific County Engineering Design Guidelines Manual for Street Improvement, Drainage and Grading Plans (if applicable)

The above listed codes and standards are referenced to establish minimum requirements and wherever this specification requires higher standards of materials or workmanship than required by the codes and standards, this specification shall apply.

Specification: GEN4550	Revision: 3	Page 4 of 15
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3 DOCUMENTATION AND REQUIRED EVIDENCE

3.1 Electrical Studies and Calculations

Load flow, voltage drop and short circuit calculations shall be performed. The calculations shall identify equipment loadings, bus conductor and cable loadings, motor terminal voltage, and available fault currents at each voltage level; and shall account for equipment sizing, cable sizing, transformer impedance, relay settings and any large motor starting. The power system model and one-line shall be used as the basis for the calculations. The power system model shall be submitted to OWNER in native format using EasyPower software.

3.2 CONTRACTOR to provide PVSyst or equivalent software tool with model inputs, including all assumptions, and power & energy calculations consistent with project design basis and for the periods specified by OWNER.

3.3 Protective Coordination Study and Relay Settings

Relay coordination studies shall be submitted preferably in EasyPower format along with a PDF of all Time Current Coordination (TCC) curves and calculations.

3.4 Equipment Sizing

Calculations shall be performed to properly size Main and Auxiliary transformers, station service transformers, and low-voltage transformers. Calculations shall be performed to properly size power cables and overhead conductors. Calculations shall be performed to properly size batteries, chargers and Uninterruptible Power Systems.

3.5 Arc Flash Hazard

- Arc flash hazard calculation to determine the arc flash protection boundary and incident energy (Cal/cm²) for all equipment where personnel may work on or near exposed energized parts. The calculation shall be to IEEE-1584 standards. The Studies shall be performed in EasyPower format.
- Where switchgear or MCC cubicles can be energized from both sides (such as main and bus-tie compartments), the incident energy shall be calculated by summing the incident energy contribution from each side.
- An arc flash warning label shall provide pertinent safety-related information about the equipment or component to which it is attached. Electrical equipment with arc flash labels may include switchgear, MCCs, and distribution panels, as examples. For arc flash labeling requirements, refer to OWNER's document number ESH0000016712 "OWNER Generation Electrical Arc Flash Protection Policy".

3.6 Other Studies (where applicable):

- Grounding Studies
- Cathodic Protection
- Illumination Calculations – for normal and emergency lighting, interior and exterior.
- Geotechnical Investigation: If existing site topographic data is not available, a geotechnical report certified by a geotechnical engineer shall be performed.

Specification: GEN4550	Revision: 3	Page 5 of 15
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PUBLIC VERSION

4 DESIGN CRITERIA

- 4.1 PROJECT and individual components shall have a minimum design life of 25 years. For components that have a design life less than 25 years, industry standard warranties shall be provided with extended warranty options for all equipment and components including but not limited to PV modules, gear boxes, generators, inverters, step-up transformers, and support foundations.
- 4.2 CONTRACTOR shall provide Cathodic protection for structural materials that may corrode due to site conditions. CONTRACTOR shall be responsible for a site evaluation and determination whether Cathodic protection is required.
- 4.3 PROJECT shall be designed for manned, unmanned, and remote operation.
- 4.4 PROJECT shall be designed to meet minimum performance guarantees as set forth in the Request for Proposal.
- 4.5 PROJECT may be "Fixed Tilt" or "Single Axis Tracking" design as set forth in the Request for Proposal.
- 4.6 PROJECT design will be in compliance with applicable Federal, State and Local Codes, Regulations and Standards listed in the Codes, Regulations and Standards section below.
- 4.7 PROJECT shall be designed with a control room as close to the point of interconnection as site design allows. The control room shall function as the communications center for the PROJECT. The control room shall provide enough room for the OWNER supplied communications systems, security equipment and Remote Terminal Unit (RTU) equipment. The control room structure shall be designed weather tight and warranted for 10 years.
- 4.8 The PROJECT shall have a Storm Water Management plan: Clean stormwater runoff is runoff from areas which are not subject to contamination.
- 4.9 Fencing: Fencing shall be seven feet high chain-link topped by a one-foot high extension arm sloped at 45°, facing outward, holding three strands of barbed wire. Fencing shall have pipeline posts at maximum 10'-0" centers, and a top and bottom bar to make the fence a rigid panel. The fence shall be located 1'-0" inside the property line. All posts, rails, fabric, wire, and gates shall be galvanized. Road gates shall be seven feet high, sliding gates with three strands of barbed wire. Width of the gates shall be four feet wider than the paved width of the road. Fencing layout, including gates, shall be shown on the site plan drawings. Isolated fence sections may be required at certain areas of power line crossings. The fence shall be grounded to limit step potentials below the permissible touch levels of IEEE 80, Guide for Safety in AC Substation Grounding. Final fence plan shall be approved by OWNER.
- 4.10 "Point of Common Coupling" (State Jurisdictional Distribution Interconnection)

CONTRACTOR will meet all Utility Interconnection Requirements at the Point of Common Coupling as contained in Utility Guideline for Interconnection to the Distribution System for State Jurisdictional Projects.

PROJECT design and equipment selection will meet IEEE 1547 Standard.

PROJECT design to include accessible, visible and lockable gang operated air break switch on the project side of the Point of Common Coupling and shall be furnished and installed by CONTRACTOR.

Specification: GEN4550	Revision: 3	Page 6 of 15
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PUBLIC VERSION

PROJECT design to include conduit, cable and other accessories to provide station service and control power furnished and installed by CONTRACTOR.

4.11 Point of Interconnection (PJM Wholesale or FERC Jurisdictional Interconnection)

CONTRACTOR will meet Utility Interconnection Requirements and all PJM Interconnection Requirements at the Point of Interconnection as defined in PJM Manual 14.

PROJECT design will meet PJM Enhanced Inverter Package A requirements with CONTRACTOR demonstrating this capability through power flow study and equipment specifications.

PROJECT design to include accessible, visible and lockable gang operated air break switch on the project side of the Point of Interconnection and shall be furnished and installed by CONTRACTOR.

PROJECT design to include conduit, cable and other accessories to provide station service and control power furnished and installed by CONTRACTOR.

5 ENVIRONMENTAL CRITERIA

All equipment shall be designed to withstand local conditions including but not limited to the following:

- Wind loading (50 year storm)
- Snow loading (50 year storm)
- Humidity: 0-100%
- Altitude: 0-1000 meters
- Ambient temperature: -30 deg. C to 50 deg. C
- Local seismic activity

6 ELECTRICAL SYSTEM/EQUIPMENT TECHNICAL REQUIREMENTS

6.1 Operating Voltage Criteria

- a. All substation and collection system equipment shall be designed to operate continuously up to a maximum of 1.05 times unit nominal bus voltage.
- b. Solar DC grid voltage shall be 1000V or 1500V, with preference given to 1500V design.

6.2 Convenience & Control Power

- a. 120VAC shall be sourced from utility as a separately derived auxiliary power source.
- b. Instrumentation Voltage : 24 VDC or 48VDC

6.3 Inverters

OWNER Approved Inverter Suppliers:

- a. GE
- b. ABB
- c. SMA America, LLC
- d. Power Electronics
- e. Mitsubishi Electric

Inverters shall meet the following criteria:

- a. Rated no less than 800 KVA per central skid
- b. Inverter shall be certified UL1741

Specification: GEN4550	Revision: 3	Page 7 of 15
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PUBLIC VERSION

- c. The inverter transformer combination shall connect to the POI or PCC via a Delta to Wye-grounded configuration.
- d. Each DC input shall have current sensor devices for array zone-monitoring. The current measurements shall be processed and made available via Modbus or DNP channel by the inverter controller.
- e. A DC disconnect switch shall be in place between the inverter re-combiner box and the main inverter section for hardware protection and isolation.
 - The switch disconnect shall be load break rated.
 - The DC disconnect when open, shall break both positive and negative bus-bars for complete isolation of the main inverter section.
 - The switch disconnect shall be accessible for lock-out, tag-out without exposing operator to energized parts.
- f. The Inverter shall be protected by surge arrestors to comply with ANSI/IEEE C62.41 high exposure.
- g. The inverter shall operate at ± 0.95 power factor or lower at full load rating and 50°C outside air temperature.
- h. Low/High Voltage and Frequency Ride Through capabilities shall be at a minimum compliant with FERC/NERC regulations.
- i. The inverter shall have an integral EMI/RFI filter as standard on its AC connection for high-frequency noise filtering.
- j. The inverter shall provide ground fault protection whenever connected to the photovoltaic array, whether connected to the utility grid or not.
- k. VAR/PF support shall be an option for applications where these are needed. PF or VAR command set-point shall be controllable via the communications channel to plant RTU.
- l. The following control modes shall be available via Modbus channel:
 - VAR mode
 - PF mode
 - Watts prioritization
 - VARS prioritization
 - Power ramp rate control shall be settable via the Modbus or DNP channel.
 - A power command (Watts) shall be available for power curtailment. The inverter shall be able to curtail power at any point regardless of array power availability.
 - Inverter shall be able to turn on/off via a remote command.
- m. Inverter shall communicate to plant controller via Modbus TCP DNP3. Modbus or DNP register mapping shall be available upon request. Proprietary protocols are not allowed.
- n. The following shall be monitored:
 - Ground Fault detector circuit;
 - Surge arrestors;
 - Main fuses (re-combiner, power train section, DC fuses, if present).
- o. The following field I/Os shall be offered for monitoring equipment integration (The I/Os are meant, for instance, for integration of weather station and transformer sensors.)
 - Four Analog Inputs: The type offered shall be standard 4-20mA analog I/Os
 - Four Digital Inputs: The type offered shall be standard digital I/O.
 - RS-485 (2)
- p. All signals monitored via these ports shall be made available via the Modbus or DNP channel.
- q. Transformers must be suitable for operation with a pulsed inverter.

Specification: GEN4550	Revision: 3	Page 8 of 15
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6.4 PV Modules:

OWNER Approved PV Module Manufacturers:

- a. First Solar
- b. Panasonic Corporation
- c. LG Electronics, Inc
- d. GCL System Integration Technology Co.
- e. Risen Energy Co.
- f. Longi Solar Technology
- g. Chint Solar
- h. REC Solar
- i. BYD Company Limited
- j. Hanwha Q Cells Co.
- k. Neo Solar Power Corp.
- l. Trina Solar
- m. JA Solar
- n. Jinko Solar
- o. Adani Solar
- p. SunPower

The above list of preferred solar manufacturers is valid as of the date on this document. It is subject to change without notice based upon final review of warranty and/or credit or business metrics at the time of any contemplated actual transaction.

PV modules must meet the following criteria:

- a. All Modules within 2% rating variance from the same OEM.
- b. Approved models must pass IEC 60721-2-1, IEC 61730-1-2 and must also pass the following testing depending on module type IEC 61646 or IEC 61215.
- c. Modules manufacturer must guaranty 1% or less Pmax loss per year for the first 10 years.
- d. All Modules shall be certified UL 1703

6.5 Meteorological Station shall communicate to the OWNER RTU via TCP, DNP3 or Modbus and shall contain or be accompanied by the following:

- Pyranometer (Direct & Indirect Irradiance)
- Pyranometer in plane of array (1 per 2MWdc), maximum of 5
- Ambient Temperature
- Rain Gauge
- Anemometer and Wind Vane
- PV Panel Temperature (1 per 2MWdc), maximum of 5

6.6 Large Power Transformers (10MVA or Greater)

- a. Transformers shall be sized at their ONAF rating in order to accommodate the maximum operating load of the normally connected equipment.
- b. Transformer target impedance design values shall be standardized as much as is practical. Exact design criteria will result from an economic optimization of capital costs versus electrical losses. Short circuit studies will be carried out to ensure fault currents are limited to the interrupting and withstand capabilities of all connected electrical equipment including but not limited to circuit breakers, disconnect switches, and underground cables.
- c. All transformers shall be of a core-form circular-coil design or shell-form design and be mineral oil (non-PCB) or FR3 liquid-insulated. FR3 may be used only in transformers that do not utilize pumps. These transformers shall be located outdoors.
- d. Transformer sizes shall adhere to the IEEE preferred ratings identified in the IEEE standards.
- e. OWNER Special Factory Test Requirements:

Specification: GEN4550	Revision: 3	Page 9 of 15
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PUBLIC VERSION

1. OWNER requires additional factory tests that are not normally performed by many manufacturers. In addition to routine dielectric tests, the transformer that is a prototype (first of a design) must undergo a Fast Front Switching Impulse (FFSI) test and a Special Termination Lightning Impulse (STLI) test. Detailed test procedures and proper sequence are available in the latest version of OWNER's Specification GEN-4018.
2. OWNER has an acceptance criteria for partial discharge (PD) measured during induced voltage tests as described in GEN-4018.
3. Audible sound level shall be measured on the prototype. The acceptance level shall be in accordance with NEMA standards.
4. Sweep Frequency Response Analysis (SFRA) testing shall be performed with a Doble model M5100 prior to disassembly at the factory. Results shall be recorded electronically and furnished to the owner.

6.7 Small Power Transformers (500 kVA to 10,000 kVA)

- a. A transformer shall be sized at its AA, ONAN or KNAN rating to accommodate the normal operating load of the equipment. An analysis shall be performed to assure that the selected transformer capacity is adequate for starting the largest motors on the system with the remainder of the system fully loaded. Abnormal loading conditions, such as closing of bus tie breakers, will be accommodated through additional fan cooling of the transformers.
- b. Transformer impedances shall be chosen to optimize the system voltage regulation while simultaneously time-limiting fault currents to within the distribution equipment ratings. Sizing, impedances and connections for transformers on similar voltage systems will be standardized as much as is practical.
- c. Transformer shall be of the following constructions:
 - i. dry-type with an AA/FA,
 - ii. mineral oil-filled with an ONAN/ONAF rating, or
 - iii. FR3 liquid-filled with a KNAN/KNAF rating.
- d. Aluminum conductor material shall not be used for windings or leads. Copper conductor is required for all windings.
- e. Windings that are energized at 15kV and above shall be round, including disk, helical and layer.
- f. Bio-Temp insulating fluid may be used as an alternative to FR3 in transformers that do not utilize pumps.
- g. Transformer sizes shall adhere to IEEE preferred ratings identified in the IEEE standards.

6.8 Outdoor Transformer Installations

- a. The placement of a liquid-filled transformer where its leakage can contaminate a lake, river, aquifer, or other water source shall not be permitted. Liquid-filled transformers of this type include but are not necessarily limited to any transformer filled with mineral oil, Bio-Temp, or FR3.
- b. All jurisdictional laws, federal, state, or local, shall be complied with for any required secondary containment requirements for liquid-filled transformers.
- c. In cases where secondary containment is mandate, each transformer shall have its own containment. Common containment volumes shall not be permitted and containment volumes shall not be constructed to allow burning oil to pool against adjacent transformers or to otherwise expose adjacent transformers to fire damage.
- d. Each containment area shall have a manually operated valve (normally closed) on an outlet for the draining of collected rainwater.
- e. All transformers containing more than 500 gallons of oil shall be sited with spatial separation and/or fire walls in accordance with NFPA 850.

6.9 Medium and Low Voltage Switchgear

- a. Medium Voltage (MV) switchgear, Low Voltage (LV) switchgear, and MV motor starters shall be of Type 2B Arc-resistant construction. Arc-resistant switchgear shall be installed per the guidelines in Annex B of IEEE C37.20.7. Wherever possible it is preferred to vent arc gasses outside of the building.

Specification: GEN4550	Revision: 3	Page 10 of 15
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PUBLIC VERSION

- b. Breaker control switches/pushbuttons shall not be mounted on the circuit breaker doors. Breaker or starter status indication shall be visible without opening the compartment door.
- c. All MV and LV circuit breakers and roll-out medium voltage motor starters shall be capable of being remotely racked in and out without opening the breaker compartment door. The appropriate remote racking mechanism shall be supplied. An on-board racking motor, that permits racking from a remote or local panel without any equipment set-up is preferred. Any local panel for controlling the racking of breakers or starters shall be located outside the switchgear room.
- d. Front doors and rear panels for the main breaker(s), the tie breaker(s), and the dual feed breaker(s) cubicles shall be painted red. A dual feed breaker is any breaker that has the potential to be back-fed from another source.
- e. IR (infrared) windows shall be provided as part of the switchgear-starter assembly such that all cable terminations and buses located in the switchgear's or starter's cable termination compartment can be inspected without requiring the removal of any panel or the opening of any door, including rear doors. "Cable terminations" refers to the terminations of main cables or of feeder cables. The IR window(s) shall not degrade the arc-flash rating of the switchgear or starter.

6.10 Relay Protection and Monitoring Systems

- a. All relays shall be microprocessor based.
- b. All voltage relays shall have sufficient thermal capacity for continuous energization.
- c. The electrical protection system shall be designed to remove a minimum of equipment from service, and readily identify the faulted equipment or system.
- d. The protective relaying system shall be a coordinated application of individual relays and/or multifunction relays.
- e. For each monitored abnormal condition there will exist a designated primary device for detection of that condition. The failure of any primary relay will result in the action of a secondary scheme to detect abnormal occurrence. The secondary relay may be the primary relay for a different abnormal condition.
- f. The protective relay system shall maintain sufficient separation between components so as to eliminate the common failure mode, where a single event can cause redundant equipment to be inoperable. Below are some good engineering practices to follow for providing physical separation:
 - 1) Primary and secondary protection should not be powered from the same power supply.
 - 2) Current and voltage signals should have terminal block space separation.
 - 3) Battery (+) and (-) cables should have terminal block space separation.
 - 4) Power to the protective relaying shall be fused separately from the breaker control (when the breaker's control fuses are pulled, the protective relays shall remain energized).
 - 5) For circuits that extend beyond the main control room, the circuit shall be interrupted by simultaneously breaking both the positive and negative buses
- g. Lockout relays shall be used to receive signal inputs from protective relays and to provide the contacts needed to initiate protective action. All lockout relays shall have a manual reset feature which will require an operator to manually reset the lockout relay prior to returning the affected equipment to service. Lockout relays shall be mounted on the same panel as their associated protective relays. All lockout relay outputs for trips shall have a test switch.
- h. Each protective relay shall be equipped with ABB FT-1 current -shorting switches on all active current circuits or shall be equipped with independent current-shortening terminal blocks or test switches to facilitate testing.
- i. The trip contacts of all circuit breaker protective schemes shall be wired in series with a single-pole ABB FT-1 test switch to disable (open) trip circuits during in-service testing. The test switches shall be front-of-panel mounted with covers. Test switches shall be mounted below the relay.
- j. Satellite clocks shall be provided where required to meet NERC disturbance monitoring and reporting requirements

6.11 Underground Cable Installations

- a. Splices:

Specification: GEN4550	Revision: 3	Page 11 of 15
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- All splices shall be geo-referenced on “As-Built” drawings (CAD) using sub-meter or better GPS locating equipment.
 - Splice kits shall be handled and installed in strict accordance with the manufacturer’s instructions.
 - Only 3M cold shrink splice kits are acceptable, and the installers must either be trained by 3M on site or have an active training certificate acceptable to 3M to ensure that the splices are installed with the utmost quality.
 - Locator balls shall be installed at every splice location. The locator balls in conjunction with the GPS coordinates shall allow for simple and straightforward field location of any splices.
 - Every splice will be field partial discharge tested as defined in IEEE 400.3.
- b. Warning Tape: Red warning tape shall be installed continuously along the underground direct buried cable at least 18 inches above the highest cable in the trench. The warning tape shall be 6 inches wide with “Caution High Voltage”, or similar wording printed along the tape.

6.12 Grounding

- a. Installation care shall be taken to ensure that proper metal-to-metal contact is made at all ground connections. Where painted metal is used for grounding connections, the paint shall be removed to ensure good electrical connection.
- b. Site Fencing: One 4/0 AWG bare solid copper cable shall be buried 3 feet outside the fence at a depth of 3 feet and shall be jumpered to fence post, at 50 foot intervals, with #2 AWG bare stranded copper cable. The #2 AWG Cable shall be extended to connect to the fence mesh and barbed wire. Where the fence leaves the ground grid area, insulated sections shall be provided which are a minimum of 10 feet wide. Ground fittings for fence shall be cast copper alloy with silicone bronze hardware. Copperstrap ground connectors and ferrous hardware shall not be used. The fence ground system shall be tied to the main ground grid with two independent #4/0 AWG ground cables.
- c. Instrument cable shields shall be grounded at one end only to prevent circulating currents. Care shall be taken to extend the continuity and insulation of the cable-pair shields through all field terminal boxes. At points of termination, pair shields and drain wires shall remain on the pair as close to the termination point as is practical. Shields shall be permanently taped to prevent unraveling, and the drain wires shall have insulating sleeves installed up to the point of termination. All shields should be grounded on the controller (DCS or PLC).
- d. All medium-voltage equipment shall have two (2)- #4/0 AWG stranded copper conductor pigtailed connected from the ground grid, structural steel or skid steel to the equipment grounding pads on opposite sides or corners of the equipment. A grounding conductor running with the feeder power conductors is not required.
- e. All low-voltage equipment, including, but not limited to electrical boxes, distribution equipment and associated transformers, shall have one (1) stranded copper bonding conductor, sized according to 1) the largest source breaker rating and 2) NEC Article 250 Table 250.122, connected from the ground grid, structural steel or skid steel to the equipment grounding pads on the equipment. An equipment grounding conductor running with the feeder power conductors is also required.

6.13 HVAC Systems

The Control Rooms shall be provided with an HVAC system to maintain the conditioned space with acceptable indoor environmental conditions suitable for the equipment and any personnel present. The HVAC system shall be designed using the applicable ASHRAE guidelines and standards and shall meet all State and Local Mechanical Building Codes, including the State Energy Conservation Codes. The ASHRAE 0.4%/99.6% Design Outdoor Cooling/Heating Design Conditions, as published in the latest edition of the ASHRAE Fundamentals Handbook (for the nearest location to the project) shall be used for the design. The Indoor Design Temperatures for the Control Room shall be: 74°F ± 2°F (cooling), 68°F ± 2°F (heating).

Specification: GEN4550	Revision: 3	Page 12 of 15
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PUBLIC VERSION

6.14 Fire Protection Systems

- a. Portable fire extinguishers shall be provided in all areas requiring handheld fire protection.
- b. Smoke detection located at ceiling level shall consist of alternating ionization and photoelectric ceiling-level detectors unless air sampling type detection is necessary.
- c. No manual pull stations shall be provided unless required by the authority having jurisdiction.
- d. All fire detection systems shall be supervised by a local fire alarm panel which is UL Listed or FM Approved.
- e. Notification appliances (horns/strobes/bells) external from each local fire alarm panel shall not be provided unless required by the authority having jurisdiction.
- f. All local alarms shall report status of each individual smoke detection zone as well as a common fire panel trouble alarm to the SCADA System and/or be annunciated as a critical alarm condition which is annunciated per the requirements of Section 8 of this specification.
- g. Fire protection during plant construction shall meet requirements and recommendations of NFPA 241.
- h. All fire protection systems are subject to the review and approval of the local fire code authority having jurisdiction.

6.15 Roads

- a. Interior driveways shall be constructed and will provide access to the solar array for maintenance. These driveways shall be 15 feet wide consisting of compacted subgrade and 3 inches of gravel.

7 CONTROL SYSTEM REQUIREMENTS

7.1 Controller requirements

- a. Critical control system equipment will be designed in a fault tolerant manner such that a component failure or a control system power source failure will not disrupt control system functions. Critical control processor cabinets will provide redundant control processors, power supplies, and data highway interfaces. If the system detects a control processor failure, a power supply failure, or a communications failure, the failed equipment will automatically transfer to its back up. In the case of a processor failure, if the backup is not available, the processor outputs will fail to their fail-safe position. Upon a back-up power supply failure, the affected equipment will fail in its de-energized position.
- b. Critical control system equipment will include any controllers that perform essential plant wide functions, such as frequency monitoring and voltage regulation, and/or whose loss would result in a significant loss of megawatts.

7.2 Data Network Requirements

- a. Refer to the OWNER design criteria document DC-ICE-005 - Fleet Control Data Communications Design Criteria for guidelines on network design.

7.3 Uninterruptible Power Supplies

- a. The control systems (controller, engineering stations, operator stations, etc.) shall be served by an Uninterruptible Power Supply (UPS).
- b. On large projects to meet the necessary design requirements, minimize construction costs, control and/or operator interface equipment is usually aggregated in multiple areas. Consider installation of independent/dedicated UPS systems to serve the control equipment in each of these areas. Extension of UPS circuits outside of protection environments of electronic equipment or control rooms is not preferred.
- c. The UPS shall be sized to supply power to its load for 2 hours after loss of its input power.

Specification: GEN4550	Revision: 3	Page 13 of 15
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PUBLIC VERSION

7.4 Trips and Interlocks

- a. All required equipment interlocks shall be shown on equipment vendor logic diagrams. Interlocks implemented in the control system shall be shown on control system logic diagrams. Hardwired interlocks will be shown on elementary and wiring diagrams.

7.5 Safety and Protection Functions

- a. Protective functions shall be designed to be very dependable and be designed to prevent failure to trip and false trips. Protective actions may be initiated based on an event, a threshold value, operator intervention, or an analysis of the plant status. The applicable safety codes governing each application shall be followed.
- b. Protective functions require periodic testing and calibration. The control system design shall recognize and accommodate that requirement.

7.6 Alarming

- a. All alarms that indicate a jeopardized plant operation shall be delivered to, or originated in, the control system, evaluated and sorted according to predefined system groups and alarm severity and annunciated to the OWNER RTU and displayed on the control system Human Machine Interface (HMI) stations. Refer to OWNER design criteria document DC-ICE-015 for additional criteria.

7.7 Operator Human Machine Interface (HMI) Stations

- a. The control system HMIs are to be powered from a UPS system. When there is more than one HMI in a control room, the power feeds shall be from separate sources such that no more than ½ of the HMIs are on one source.

7.8 Engineering Interface

- a. PC based, Windows based engineering workstation (EWS) shall be provided for the control system. The platform shall be the most current available.
- b. Each EWS will be capable of control function manipulation to execute all logic. Each EWS shall be capable of creating or configuring all control system functions.

7.9 Diagnostic Functions

- a. Diagnostic functions shall be provided to identify faulty or failed equipment. The resulting output of diagnostic functions shall be the identification and documentation of faulty or failed control and monitoring equipment or process equipment to the highest level of detail possible.
- b. Maintenance functions shall be provided to identify maintenance requirements, schedule, and provide guidance for all identified plant maintenance activities. The resulting output of maintenance functions shall be the identification and documentation of plant maintenance status, needs, and procedures consistent with the objective of maximum plant availability.
- c. The control system shall include a full set of online self-diagnostics using real time measurements. These shall include but not be limited to: hardware card voltages over/under range, A/D converter offset over range, microprocessor stall (failure), memory check sums/parity validations, communications failures, processor loading excessive, and a set of power up diagnostics.

8 NERC REQUIREMENTS

- 8.1 The CONTRACTOR shall consult with and obtain the approval of OWNER Security Services regarding physical security requirements that must comply with NERC-CIP during the following phases of the project: design, installation, commissioning, and operation.

- 8.2 The CONTRACTOR shall consult with and obtain the approval of OWNER Instrument and Controls Engineering regarding any designs that are governed by NERC-CIP regulations. The approval will ensure

Specification: GEN4550	Revision: 3	Page 14 of 15
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PUBLIC VERSION

compliance with NERC-CIP during the following phases of the project: design, installation, commissioning, and operation.

- 8.3 CONTRACTOR shall consult with and obtain the approval of OWNER regarding NERC Compliance with PRC requirements. The facility needs to be initially tested, have proper protective relay coordination, and have a defined maintenance policy in place that complies with NERC Reliability Standards. These standards can vary depending on whether the facilities are Generation-owned versus Transmission-owned.

9 ATTACHMENTS

OWNER Specification GEN-4018 – “General Specification for Power Transformers”
OWNER Specification DC-ICE-005 – “ Fleet Control Data Communications Design Criteria”
OWNER Specification DC-ICE-015 – “ Fleet Alarm Management Criteria”
OWNER Specification DC-NGDE-002 – “Architectural Design Criteria”
OWNER Specification ESH0000016712 - “Electrical Arc Flash Protection Policy”

Specification: GEN4550	Revision: 3	Page 15 of 15
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PUBLIC VERSION



**ELECTRICAL ENGINEERING
SPECIFICATION
COVER SHEET**

Specification Number: GEN-4018
Revision: 3
Date: December 12, 2013

TITLE: General Specification for Power Transformers

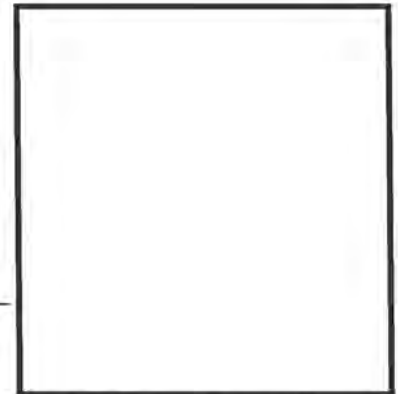
Scope of Changes:

☒

Revision (Full Procedure)

☐

Change Sheet, Affected pages: _____



P. E. Stamp, if required.

Summary of Changes: Updated items throughout the entire specification.

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Specification Owner (Organization): Electrical Systems & Equipment Eng.

Prepared by: Aaron Hinze

Date: December 12, 2013

Reviewed by: Mark Samborsky

Date: December 12, 2013

PUBLIC VERSION

TABLE OF CONTENTS

1. SCOPE.....	5
2. TERMINOLOGY.....	5
2.1 MULTI-WINDING TRANSFORMER	5
2.2 SPLIT WINDING TRANSFORMER.....	5
2.3 PROTOTYPE TRANSFORMER.....	5
2.4 ABBREVIATIONS	5
3. STANDARDS, OWNER'S SPECIFICATIONS AND REFERENCES	5
3.1 INDUSTRY STANDARDS.....	5
3.2 OWNER'S SPECIFICATIONS.....	6
3.3 OTHER REFERENCES:.....	6
4. SERVICE CONDITIONS.....	6
4.1 GENERAL.....	6
4.2 LOADING ABOVE NAMEPLATE MVA RATING.....	6
4.3 GSUT SPECIAL SERVICE CONDITIONS	8
4.4 ENERGIZATION AND DE-ENERGIZATION.....	9
4.5 THROUGH-FAULT WITHSTAND CAPABILITY:	10
4.6 AMBIENT TEMPERATURE.....	10
5. NAMEPLATE RATINGS.....	10
5.1 FREQUENCY	10
5.2 TEMPERATURE RISE AND LOADING CONDITIONS.....	10
5.3 NAMEPLATE RATINGS IN THE ORDERING SPECIFICATION.....	11
5.4 TOLERANCES ON IMPEDANCE	11
5.5 POLARITY, ANGULAR DISPLACEMENT AND TERMINAL ARRANGEMENT.....	12
5.6 INSULATION LEVELS.....	12
6. CONSTRUCTION REQUIREMENTS.....	13
6.1 GENERAL.....	13
6.2 WINDINGS AND CONDUCTORS.....	13
6.3 TAP CHANGER (TC)	14
6.4 LEADS AND SUPPORTS	15
6.5 CLAMPING STRUCTURES.....	15
6.6 CORE REQUIREMENTS.....	15
6.7 BUSHINGS	16
6.8 BUSHING CURRENT TRANSFORMERS (BCTs).....	17
6.9 EXTERNAL CLEARANCES AND DIMENSIONS.....	18
6.10 SURGE ARRESTER (SA) PROVISIONS	18
6.11 BUSHING POTENTIAL DEVICE (BPD) BRACKETS	21
6.12 DISSOLVED GAS MONITOR (DGM)	21
6.13 GROUND CONNECTIONS.....	22
6.14 VALVES AND FITTINGS	23
6.15 GASKETS	23
6.16 TANK CONSTRUCTION	23
6.17 INSULATING OIL.....	26
6.18 INSULATING OIL PRESERVATION SYSTEM (IOPS).....	26

PUBLIC VERSION

6.19 PAINT	26
6.20 FACTORY ASSEMBLY	27
7. AUXILIARIES, CONTROL AND PROTECTION (ACP)	27
7.1 GENERAL	27
7.2 AUXILIARY AND CONTROL POWER	27
7.3 COOLING CONTROLS	28
7.4 COOLING EQUIPMENT	30
7.5 TANK MOUNTED INDICATORS AND DEVICES	31
7.6 DEVICES IN CONTROL CABINETS	34
7.7 WIRING AND TERMINATIONS	35
7.8 CONTROL CABINET (CC) AND TERMINAL BOXES (TB)	39
7.9 DIELECTRIC CAPABILITIES	39
8. DESIGN, PERFORMANCE AND MANUFACTURING REVIEWS	39
8.1 GENERAL	39
8.2 DESIGN REVIEW (DR)	40
8.3 MAGNETIC CIRCUIT	40
8.4 WINDINGS AND LEADS	41
8.5 MAJOR ACCESSORIES	42
8.6 BUSHING DRAW LEAD CONDUCTORS	42
8.7 INSULATION DESIGN EVALUATION	42
8.8 THROUGH-FAULT DESIGN	43
8.9 THERMAL DESIGN AND LOADING	44
8.10 INSULATION PROCESSING	45
8.11 TEST PROPOSAL	45
8.12 EQUIVALENT CIRCUIT PARAMETERS	45
8.13 TRANSIENT MODEL	46
8.14 VERIFICATION OF TRANSIENT MODEL	46
8.15 COMPARISON WITH DESIGN CRITERIA	49
8.16 LOSS MEASUREMENT ACCURACY	49
8.17 GEOMAGNETICALLY INDUCED CURRENT (GIC) CAPABILITY	49
8.18 INSPECTIONS	49
9. TEST REQUIREMENTS	49
9.1 GENERAL	49
9.2 RESISTANCE AND TURN RATIO	49
9.3 DIELECTRIC TESTS GENERAL REQUIREMENTS	50
9.4 FAST FRONT SWITCHING IMPULSE (FFSI) TESTS	52
9.5 SWITCHING IMPULSE (SI) TESTS	52
9.6 LIGHTNING IMPULSE TESTS	53
9.7 APPLIED VOLTAGE (AV) TEST	56
9.8 INDUCED VOLTAGE (IV) TEST	56
9.9 INSULATION POWER FACTOR (IPF) TEST	57
9.10 NO-LOAD LOSS AND EXCITATION CURRENT	58
9.11 AUDIBLE SOUND	58
9.12 IMPEDANCE AND LOAD LOSS	58
9.13 ZERO SEQUENCE IMPEDANCE	58
9.14 TEMPERATURE RISE (TR) TESTS	59
9.15 TESTS ON AUXILIARY, CONTROL AND PROTECTION (ACP) EQUIPMENT	61
9.16 THROUGH-FAULT TESTING	61
9.17 SWEEP FREQUENCY RESPONSE ANALYSIS (SFRA)	61

PUBLIC VERSION

10. TRANSPORTS, HANDLING AND STORAGE	61
10.1 GENERAL.....	61
10.2 FACTORY PREPARATION FOR TRANSPORT.....	61
10.3 DELIVERY OF ACCESSORIES	62
10.4 IMPACT RECORDER	63
10.5 SPECIAL TRANSPORT REQUIREMENTS	63
10.6 OIL DELIVERY	63
10.7 SHORTAGES AND DELIVERY DELAYS	63
10.8 STORAGE	64
10.9 ACCEPTANCE INSPECTIONS AND CRITERIA	64
10.10 UPRIGHTING/RIGGING REQUIREMENTS	64
10.11 GASKETS	64
11. DOCUMENTATION	64
11.1 GENERAL.....	64
11.2 GENERAL DRAWING REQUIREMENTS	64
11.3 DRAWING REVIEW	66
11.4 CORRECTNESS OF DRAWINGS	67
11.5 OUTLINE DRAWING.....	67
11.6 PARTS LIST.....	68
11.7 TRANSPORT OUTLINE	69
11.8 BUSHING OUTLINE	69
11.9 NAMEPLATE	70
11.10 HYDRAULIC SCHEMATIC.....	70
11.11 CONSERVATOR AIR CELL	70
11.12 INSTALLATION DETAILS	70
11.13 CONTROL SCHEMATIC	70
11.14 WIRING CONNECTION DIAGRAM	71
11.15 CABLING DIAGRAM	71
11.16 CONTROL PANEL LAYOUT	71
11.17 BCT CURVES	71
11.18 INSTRUCTION BOOKS (IB).....	71
11.19 PHOTOGRAPHS	74
11.20 CERTIFIED TEST REPORTS	74
11.21 TROUBLE REPORTS	75
11.22 SPECIAL ENGINEERING REPORTS.....	75
11.23 SCHEDULES	76
11.24 NOTIFICATION OF MANUFACTURING AND TESTING STAGES	76

PUBLIC VERSION

General Specification for Power Transformers, GEN-4018

1. SCOPE

This specification covers all generator step-up and plant auxiliary transformers rated 100 MVA and above. This specification shall also apply to other transformers when cited by the Ordering Specification or contract documents.

This specification defines minimum requirements for design, construction, and performance. Seller shall follow good engineering and manufacturing practices to produce a transformer, including accessories, which in conjunction with normal maintenance will provide safe and reliable service through a 40-year life under the rigors of service in an electric utility power system.

2. TERMINOLOGY

2.1 Multi-Winding Transformer

A transformer that has more than two windings per phase. A transformer with a tertiary winding is considered to be a multi-winding transformer.

2.2 Split Winding Transformer

A multi-winding transformer that has at least two windings of identical voltage and power ratings.

2.3 Prototype Transformer

The first transformer of a series having identical design.

2.4 Abbreviations

P.U.	Per Unit
GSUT	Generator Step-up Transformer
AUTO	Autotransformer
OE	Owner's Engineer
EHV	Extra High Voltage (345 kV and Above)
MFR	Manufacturer
DETC	De-energized Tap Changer
IPB	Isolated phase Bus
LTC	Load Tap Changer

3. STANDARDS, OWNER'S SPECIFICATIONS AND REFERENCES

3.1 Industry Standards

3.1.1 Transformer Standards

Standards that apply (in order of precedence) shall be the latest revisions of ANSI/IEEE C57, NEMA TR-1, and IEC 76. The standard revision that applies shall be the latest edition published on the date the contract becomes effective.

PUBLIC VERSION

NEMA TR-1 shall apply only to details not specified by ANSI/IEEE C57, and IEC shall apply to details not specified by ANSI/IEEE C57 or NEMA TR-1. Additional standards referenced by the three standards cited above shall apply in the same order of precedence, i.e. those standards referenced by ANSI/IEEE C57 precede those referenced by NEMA TR-1 and IEC 76.

3.1.2 Standards for Auxiliary, Control and Protection (ACP) Equipment

Standards, which apply, include the latest revisions of ANSI/IEEE C37.90, C37.90.1 and 37.90.2.

3.1.3 Other Standards

Other standards referenced within this specification shall apply with precedence over the IEC Standards only.

3.2 Owner's Specifications

All additional specifications provided by Owner in the request for quotation package shall apply. These shall always include the following AEP specifications and other requirements:

- 1) "Technical Requirements for Power Apparatus Bushings," No. SS-797001 dated August 30, 2013
- 2) AEP Ordering Specification
- 3) "EPFS Operating Instruction Vendor Document Submittal," Rev.0, dated June 8, 2011

3.3 Other References:

Other references in this specification include:

O. Petersons and S. P. Mehta, "Calibration of Test Systems for Measuring Power Losses of Transformers," National Bureau of Standards (NBS) Technical Note 1204, 1985.

4. SERVICE CONDITIONS

4.1 General

Service conditions shall be in accordance with 3.1.1 except as amended in Sections 4.2, 4.3, 4.4, and Ordering Specification.

4.2 Loading Above Nameplate MVA Rating

4.2.1 Loading Conditions

All transformers shall be capable of loading above nameplate MVA rating in accordance with the latest revision of IEEE C57.91. GSUTs shall be capable of loading at 1.1 times their nameplate MVA rating at maximum ambient temperature

PUBLIC VERSION

required in **Section 4.6** for at least 8 hours with a preload of 100% at thermal equilibrium of the nameplate MVA rating. All other transformers shall be capable of loading in accordance with **Table 1**. These loading capabilities shall apply to all transformers for the following conditions: a preload of 90% at thermal equilibrium of nameplate MVA rating, a hottest spot temperature not to exceed 140 °C (referring to long time loading), a top oil temperature not to exceed 110 °C, and a 2 month loss of life per incident.

Table 1
Short Time Minimum Acceptable Loading Capability
P.U. of Nameplate MVA Rating

Ambient Temperature °C	Load in Per Unit of Nameplate Rating (Load Duration in Hours)				
	0.5	1.0	2.0	4.0	8.0
10	1.50	1.45	1.39	1.34	1.31
40	1.26	1.23	1.19	1.15	1.13
50	1.18	1.14	1.12	1.11	1.10

4.2.2 Ancillary Equipment

Ancillary equipment, such as bushings, tap changers, leads, etc. shall not limit the loading capability of the transformer. Seller shall provide Owner with derated MVA rating for loss of a cooler bank.

4.2.3 Loading of Multi-Winding Transformers

4.2.3.1 Input and Output Windings

Multi-winding transformers shall be capable of operation with any combination of winding loads and power flow directions, with the following limitations:

- 1) The arithmetic sum of loading capability(ies) of output winding(s) shall not exceed the arithmetic sum of the loading capability(ies) of input winding(s), as specified in **4.2.1**.
- 2) The loading capability of each output winding shall not be less than the loading capability specified in **4.2.1**.
- 3) Stabilizing delta windings (such as tertiary windings) with external terminals shall be designed for loading capabilities specified in **4.2.1**.

4.2.3.2 Load Phase Angles

For purposes of determining transformer-loading capabilities, all MVA loads shall be considered as in phase with one another. In addition, tertiary windings shall be capable to carry their rated MVA load at any load phase angle between -90° and 90°.

PUBLIC VERSION

4.2.4 Power Flow Direction

Multi-winding transformers shall be designed for power flow in the step down or step up direction with loading capabilities and conditions as defined by 4.2.1 and 4.2.3.

4.3 GSUT Special Service Conditions

4.3.1 Back-Feed Operation

In addition to the usual step-up operation, GSUTs shall be capable of back feed (step down) operation with the high voltage terminals connected to the power grid. During back feed, the low voltage windings and terminals shall be capable of operation under the following non-simultaneous conditions:

- 1) Ungrounded low voltage terminals, disconnected from the generator bus;
- 2) Ungrounded low voltage terminals, connected to the generator bus and associated auxiliary devices (e.g., auxiliary power transformers, potential transformers, etc.), with the ground capacitance of the connected elements (typically 3000 pF per phase) providing the only coupling to ground;
- 3) One low voltage line terminal connected to ground and the remaining low voltage terminal(s) ungrounded and surge arrester terminated.

Conditions (1) and (2) above apply to three phase operation, and (3) applies to either three phase or single-phase operation. Conditions (2) and (3) above shall also be met with step down loading through a range of 0% to 30% of the nameplate MVA rating.

4.3.2 Low Voltage Bus Connection

Unless otherwise specified, GSUT low voltage bushing terminals shall be designed for connection to self-cooled or forced-cooled isolated phase bus (IPB), with the following maximum hottest spot temperatures:

- 1) IPB conductor: 105 °C
- 2) IPB duct air: 90 °C
- 3) IPB enclosure: 110 °C

4.3.3 Operating Capability at Voltages and Frequencies Different from the Nominal Values

Transformers shall be capable of continuous and short time operation at voltages above nameplate rated voltages and at frequencies below nominal 60 Hz. **Table 2** lists minimum acceptable continuous MVA ratings of the primary and secondary windings at V/Hz ratios above 1.0 P.U. for different MVA loads and power factors. **Table 3** shows the minimum acceptable short time V/Hz ratios for unloaded and fully loaded conditions.

PUBLIC VERSION

The tables specify minimum acceptable MVA operating capabilities at several possible V/Hz ratios in order to define a general curve for the operating capability at V/Hz ratios different of 1.0 P.U. The Seller shall insure the required MVA operating capabilities through all possible V/Hz ratios. The frequency range for which the tables apply is 5-66 Hz.

The following example illustrates application of **Tables 2 and 3**. For a load of 1.00 P.U. of maximum nameplate MVA at 0.8 lagging power factor, the overall V/Hz P.U. capability shall be 1.04 for five minutes (**Table 3**, column 3). This value multiplied by 1.125 or 1.07 (**Table 2**, columns 3 and 4) gives the primary or secondary V/Hz P.U. capabilities, respectively. Under this condition, the minimum V/Hz operating capability of the primary (supply) winding and secondary (load) winding shall be $1.04 \times 1.125 = 1.17$ P.U. and $1.04 \times 1.07 = 1.11$ P.U., respectively.

Table 2
Minimum Acceptable MVA Capabilities of the
Primary and Secondary Windings of GSUTs for
Continuous Operation at V/Hz Ratios above 1.0 P.U.

P. U. Load (x Max Rating)	Load Power Factor	Primary V/Hz (1) (x Tap Rating)	Secondary V/Hz(1) (x Tap Rating)
1	0.707 lag	1.125	1.06
1	0.8 lag	1.125	1.07
1	0.9 lag	1.125	1.085
1	0.95 lag	1.125	1.095
1	1	1.125	1.12
0	—	1.125	1.125
1	0.95 lead	1.1	1.125
1	0.9 lead	1.09	1.125
1	0.8 lead	1.075	1.125
1	0.707 lead	1.065	1.125

(1) Maximum Continuous Voltage shall be limited to values given in
Table 5

Table 3
Minimum Acceptable Short Time
V/Hz Ratios for No-Load and
Full Load Conditions

Duration (Minutes)	No-Load Condition (x Tap Rating)	Full Load Condition (x Table 2 Values)
0.1	1.4	1.24
0.25	1.325	1.18
0.5	1.275	1.13
1	1.235	1.1
2	1.2	1.07
5	1.175	1.04
10	1.16	1.03
30	1.15	1.02
60	1.14	1.015
120	1.135	1.01
300	1.13	1.005
≥600	1.125(1)	1

4.4 Energization and De-energization

Transformers shall be capable of being energized or de-energized from any set of terminals as dictated by system operation requirements with or without load connected. The latter case will occur during system protective maneuvers such as line fault interruption and/or reclosing operations. Transformers shall also be capable of withstanding transients that may occur when fault currents are interrupted and/or chopped by the switching device used for transformer protection. Arresters will be connected at transmission line terminals during transformer operation. The characteristic of the switching device(s) to be used in conjunction with the transformer is available from OE upon request.

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4.5 Through-Fault Withstand Capability:

The transformer will experience numerous through faults during its service life. The through fault withstand capability shall be in accordance with ANSI/IEEE C57.12.00. Data provided in Table 4 shall be used in the calculation of the transient and steady state values of the through faults. The X_1/R_1 ratio used in the through-fault calculations shall be equal to the transformer X_1/R_1 ratio or the values given in **Table 4**, whichever is greater. The fault at one terminal may be supplied from one or both unfaulted terminals of a multi-winding transformer.

Table 4
System Parameters Specification for Through-Fault Conditions

Nominal System, kV	Minimum X_1/R_1 Ratio	Asymmetrical Peak Factor, K	X_0/X Ratio
765	65	2.762	0.6
500	65	2.762	0.6
345	50	2.743	0.6
230	65	2.762	0.6
161	65	2.762	0.4
≤138	65	2.762	0.4

4.6 Ambient Temperature

The transformer shall be capable of operation through an ambient temperature range of -30 °C to +50 °C unless modified by Ordering Specification.

5. NAMEPLATE RATINGS

5.1 Frequency

The rated (nominal) frequency shall be 60 Hz.

5.2 Temperature Rise and Loading Conditions

5.2.1 Winding Rise

The average winding rise over ambient at nameplate MVA shall not exceed 65 °C. The winding hottest spot temperature rise shall not exceed 15 °C above the measured average winding rise. Hottest spot of internal leads and crossovers shall not exceed the winding hottest spot.

5.2.2 Oil Rise

The top oil temperature rise over ambient shall not exceed 65 °C.

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5.2.3 Temperature Rise of Metallic Parts

The hottest spot temperature rise above ambient of metallic parts in contact with solid insulation other than those covered by 5.2.1 shall not exceed 80 °C. LV connections and bushing turrets shall not exceed maximum IPB temperatures described in 4.3.2. The rise above ambient of other metallic parts in contact with oil, including the tank, shall not exceed 100 °C at rated MVA.

5.2.4 Loading Conditions for Temperature Rise Limits

The loading conditions for which the above temperature limits apply shall be as described in applicable standards. The above temperature limits shall also apply for the operating conditions described in 4.3.3.

5.3 Nameplate Ratings in the Ordering Specification

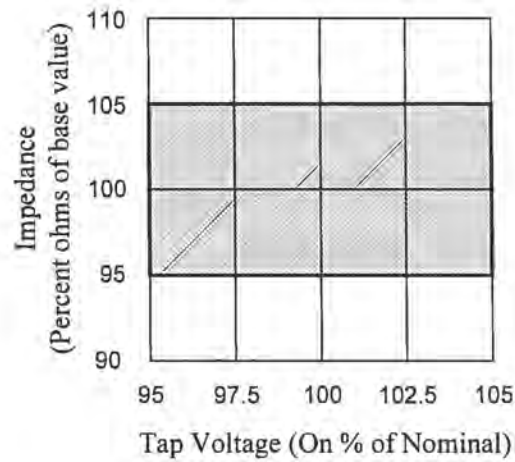
The Ordering Specification shall indicate at least the following nameplate ratings:

1. Cooling Class
2. Number of phases
3. Number of windings per phase
4. MVA rating for each type of cooling
5. Voltage ratings and taps
6. Connections
7. Impedance value at each voltage tap position
8. CT ratio and ANSI accuracy

5.4 Tolerances on Impedance

The following requirement shall be met if specified either in the Ordering Specification or the request for bid letter: For any given tap voltage, the measured ohmic values of the HV/LV short-circuit impedance shall be within the 5% tolerance range specified **Figure 1**. The ohmic value of the HV/LV impedance at center tap in the Ordering Specification is the base impedance (the 100% value at the rated tap). For instance, a 450 MVA, 339/137.5 kV transformer with 10.5 % impedance has a HV/LV base impedance of 26.8 ohms at rated tap.

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Allowable Tolerance Range for HV/LV Impedance

Figure 1

5.5 Polarity, Angular Displacement and Terminal Arrangement

5.5.1 General

Same phase winding polarity shall be subtractive. Angular displacement between phase voltages and the physical arrangement of the terminals (bushings) shall conform to applicable standards.

5.5.2 Single Phase Rating

Transformers with high voltage winding ratings 500 kV and above shall be of single-phase construction.

5.6 Insulation Levels

Table 5 specifies the relationship between minimum acceptable winding and bushing insulation levels and nominal system voltage. Minimum BIL of all neutral terminals and their bushings shall be 200 kV for grounded wye connected windings.

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Table 5
Minimum Acceptable Insulation Levels at Line Terminals

Nominal System Voltage (kV rms, w-w)	Maximum Continuous Voltage (kV rms, w-w)	Minimum Winding/Bushing BIL (kV crest)
765	840	2050
500	551	1550
345	381	1050
230	253	900
161	177	750
138	152	650
69		350
46		250
34.5		200
25		200 ⁽¹⁾
≤15		200 ⁽¹⁾

(1) Applies to GSUTs with this nominal LV rating. These terminals shall be capable of 27.5 kV rms, continuous line-ground. Transformers other than GSUTs with nominal 25 kV windings/bushings shall have a 150 kV BIL, and 15kV or less windings/bushings shall have 110 kV BIL.

6. CONSTRUCTION REQUIREMENTS

6.1 General

This section describes general construction requirements. Construction requirements, in general, and accessories, in particular, be specified in the latest revision of ANSI C57.12.10, exceptions being when this specification, the Ordering Specification or ANSI C57.12.00 specifies different requirements. **Section 7** covers requirements for control and protection equipment and associated enclosures. In some specific cases, **Section 6** allows for the substitution of specified material by the term "or approved equivalent." If Seller proposes use of an equivalent, OE must be advised of the proposed change in writing. OE will either approve or disapprove the substitution in a written response. All material used or proposed for use in the transformer shall be tested and shall have passed the transformer oil compatibility test using the method outlined in ASTM D3455. All material shall be subject to rigid quality assurance and control standards and material quality assurance reports shall be made available upon request. The Seller shall have complete traceability on all material from receiving until final installation in the transformer.

6.2 Windings and Conductors

6.2.1 Materials and Winding type

Aluminum conductor material shall not be used for the windings or leads. Copper conductor is required for all windings. Windings shall be round, including disk, helical and layer. Layer windings shall have cooling liquid in direct contact with all turns.

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6.2.2 Joints in Windings

Joints are permissible at locations external to the windings, specifically at crossovers between layers or disks. A joint is defined in this context as the physical joining of two or more separate winding conductors by means of welding, brazing, soldering, and crimping. Internal joints, i.e., joints made within the body of the winding layer or winding disk, are not permissible unless the joint involves a single strand of a multiple (at least five) strand conductor.

Seller shall have an effective quality assurance procedure for verifying that conductors are free from defects in joints and that conductor burr, nicks or indentations, dimensional tolerances and mechanical strength are within acceptable limits for the application.

Design of conductor joints and connections shall limit circulating currents and overheating such that abnormal aging or deterioration does not occur when the apparatus is operated within the scope of service conditions specified.

6.3 Tap Changer (TC)

The TC(s) design and application shall provide for the utmost reliability under all service conditions.

6.3.1 Dielectric Requirements.

The voltage withstand capability between TC contacts and between any contact and ground shall be greater than the worst case stress which would appear across the same points during impulse tests specified in **Section 9.6**. This design requirement applies to the condition where specified tests are performed at a tap position that results in the greatest stress in the TC. The power frequency voltage withstand capability of the tap changer between contacts and from each contact to ground shall likewise take into account the tap position during induced tests which results in the greatest stress between points.

6.3.2 Ampacity Requirements

The TC ampacity shall exceed that of the transformer under the service conditions specified in **Section 4**.

6.3.3 Thermal Requirements.

Insulation materials used in the TC shall be capable of operation in oil temperatures commensurate with the loading conditions specified in **Section 4**, without abnormal deterioration of their mechanical or dielectric properties.

6.3.4 Mechanical Requirements

TCs shall not be mounted on the tank wall, cover, or other location subject to deflection due to vacuum evacuation of the tank, or mechanical forces encountered in transport or service.

PUBLIC VERSION

The drive mechanism shall have the following characteristics: operates easily, prevents incomplete tap change or movement beyond highest/lowest positions, prevents operation while energized, provides clear indication of current tap position, and provides for padlocking of the drive mechanism. A single tap changer operating mechanism is preferred. The drive mechanism handle shall be easily accessible, clearly visible and located at a practical height. If more than one drive mechanism is necessary, warning plates shall be located on or near each mechanism advising the operator that both mechanisms must be changed. Bolted connections to the tap changer shall be made with multiple hole pad connectors. Single or slotted hole connections are not acceptable. A notice on the main transformer nameplate is also required.

The TC design shall be such that contact pressure is not diminished during through-fault events.

6.4 Leads and Supports

Leads and lead supports shall be designed for all dielectric, mechanical, and thermal effects that could be encountered. The design shall not permit permanent deflection of supports and leads due to forces acting on the lead during transport or service. Tap leads and series or parallel crossover leads and supports shall be designed to provide significant safety margins above the worst case dielectric stresses which would occur during specified impulse and power frequency tests, as though specified tests were performed at each tap position. Similarly, line leads shall be designed to provide reasonable safety margins during these conditions.

Wooden members used for core, coil or lead supports shall be free from knots and other defects.

6.5 Clamping Structures

Clamping structures shall be designed for all dielectric, mechanical, and thermal effects that could be encountered. All transformer board required for the clamping structure shall be a composite material. Laminated wood is not acceptable.

6.6 Core Requirements

6.6.1 Burr Size

Maximum allowable burrs on a slit or cut edge of the electrical steel used in the core shall be less than the thickness of the insulation on the electrical steel laminations. Excessive slit edge damage during manufacture may result in rejection of the core.

6.6.2 Maximum Temperature

Maximum core temperature rise above top oil temperature rise is 20°C at rated voltage.

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6.6.3 Grounding

Magnetic cores shall be directly grounded without any impedance or fuse-like elements connected in series.

All transformers shall have core grounds established outside the tank using a bushing with removable external ground connection. The main core shall be independently grounded. Auxiliary cores shall be tied together internally and the ground lead extended through a single separate bushing.

Either a NEMA 3R terminal box with removable cover or a suitable guard structure shall be used to protect core ground bushings and connections located on the tank wall from environmental and physical damage. The core ground bushing stud shall be at least 0.5 inch diameter. An easily removable copper strap shall be provided for the external ground connection. A warning plate shall be provided near this bushing stating, "Core Ground Must Always Be Connected When Equipment Is Energized."

6.7 Bushings

6.7.1 Applicable Specifications and Standards

Bushings shall conform to AEP Specification No. SS-797001 - Technical Requirements for Power Apparatus Bushings, and the latest versions of ANSI/IEEE Standards C57.19.00 and C57.19.01. For bushings less than 34.5 kV, minimum acceptable winding and bushings insulation levels listed in Table 5 shall be used.

6.7.2 Bushing Draw Lead Capability above Nameplate Rating

The MVA capability of bushing draw leads shall be at least 110 % of the transformer's maximum MVA nameplate rating and shall not limit the ability of the transformer's loading above nameplate MVA, as specified in **Section 4**. Seller shall provide information pertaining to draw leads per **Section 8.6**.

6.7.3 Lower End Connections

Bolted connections to the lower end of bushings shall be made with multiple hole terminals, tangs or spades. Single or slotted hole connections are not acceptable.

6.7.4 Draw Lead Conductor

The minimum draw lead conductor size shall be in accordance with the curves shown in **Figure 2**.

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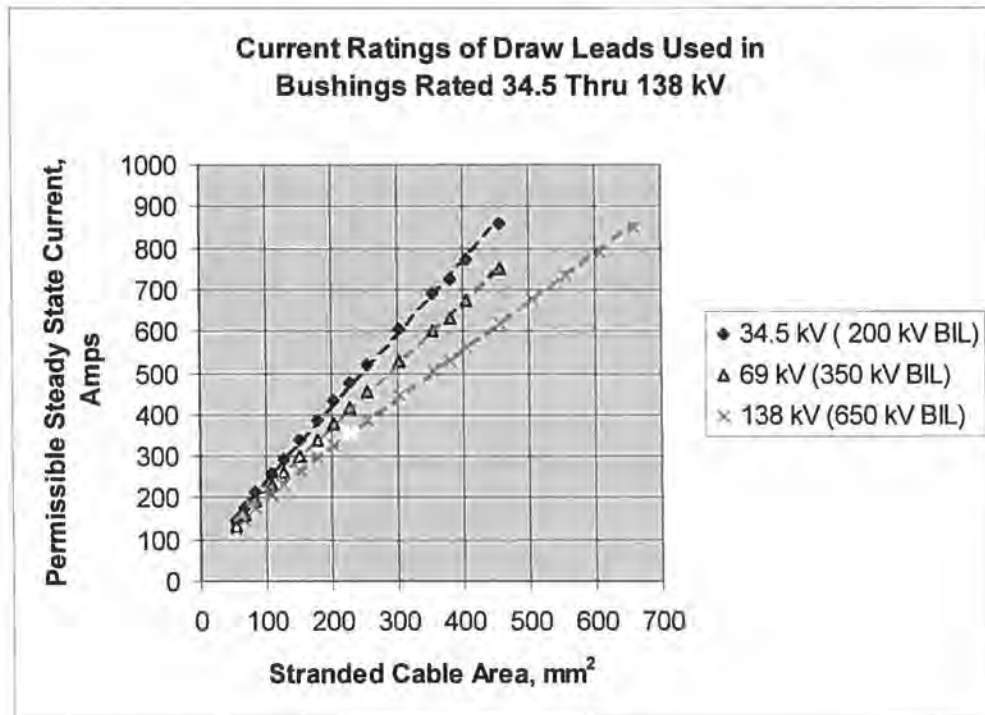


Figure 2
Recommended Cable Current vs. Cable Area

6.7.5 Top Terminal

The top terminal of all bushings rated 138 kV and above shall be capable of withstanding a moment of 800 ft-lbs applied while the terminal is installed on the bushing. The resultant loading shall not cause permanent deflection of the terminal or the bushing.

All top terminals with threaded studs on bushings rated greater than 1600 A shall have top terminals with 4 in. (102 mm) minimum useable thread length.

6.7.6 Bushing Stud Connectors

A NEMA 4-hole bushing stud connector, tin-plated, shall be supplied with each bushing. Exception: stud connectors not required for low voltage terminals on GSUTs.

6.8 Bushing Current Transformers (BCTs)

BCTs shall conform to ANSI/IEEE C57.13. They shall be mounted inside the transformer and shall be 5-tap multi-ratio unless otherwise specified.

PUBLIC VERSION

Conductor for BCT secondary windings and leads shall have continuous ampacity of 10 amps on any tap for all anticipated top oil temperatures during loading conditions specified in **Section 4**. Further details of wire gauge and insulation are specified in 7.7.2.

6.9 External Clearances and Dimensions

Table 6 specifies phase-ground and phase-phase clearances for each nominal operating voltage. This table also specifies required clearance between the top shed of the insulator of bushings of different phases. Phase-ground clearances shall also apply between terminals of different voltage levels, from live-part to live-part between the higher and lower voltage bushings. When calculating this clearance, assume the top of the lower voltage bushing cap extends 18 in. (457mm) higher to allow for typical cable connections to that bushing. **Table 6** does not apply to the bushing strike distances, which are the Seller's responsibility.

Table 6
Minimum External Clearances for Bushings

Nominal System Voltage	Metal-Metal Between Live Part and Ground		Metal-Metal Between Live Parts of Different Phases		Between Top Sheds of Bushing Sheds of Different Phases	
	(in)	(mm)	(in)	(mm)	(in)	(mm)
(kV)						
765	188	4775				
500	144	3658				
345	89	2261	100	2540	95	2413
230	63	1600	89	2261	71	1803
161	44	1118	57	1448	52	1321
138	37	939	(3)	(3)	(3)	(3)
69	23	585	(3)	(3)	(3)	(3)
46	15	381	(3)	(3)	(3)	(3)
34.5	12	305	(3)	(3)	(3)	(3)
25	8	203	(3)	(3)	(3)	(3)
15	6	153	(3)	(3)	5	127
≤5			(3)	(3)	(3)	(3)

- NOTES: 1. The values in column two will also apply for clearances between bushings of different voltage levels.
2. The values in columns three and four shall be met simultaneously.
3. These values shall be per Table 11 of IEEE Std. C57.12.00 for power transformers.

6.10 Surge Arrester (SA) Provisions

SAs shall not be supplied with the transformer. However, the related items specified in 6.10.1 through 6.10.3 below shall be provided.

6.10.1 Mounting Brackets

Tank mounted brackets for SAs shall be supplied on all high voltage side bushing terminals for GSUTs of all voltage classes. This requirement does not apply to

PUBLIC VERSION

terminals that are specified to be within a bus duct enclosure or low voltage terminals of GSUTs.

SA mounting brackets shall be spaced to provide phase-to-phase (centerline-centerline) and phase-to-ground (metal-metal) clearances specified in **Table 7**. **Table 7** also specifies minimum arrester heights (live part to ground). The bracket shall be positioned to ensure that the top terminal of the associated bushing is not higher than the minimum SA height.

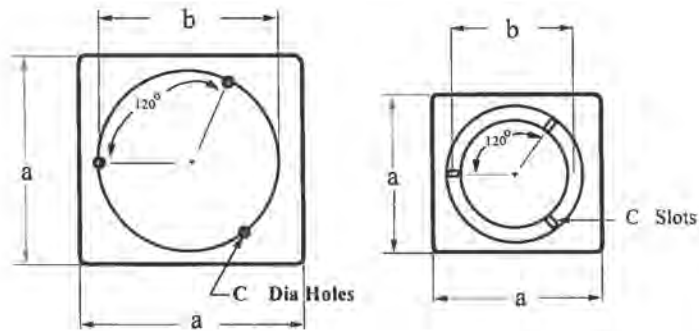
Table 7
Minimum Clearances for Arresters

Nominal System Voltage	Phase-Phase		Phase-Ground		Minimum Arrester Height	
(kV)	(in)	(mm)	(in)	(mm)	(in)	(mm)
765			195	4953		
500			147	3602		
345	120	3048	95	2413	115	2921
230	92	2337	72	1829	86	2184
161	87	2210	60	1524	81	2057
138	70	1778	60	1524	60	1524
88	60	1524	50	1270	50	1270
69	40	1016	30	762	31	787
46	30	762	25	635	25	635
34.5	25	635	20	508	20	508
23	20	508	18	457	18	457
15	16	406	15	381	15	381
4	15	381	9	229	12	304

NOTE: The above clearances are for the arrester top metal terminals. Arresters for 345 kV and higher voltage systems may be made up of sections in which case the arrester column would have metal flanges equally spaced along the arrester.

Mounting brackets and plates shall be fabricated and drilled by Seller per **Figure 3** and **Table 8** to accommodate the SA's bolt circle diameter and support the arrester's weight. **Figure 3(a)** applies to terminals rated 500 kV and above and **Figure 3(b)** for all other terminal ratings. **Table 8** specifies minimum mounting base plate size and weight capacity for a given nominal operating voltage.

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a) 500 kV and above (b) 345 kV and below
Arrester Mounting Bracket Detail
Figure 3

Table 8
Arrester Mounting Plate Size and Weight Capability

Nominal System Voltage (kV)	Minimum Plate Square, a		Mounting Flange Figure	Bolt Circle Diameter, b		Hole/Slot Size, c		Minimum Weight Capacity	
	(in)	(mm)		(in)	(mm)	(in)	(mm)	(lbs)	(kg)
765	25	635	2a	20	508	0.81	21	4000	1814
500	21.5	546	2a	16.5	419	0.81	21	2400	1089
345	18	457	2b	10	254	0.62 x 1.18	16 x 30	1250	568
230	18	457	2b	9.38	238	0.62 x 1.44	16 x 37	600	273
161	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	575	263
138	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	560	255
88	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	425	194
69	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	420	191
46	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	196	90
23 & 34.5	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	113	52
4 & 15	12	305	2b	9.38	238	0.62 x 1.44	16 x 37	70	32

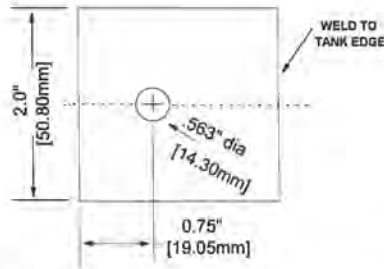
6.10.2 Arrester Ground Pads

Transformers shall have one two hole NEMA ground pad located on the tank cover near each SA mounting bracket. Holes in pads shall be 1/2" UNC. Stainless steel pads are acceptable.

PUBLIC VERSION

6.10.3 Cable Clamps

Clamps sized for #4/0 AWG cable shall be provided for each SA for Owner's installation of ground lead. The preferred method is to provide the 2" square tang, drilled to accommodate mounting clamps shown in **Figure 4**. These clamps should be located toward the right edge of the tank wall on which the SA brackets are mounted and spaced no more than 24 in (610 mm) apart.



Cable Clamp for Mounting Cable Figure 4

6.11 Bushing Potential Device (BPD) Brackets

Brackets for BPDs shall be supplied on transformers for each phase rated 138 kV and above. Brackets shall accommodate General Electric type KA-108 BPD and shall be located such that the centerline of the BPD is 60 ± 6 in. above the transformer base.

6.12 Dissolved Gas Monitor (DGM)

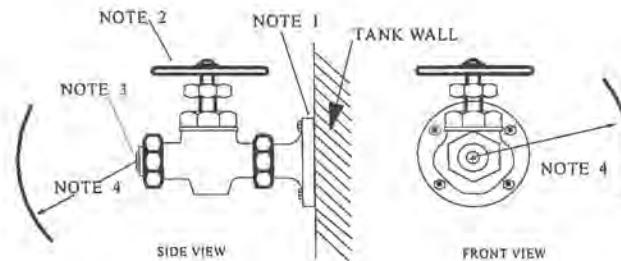
Plant auxiliary transformers shall require the Calisto 2 or GE Hydran M2, while generator step-up transformers require the Kelman Transfix/Hydran M2 system. The associated part numbers are listed below. The Calisto 2 and Kelman Transfix shall be located on the same side of the transformer as the control cabinet and the centerline of the DGM shall be 60 ± 6 inches or can be located on a separate stand provided by the OEM.

Model	Part Number	Description
Calisto 2	020-CALIS	Dissolved Gas Monitor
	003-PROBE	Precision Oil Temperature Probe
	SCAL-005	Isolation Valves
	HOS-00020	S.S. All Metal 3/8" ID Flexible Hose XX' Inlet and 20' Outlet Hose
Hydran M2	Hydran M2	Dissolved Gas Monitor
	16529	Qty. 2, 4-20mA Output Cards
	17046	Serial Ethernet Port (10/100T)

PUBLIC VERSION

Transfix	Transfix 1.6	Dissolved Gas Monitor
	COMM01018	Ambient Temperature Sensor
	COMM01010	DNP3 over RS485
	13-0256-01	Modbus ASCII/RTU over RS485 (2 or 4 wires)
	12398	Qty. 1, Analog input card PT1000 Temp Sensor
		External Magnetic Mount Temp Sensor (4-20mA)
	24-0316-01	Sun Canopy
	COMM010087	16 Analog Outputs, 4-20mA

Seller shall provide two entry ports for the Kelman Transfix and Calisto 2, one for supply and the other for return. The supply port shall be located near the top of the transformer, while the return port shall be located near the bottom of the transformer. Seller shall provide one entry port for the Hydran M2. The ports shall allow access through the tank wall by means of an external cut coupling with 1 1/2 in. NPT threads and a matching pipe plug. The ports shall be located in a safely and easily accessible area when the transformer is energized, in an area of low electrical stress and of moderate to low, but not stagnant, oil flow. A 1 1/2 in. gate type valve shall be provided for each entry port. **Figure 5** illustrates the required arrangement of the entry ports and valves. At least 9 in. (229 mm) clearance to other transformer components shall be provided to allow for installation, removal or maintenance.



NOTES:

1. VALVE MAY BE MOUNTED VIA FLANGE OR ON MINIMUM LENGTH NIPPLE
2. 1 1/2" (BRONZE) GATE VALVE
3. 1 1/2" NPT PIPE PLUG
4. 9" MINIMUM CLEARANCE TO OTHER COMPONENTS

Dissolved Gas Monitor Entry Port Detail

Figure 5

6.13 Ground Connections

6.13.1 Tank Ground Pads

Four NEMA two hole ground pads for #4/0 AWG bare copper conductor shall be provided for tank grounding. A pad shall be located near each corner of the tank not more than 15 in. (381 mm) above the base. Holes in pads shall be 1/2" UNC. Stainless steel pads are acceptable.

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6.13.2 Neutral Lead Clamping

For three phase units, clamps shall be provided to support Owner supplied #4/0 AWG bare copper conductor from neutral bushing down the tank wall. Single-phase transformers shall have clamps equally spaced but for use with an insulated neutral cable of #4/0 AWG size. 0.5 in. diameter threaded studs with 13 threads per inch, at least 1 in. (26 mm) long and spaced not more than 24 in. (610 mm) apart shall be used to allow adequate flexibility for various applications. These clamps should be located on the tank wall immediately below the neutral bushing or near a corner of the tank. Clamps can be mounted using tangs described in 6.10.3.

6.14 Valves and Fittings

Gate type valves shall be used for all valve applications except as described below. For radiators without pumps, flapper type valves are permissible on individual radiators provided that they allow complete isolation from the tank even when frequently used. Flapper valves are not acceptable for applications where multiple radiators feed into a manifold. Globe type fill and drain valves are permissible. Flapper valves are acceptable for isolating Buchholz relays.

Valves and fittings used for oil and gas piping shall be applied to retain their functional integrity throughout the life of the transformer even with frequent use. Pipe fittings and connectors shall be reusable and of heavy-duty construction. Valves shall be mounted on flanges with grooved retainers for gasketing. All valves shall have metal-to-metal internal seats. Valves and fittings shall have English unit dimensions and shall be manufactured in the USA.

6.15 Gaskets

Compressible gaskets shall be suitably retained in machined grooves. Metal stops or wire type gasket retainers shall not be used. Gaskets shall be Nitrile rubber except for the following special applications: Gaskets for high temperature flanges (above 110 °C maximum), flanges for bushings which are connected to a bus enclosure, or flanges for high current bushings (above 3000 Amps) shall be of fluorocarbon or fluorosilicone material, such as "Viton" or "Fluorel."

Gaskets shall maintain proper compression and effective seal throughout all operating temperatures and pressures that may be experienced under the service conditions specified in Section 4. Gaskets shall be made without joints. However, if a one-piece gasket is not available, the gasket shall have a vulcanized scarf joint. Butt splice joints are not acceptable.

6.16 Tank Construction

6.16.1 Tank Cover

The tank cover shall be welded to the main tank in combination with a suitable means to provide a complete seal at the tank/cover interface.

PUBLIC VERSION

6.16.2 Tank Base

The tank base shall be designed to allow the transformer to be supported permanently by wood ties, steel beams, or concrete piers of 8 in. (203 mm) minimum width and spaced in a parallel fashion on a flat concrete foundation or directly upon a flat concrete foundation. Specific details will be identified in Ordering Specification.

6.16.3 Shipping Height Restrictions

Preferred maximum shipping height of transformers is 150 inches (3810mm). Exceptions must be approved by the OE. In order to obtain minimum practical shipping height, accessories located on top of the transformer should be removed or removable. Items such as: Arrestor brackets, CT termination boxes and core ground bushings shall not become the item that determines shipping height.

6.16.4 Jacking Points

Jacking points shall be in accordance with ANSI C57.12.10 except for transformers of weights over 200,000 lbs. (90,718 kg), the dimensions in Figure 3 of C57.12.10 shall be changed to A = 16 in. (406 mm) and B = 5.5 in. (140 mm). Pads shall be conveniently located, free of interference with ground connections, base supports, etc. Pads shall be supported against the main tank by at least two structural supports and shall be designed to support a fully assembled, oil-filled transformer. Transformer design shall be such that jacking points shall be accessible when the transformer is completely assembled.

6.16.5 Tank Shielding

Transformers that have currents in leads or bushings in excess of 3000 A shall have special provisions to shield the tank from the magnetic flux due to these high currents. Flux shunts, conducting screens or special tank wall construction shall be considered and the best solution to mitigate tank overheating shall be implemented.

6.16.6 Manholes

Manholes shall be provided for access into the tank. These manholes shall provide an opening of at least 20 in. (508 mm) diameter. If the manhole is not round, the minor and major dimensions shall be at least 18 in. (457 mm) and 22 in. (559 mm), respectively.

Manholes shall be located to provide reasonable access for internal inspection and maintenance, and to permit replacement of LV bushings without requiring personnel to entering tank.

6.16.7 Mounting for Fall Protection or Confined Space Rescue Equipment

Two (2) 9 in. x 9 in. plates with details and dimensions per **Figure 6** shall be welded to the tank cover for the purpose of attaching tether poles or confined space rescue equipment. Whenever possible, these plates shall be located near the manholes in the manner shown in **Figure 7**.

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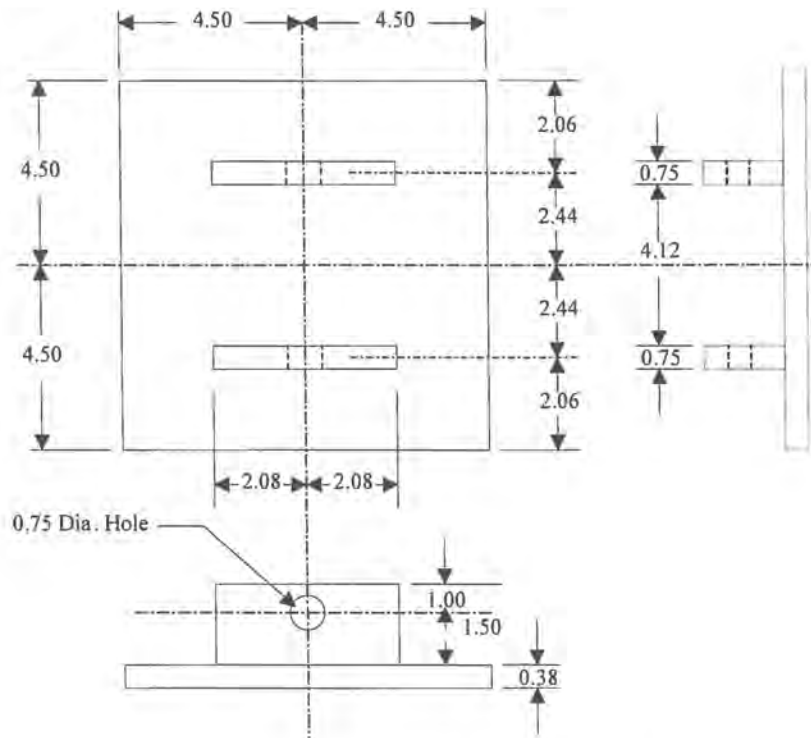


Figure 6
Plate Welded to Tank Cover for Attaching Tether Pole
or Confined Space Rescue Equipment

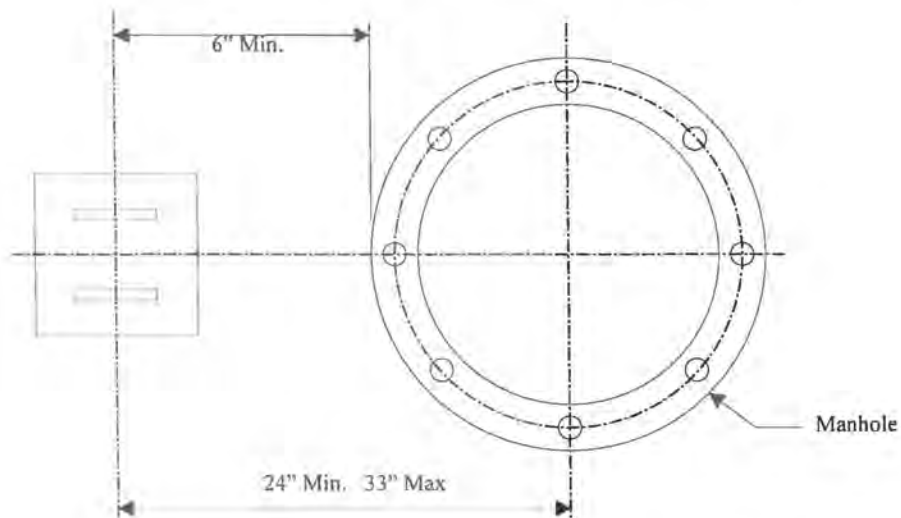


Figure 7
Placement of Welded Bracket Shown in Figure 6

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6.17 Insulating Oil

6.17.1 Oil Characteristics

Seller shall certify that: 1) the insulating oil used in factory testing of the apparatus contains no detectable PCBs; and 2) the unit is PCB free. In addition, when Seller releases separate orders for delivery of oil for the subject apparatus, Seller must require the oil supplier to certify, upon delivery to the Owner's site, that the fluid contains less than 1.0 mg/kg (1.0 ppm) PCB. Certification shall be determined in accordance with Method ASTM D4059-86, Analysis of Polychlorinated Biphenyls in Mineral Insulating Oils by Gas Chromatography, or latest revision. Upon request, Seller shall provide a report of all cleaning and filling procedures including analytical tests and quality control measures to assure conformance to such specification.

6.17.2 Oil Specification

Approved suppliers of oil are identified in the Ordering Specification. Oil shall meet DOBLE Transformer Oil Purchase Specification which is more specific than Appendix D of ANSI C57.12.12. The Doble modified corrosive sulfur test, ASTM D 1275-03 shall be performed. Seller shall also provide a copy of their oil specification in the Instruction Book.

6.17.3 Oil Specimen

Upon OE's request, seller shall ship an oil sample, taken from each tanker truck prior to oil fill of transformer, in a four quart, non-returnable glass containers for test at the Owner's Laboratory or Laboratory of choice

6.18 Insulating Oil Preservation System (IOPS)

The IOPS shall function over a top oil temperature range of at least -30 °C to +120 °C and shall accommodate oil volume changes during all operating conditions cited in **Section 4.2**. All transformers shall be equipped with a conservator/diaphragm IOPS with an air cell and dehydrating breather. The IOPS shall maintain an oil level under the above conditions such that the transformer's highest oil-filled points (e.g., bushing adapters, gas detector, mechanical relief, etc.) are kept at atmospheric or greater pressure at all times.

The minimum diameter of the pipe connecting the expansion tank to the main tank shall be 3 in. (77 mm). Nonmetallic flexible hose is not acceptable. The air cell mounting shall permit access, especially during initial installation and oil filling, by a 0.375 in. (10 mm) diameter wooden rod used to confirm the oil level. Seller shall provide temperature correction curves for the proper oil level below the air cell flange in the instruction book/assembly instructions. The conservator shall not be located on the same segment as the line terminals.

6.19 Paint

Tanks and fittings shall be painted "Sky Blue Gray" as described by Munsell No. 5.0 BG 7.0/0.4 or ANSI 70. The surface shall be prepared to remove all contamination or residue

PUBLIC VERSION

by solvent washing. The following paint applications are required (in order): One rust inhibiting prime coat, 0.002 in. (0.05 mm) dry thickness; two finish coats, 0.002 in. (0.05 mm) dry thickness each. Hence, the aggregate film thickness of primer and finish coats shall be 0.006 in. (0.15 mm). Contamination of the paint with water, oil or other materials shall be avoided. Paint shall not be applied to surfaces which are above 50 °C, or when ambient air temperature is below 5 °C during painting or expected to fall below 0 °C before the paint dries.

Touch-up paint shall be provided along with the appropriate MSDS(s) for post installation.

6.20 Factory Assembly

The transformer shall be completely assembled in the factory to: insure that all parts are available, functional and fit correctly; to verify adequate electrical clearances during testing; and to allow OE to inspect the assembled transformer at the time of factory test.

7. AUXILIARIES, CONTROL AND PROTECTION (ACP)

7.1 General

ACP accessories and devices shall be made in the United States or Canada, with English units, so that replacement parts can be easily obtained. Sellers wishing to use other accessories and devices shall prepare a written request to OE including a proposed substitute and a brief description of the reason for substitution. The OE shall then approve or deny the requested substitution within a reasonable time. Since substitutions may be rejected by OE, it is recommended that Seller submit such a proposal at the bid stage or as early as possible after he has received a contract.

Removal of any ACP equipment (except for oil level indicators) shall not require draining oil from the main tank. All items in contact with the oil shall have isolating (gate) valves such that minimal oil is lost in order to remove the item.

7.2 Auxiliary and Control Power

Owner will supply two sources of auxiliary ac power for fans and pumps externally. The Ordering Specification will indicate the power source configuration available. Each supply shall be of sufficient capacity to supply all coolers and associated control circuitry. Seller's ac auxiliary equipment shall be suitable for operation through a range of $\pm 10\%$ of the auxiliary supply voltage specified by the Ordering Specification. Seller shall include on control schematic maximum power requirements and starting currents that power sources must supply.

The Ordering Specification shall state the available dc control and annunciation power provided by Owner. Seller's dc equipment shall be suitable for operation through a range of 80 to 112 % of the voltage specified in the Ordering Specification.

A separate 120VAC source shall be supplied by customer to power ancillary equipment such as temperature and gas monitoring systems.

PUBLIC VERSION

7.3 Cooling Controls

Seller shall provide a control scheme (see Figure 8 for an example) as specified in the Owner's control elementary drawing identified in the Ordering Specification. If cooling class is not specified, the Seller shall indicate the proposed type of cooling and request the appropriate cooling schematic drawing from the Owner.

Owner will provide a second (or emergency) source of auxiliary power (per Section 7.2). Seller shall supply suitable controls for time-delayed automatic transfer, in the event of loss of one of the power sources. The automatic transfer switch shall be mechanically interlocked, with undervoltage and overcurrent protection, and fault isolation in accordance with the latest revision of the Owner's control elementary. The time delay shall be provided by an Agastat type 7012 relay provided by the Seller.

The control circuit shall be arranged both electrically and physically such that a single fault shall not cause the loss of more than half the cooling system. Alarms shall be provided to indicate loss of either power supply at any time. A barrier will separate the duplicate power supplies.

The cooling equipment shall be controlled by the winding hot-spot temperature relays as specified in 7.5.3.2. No dc relays shall be used in the cooling control circuits.

One-half of the cooler groups, "Group 1", shall have as its normal supply the first Owner supplied power source. The other half of the cooler groups, "Group 2", shall have as its normal supply the second Owner supplied power source. Each cooling group's fans shall be divided into subgroups with breakers provided for each subgroup. The subgroup cannot exceed one-fourth of the cooling group. When less than four fans are used per cooling group, each fan shall have its' own breaker.

Each pump or fan motor 2.0 Horsepower (HP), or larger, must have its own individual NEMA rated full-voltage, non-reversing (FVNR) magnetic motor starter with integral thermal overload relay. Each starter must be supplied with two N.O. and two N.C. auxiliary contacts.

A three position selector switch shall be provided by the Seller for cooling fan and pump operation and shall be mounted at a convenient elevation in the control cabinet, 45 to 66 in. (1145 to 1675 mm) above the base of the transformer. This switch shall be provided with "Group 1", "Manual", and "Group 2" positions such that it allows the Owner flexibility in what cooling banks are in operation. For instance, if "Group 1" were selected, Group 1 cooling group would be operational and Group 2 would be triggered from the winding hot spot and top oil temperature monitor in 7.5.3.3 and vice versa. "Manual" shall allow both Group 1 and Group 2 cooling banks to be operated simultaneously. The selector switch shall be operable by hand with no tools required

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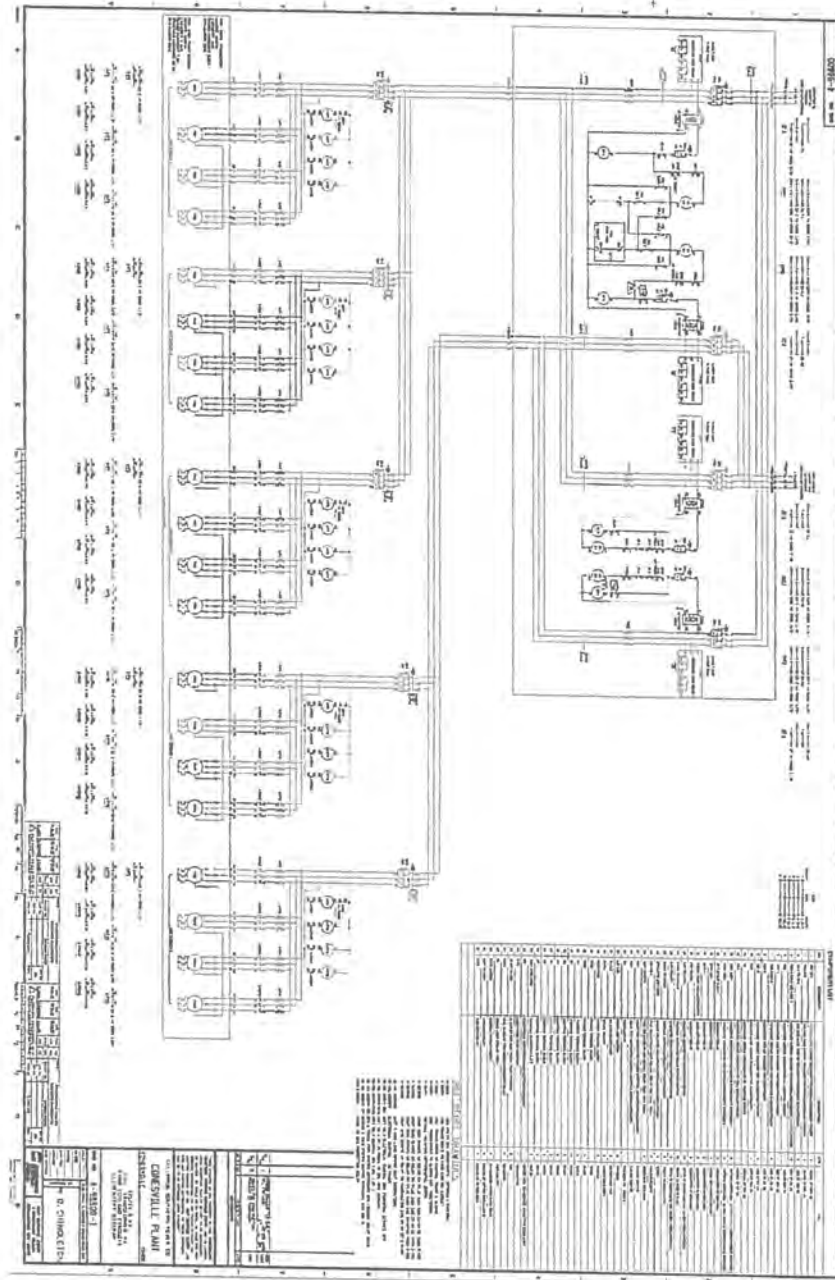


Figure 8
Typical Cooling Elementary

PUBLIC VERSION

7.4 Cooling Equipment

7.4.1 General

All cooling equipment shall be suitably designed and applied for both continuous and intermittent operation, outdoors, in a harsh environment, rated for 50°C ambient temperature, and shall be capable of simultaneous operation at any time without restrictions. All fan and pump motors shall be "across the line" start induction motors.

7.4.2 Fans and Fan Motors

Fan motors shall conform to the latest revision of NEMA MG-1-10.37 and shall have these physical features: NEMA frame sizes with unaltered mounting dimensions and shaft extensions; totally enclosed, fan-cooled (TEFC) construction; steel end bells; corrosion resistant paint; copper conductors in both rotor and stator windings; service factor of 1.15 or greater; class F insulation or better; heavy duty external leads with crimped connections to stator winding leads; ball bearings with a V-ring shaft slinger and a shaft lip seal. If vertically mounted, they shall be designed for the added thrust loading which results. Fan motors shall not have centrifugal switches or internal thermal protection elements. Fans shall be mounted on a hinged swing panel for ease of maintenance. Unifin, ForZair™ or OE approved equivalent shall be provided.

Fan blades shall not be subject to fatigue or deterioration from the operating environment described in 7.4.1. Blades of an epoxy bonded fiber material or similar synthetic compound shall not be used unless suitable means have been made to protect them from ultraviolet light degradation.

7.4.3 Pumps

When forced oil cooling is used, Seller shall supply a valve on either side of each pump which allows the pump to be isolated without removing main tank oil or the oil in the remainder of the cooler and piping connected to each pump. Pumps shall have metallic sleeve bearings and shall be located at the inlet side (top) of the coolers. Preferred pump designs are J.W. Harley or Harley by Cardinal with a TecSonics bearing wear-indicating system. Pumps shall be designed to run continuously to avoid wear from cycling the pumps on and off.

7.4.4 Motor Connections

Power cables from pump and fan motors shall be provided with connectors that allow simple disconnection and are located not higher than 72 in. (1830 mm) above the tank base.

7.4.5 Coolers and Radiators

Valves shall be provided for isolating and removing each cooler or radiator and, where applicable, the cooling pumps.

PUBLIC VERSION

7.5 Tank Mounted Indicators and Devices

Table 9 specifies ACP devices that Seller shall provide as well as requirements for contacts and mounting heights of device gauges. The design, location, mounting and wiring of tank mounted indicators and devices shall be such that vibration does not result in their damage or malfunction. Temperature indicators shall have quick disconnection cables located at an accessible height. Terminal points shall be provided for each contact in the control box. All indicators shall be installed in such a manner that they are unobstructed by coolers or other devices and are readable from ground elevation.

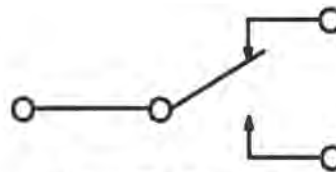
Capillary tube devices shall be suitably mounted and guarded to avoid damage during transport, installation, maintenance, and service conditions.

Some devices are specified in **Table 9** to have a form "C" contact. A schematic description of this contact is shown in **Figure 9**. If a "C" contact is not available, one A (Normally Open, N.O.) and one B (Normally Closed, N.C.) contact can be substituted to provide the functionality of **Figure 9**.

Table 9
Control and Protection Device Requirements

Device	Contact Description	Mounting Height of Gauge Face	
		(in)	(mm)
Oil level gauge	1 - Form C	On conservator	
Oil flow indicators (forced-oil cooling only)	1 - Form C	At Cooler Port	
Oil temperature gauge	1 - Form C	45-70	1143-1778
Winding temperature gauge	4 - Form C	45-70	1143-1778
Winding hot spot and top oil temperature monitor	10 Relays Programmable	45-70	1143-1778
Mechanical pressure relief device	1 - Form C	Top cover	
Bucholz relay	1 - Form C	N/A	
Calisto 2	5 - NO/NC	N/A	
Hydran M2	4 - NO/NC	N/A	
Kelman Transfix	8 - NO/NC	N/A	

PUBLIC VERSION



Form "C" Contact
Schematic Description
Figure 9

7.5.1 Oil Level Gauge

Contacts shall be wired directly into the control cabinet. QUALITROL is the preferred brand.

7.5.2 Oil Flow Indicators

Vane type oil flow indicators are required for transformers with forced oil cooling and shall be located at the bottom (discharge) end of the coolers. Differential pressure flow indicators are not acceptable. Flow indicators shall be selected and applied such that they provide correct flow indication throughout all ranges of service conditions specified. QUALITROL is the preferred supplier.

7.5.3 Temperature Indicators

7.5.3.1 Oil Temperature Gauge

Oil temperature gauge shall have two separate adjustable output contacts for "high" alarm and "extra high" alarm temperature indication. QUALITROL is the preferred supplier. This gauge shall also be used to alarm as described in 7.6.5.

7.5.3.2 Winding Temperature Gauge

Winding temperature gauge shall have at least two separate adjustable output contacts for "high" alarm and "extra high" alarm temperature indication. QUALITROL is the preferred supplier. This gauge shall also be used to alarm as described in 7.6.5.

7.5.3.3 Winding Hot Spot and Top Oil Temperature Monitor

The required winding hot spot and top oil temperature monitor is a QUALITROL ITM (Intelligent Transformer Monitor) with 120 Vac supply, 4 to 20 mA analog output range, and analog readout. ITMs shall be either separate enclosures or mounted in the control cabinet with a glass in the control cabinet door such that the readout can be read without opening the door. Model numbers are shown in **Table 10**. Winding

PUBLIC VERSION

temperature indicators shall be provided in each phase of GSUT bank comprised of single-phase transformers or in the center phase of three-phase transformers. Multi-winding transformers shall have one winding temperature indication for each winding. Calculated winding temperature is preferred using CT compensation.

The QUALITROL ITM shall be used to initiate the cooling groups as prescribed in **Section 7.3**. The QUALITROL ITM shall also be used to alarm as described in **7.6.5**.

Table 10
Style Numbers for QUALITROL Analog Display, 120 VAC Supply Electronic Temperature Monitors

Type of Transformer		Number of Currents	Panel Mount	Separate Enclosure
Three Winding	1 and 3 Phase Multi-winding	3	ITM509-00047577	ITM509-00047581
Two Winding	1 Phase and 3 Phase GSUs, Two Winding Transformers	1	ITM509-00047578	ITM509-0047584

Note: All monitors have 4-20 mA output

7.5.3.4 Temperature Settings

Set points and temperature settings of the contacts associated with temperature indicators shall be as shown in **Table 11**.

Table 11
Set Points and Settings of Contacts Associated with Temperature Indicators

Set point	Description	Temperature Settings (°C)	
		ONAN/ONAF/ONAF	OFAF/OFAF
1	Liquid Temperature High	95	
2	Liquid Temperature Extremely High	105	
3	Cooling Group 1	80	
4	Cooling Group 2	90	75
5	Winding Temperature High	115	
6	Winding Temperature Extremely High	130	

7.5.4 Mechanical Pressure Relief Device

QUALITROL Type XPRD is the preferred device.

7.5.5 Buchholz Relay

Approved Buchholz relay types are QUALITROL VEM-EMB Type 9-25-315 or a Siemens Buchholz. Buchholz relays shall have an 80 mm bore, 160 mm mounting

PUBLIC VERSION

bolt circle with 18 mm bolt holes and shall have one normally open and one normally closed contact on the lower switching system.

The device shall be furnished without seal-in relays, and mounted in accordance with the relay manufacturer's recommendations.

7.6 Devices in Control Cabinets

7.6.1 General

Design, location, mounting and wiring of ACP devices in the control cabinet shall be such that vibration does not cause damage to or malfunction of the devices. The power supply connections shall be either guarded or suitably located to prevent a shock hazard to personnel working on the control box. To accomplish this, devices shall be grouped together according to their voltage and the ampacity of their associated cables such that higher voltage devices and high ampacity conductors/terminations are grouped together in one section of the cabinet away from the low power devices operating at lower voltages. Additionally, devices that are energized at 260 V and above shall be shielded by transparent barriers which facilitates visual inspection of the equipment but yet guards against accidental contact or flashover initiation while working on the low power or low voltage equipment.

7.6.2 Device Mounting

No control and protection equipment shall be mounted directly on the cabinet's external walls. Suitable mounting plates shall be provided for mounting all equipment. These plates shall not be mounted with fasteners that penetrate the cabinet wall. All devices, wiring and terminals in the cabinet shall be accessible while the transformer is in operation. As much as practicable, the devices and terminals should be within reach from the ground level, without a ladder.

7.6.3 Device Characteristics

All devices are subject to approval by OE. Some relays and other devices are specified by the Owner's control elementary, 7.6.4, 7.6.5, and Table 13. The following additional device characteristics are specified:

- 1) Circuit breakers shall be thermal magnetic type. Motor circuit protectors (MCPs) are acceptable alternatives to circuit breakers for individual motor loads.
- 2) Motor starters for loads above 2 kW shall be NEMA rated full-voltage, non-reversing (FVNR) magnetic starters and shall have eutectic type thermal overloads.

7.6.4 Control Switches

GE SB1 or Electroswitch 24 Series shall be provided.

PUBLIC VERSION

7.6.5 Fuses

All fuses shall be Bussman Superlag renewable type. Minimum current rating shall be 5 A except for protection of electronic components. Glass cartridge type fuses to 10 A may be used in electronic panels for non-critical applications.

7.6.6 Auxiliary Relays

GE Century type HGA auxiliary relays shall be provided for all of devices listed in **Section 7.5** except the oil flow switches and the sudden pressure switches.

An Agastat type 7012 \bar{x} D (where \bar{x} is a variable dependent of the voltage specified in Ordering Specification) relay shall be provided for the flow switches. A flow switch for each pump shall be wired in series with a N.O. contact from the respective pump. This series combination for each pump shall then be paralleled with all other pumps for the transformer. This parallel combination shall be wired in series with the coil of the Agastat relay mentioned above.

A GE Century type HGA auxiliary relay shall be provided to monitor the voltage of the power sources for the cooling control. N.C. contacts from each of the Normal and Emergency voltage relays shown in Owner's control elementary drawing shall be used to alarm on loss of either power supply discussed in **Section 7.3**.

HGA Century type auxiliary relays shall be provided for each of the winding temperature, oil temperature, and system state outputs of the ITM device provided for under **7.5.3.2**.

HGA Century type auxiliary relays shall be provided for alarm outputs, including system fail, of the gas monitor device that is specified in the Ordering Specification.

All of the above mentioned HGA and Agastat relays shall have a contact wired in parallel to form an alarm bus. A GE Century type HGA auxiliary relay shall be provided to monitor the alarm bus voltage. A two (2) pole breaker shall be provided for supply of this alarm bus. Customer will provide the power source for the alarm bus. One (1) N.C. contact from each of the HGA and Agastat relays shall be wired in parallel and then this parallel combination shall be wired in series with a red indicating light for alarm indication. This light is to be located locally at the control panel. In addition, terminal points are to be provided for remote alarm indication. The second N.C. contact from each of the HGA and Agastat relays is to be wired to terminal blocks for use with the plant annunciators. Voltage rating of the relays will be specified in the Ordering Specification.

7.7 Wiring and Terminations

7.7.1 General

All wiring shall be brought to a central control cabinet, in a neat and orderly arrangement, suitably protected from weather, dust, vibration, electric and magnetic fields (EMF), mechanical and thermal damage. Control and instrument wiring, alarm leads and BCT tap leads shall be terminated at terminal blocks

PUBLIC VERSION

located in the cabinet. No splices are permitted in the BCT or control circuits. All wiring for transformer mounted devices shall be installed in rigid galvanized conduit or shall be interlocked armor.

7.7.2 Wire Gauge

BCT secondary leads and wiring shall be 600 V, stranded copper, 125 °C, Tefzel, or approved equivalent insulation. Minimum acceptable wire size shall be 14 AWG for BCT secondary leads. Other power wiring shall be 600 V, stranded copper, 90 °C, cross-linked polyethylene (XLP), or approved equivalent insulation. Minimum acceptable wire size shall be #12 AWG for power wiring. All other protection and control wiring shall be 600 V, stranded copper, 90 °C SIS or approved equivalent. Minimum acceptable wire size shall be # 16 AWG for electronic devices. Note that these are minimum sizes. Proper sizing must consider loading and ambient conditions. The National Electrical Code (NFPA 70) is recommended for guidance.

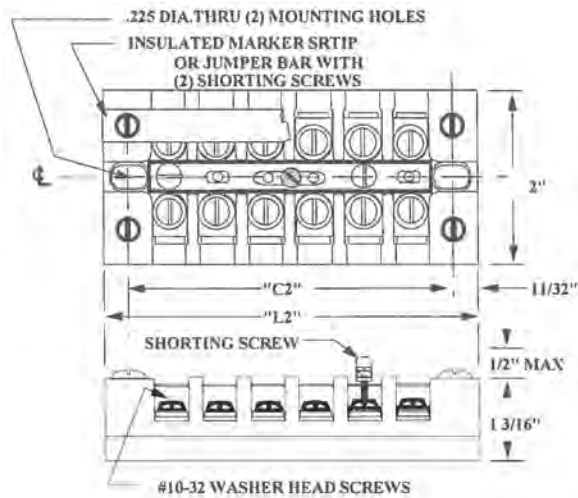
7.7.3 Connection Terminals

All terminations shall be made with insulated, eye type, extruded barrel, and compression connectors. Required connection terminals are Burndy type YAEV-10 or their approved equivalent. Should smaller conductor be permitted for special applications YAEV-14 terminals or approved equivalent shall be used. Connectors with split barrels, or for light duty, or of appliance or fork type terminals are never acceptable. All compression terminations shall be made with the tool specified by the connector supplier.

7.7.4 Terminal Blocks

All terminal blocks shall be removable screw or stud type. Compression type blocks are not acceptable. Short-circuiting type terminal blocks shall be furnished for shorting and grounding all BCT leads. Non-short circuiting type terminal blocks shall be furnished for terminating all control and protection leads. Only approved terminal blocks, as listed in **Table 12**, are permitted for control and protection. Substitutions will not be accepted unless approved in writing by OE. **Figure 10** details the physical dimensions of the approved control terminal blocks.

PUBLIC VERSION



Number of Points	Dimensions (in)	
	C2	L2
4	3-1/8	3-3/16
6	4-7/16	5-1/8
8	5-3/4	6-7/16
12	8-3/8	9-1/16

Terminal Block Dimensions

Figure 10

Three-phase power terminal blocks for maximum loads above 30 A shall be Marathon type 1433561-CU, 3-pole, 230 A block with a 3/8" stud on the source side and a 1/4" stud on the load side with clear plastic cover.

Table 12
Approved Control Terminal Blocks

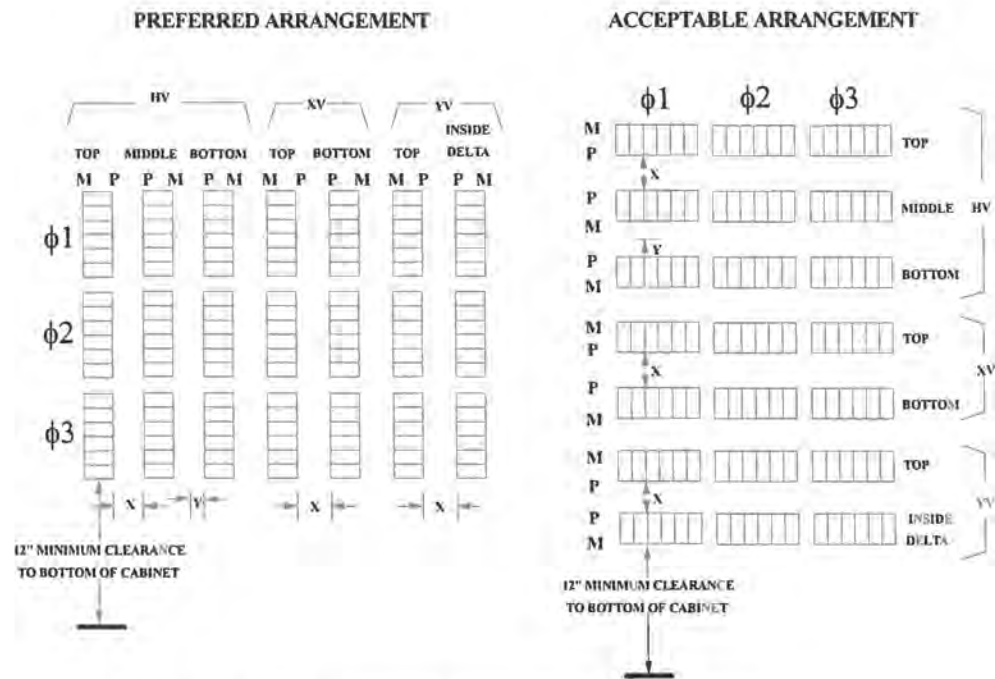
Number of Points	BCT Leads		Control and Protection Leads	
	<u>(Short-Circuiting Type)</u>		<u>(Non-Short-Circuiting Type)</u>	
	Penn-Union Catalog Number	Marathon Catalog Number	Penn-Union Catalog Number	Marathon Catalog Number
4	6004-SCS	1604920	6004	1604921
6	6006-SCS	1606920	6006	1606921
8	6008-SCS	1608920	6008	1608921
12	6012-SCS	1612920	6012	1612921

Note: **Figure 10** shows the physical detail of terminal blocks with the above catalog numbers.

7.7.5 Terminal Block Arrangement

BCT blocks shall be assigned specific locations and have individual identifications in the control cabinet and shall be arranged in one of the two acceptable methods shown in **Figure 11**, preferably in the arrangement shown on the left-hand side. The "top" BCT position is the one nearest to the external terminal and the "bottom" position is nearest the winding. A minimum clearance of 12 in. (305 mm) is required between the bottom of the terminal blocks (specified in **Section 7.6.4**) and the bottom of the control box. Minimum clearance between terminal blocks shall be as specified in the table of **Figure 11**.

PUBLIC VERSION



M indicates the side for Seller's connections to terminal blocks.
P indicates the side for Owner's connections to terminal blocks.
X is the clearance required for Owner's connections when Owner's sides of parallel terminal blocks are adjacent.
Y is the clearance required between the Manufacturer's wiring and the end of terminal block used for Owner's connections.
X and Y are specified below:

No. of Terminal Points in Column/Row	Minimum Allowable Dimensions			
	"X"		"Y"	
	In	mm	In	Mm
Less or equal to 18	6	155	4	105
19 - 36	6	205	5	130
Greater than 36	10	255	6	155

BCT Terminal Block Arrangement in Control Cabinet
Figure 11

PUBLIC VERSION

7.8 Control Cabinet (CC) and Terminal Boxes (TB).

7.8.1 General Requirements

The Seller shall abide by IEEE C57.148 Standard for Control Cabinets for Power Transformers. If there is a conflict between this specification and IEEE C57.148 this specification shall take precedence. The CC and TB shall be NEMA 3R ventilated enclosures with dust filters. The enclosure shall be large enough for unclamped wiring with sufficient heat rejection capability.

The CC shall be shock mounted if the peak-to-peak vibration of the wall on which it is mounted exceeds 100 microns.

The bottom of CC must have a gasketed removable solid plate covering an opening of at least 6 x 12 in. (152 x 305 mm). No valves or other devices shall be located under this plate. This area is reserved for control and power cable conduits entry into the CC.

7.8.2 Heaters and Lights

All CCs shall be provided with strip heaters centrally located in the lower quarter of the cabinet to evenly distribute the heat within CC. For extended life, heaters shall operate at 50% of their 240 V rating. Heaters shall be sized to provide an output of 2 W/ft² (22 W/m²) of exterior cabinet surface area while operating at 120 V. Heaters shall be guarded, equipped with reflective backing and protected with fuses per 7.6.4. Heaters shall be thermostatically controlled to operate whenever the cabinet temperature is 30 °C or below. The thermostat shall be located near the middle height of the CC.

Door actuated, incandescent, convenience lights and GFI protected power receptacles shall be provided for operation at 120 Vac. Fluorescent lights are not acceptable. The lights and heaters shall be brought to terminal points. Owner will supply power from an external source.

7.9 Dielectric Capabilities

In addition to the requirements specified by ANSI/IEEE Standards C37.90, C37.90.1 and C37.90.2, ACP equipment shall have dielectric capabilities commensurate with 9.16.

8. DESIGN, PERFORMANCE AND MANUFACTURING REVIEWS

8.1 General

Seller shall design the transformer such that it performs satisfactorily under all the service conditions specified in **Section 4** with its referenced standards and guides in addition to any further service capabilities specified in the Ordering Specification. Seller shall also define the actual performance characteristics of the transformer to demonstrate that it meets or exceeds these requirements.

PUBLIC VERSION

Information required in this chapter shall be submitted according to the following schedule:

- 1) At Design Review: All data specified in **8.3-8.11, 8.15-8.18**
- 2) Within 8 weeks after Design Review: Design Review report specified in **8.2**, modeling parameter portions of **8.12**; the model of **8.13**; and any additional clarifications requested during Design Review.
- 3) Within six weeks after shipment: Verification and evaluation requirements of **8.9, 8.12.2, and 8.14.**

8.2 Design Review (DR)

A Design Review (DR) is required for all prototype transformers within the scope of this specification. Seller's designer(s) shall meet with OE to review the basic design of the transformer. This DR meeting shall be held after the basic design has been established, but before manufacturing begins.

The primary intent of the DR is to allow OE to gain an understanding of design practices applied to transformers being supplied to Owner by Seller. All information obtained in the DR will be held in strict confidence. It is not intended that the DR would cause modifications to the design. However, should it be discovered that Seller has not complied with the specified requirements in the contract, the Seller must make those changes necessary to comply with all contract specifications.

Seller's representative shall notify OE of a reasonable date for a DR meeting at least two weeks in advance for Sellers in the continental U.S. and four weeks for others. Pre-design contract reviews are encouraged in order to clarify requirements for both parties. At OE's discretion, Seller shall, in lieu of a DR meeting, provide a written submittal of the required information subject to OE's review and comment.

Further requirements covered within this Specification or the Ordering Specification may be discussed at the DR, and Seller shall be prepared with details of how they will meet or exceed such requirements. Seller shall prepare a written report summarizing the details covered at the meeting and submit them to OE for review within eight (8) weeks of the date of DR. Tabulations of all data shall be included.

Seller shall identify procedures that ensure dry air is maintained during transport at the DR.

8.3 Magnetic Circuit

Seller shall provide the following data at the DR:

- 1) Number of core limbs
- 2) Core window dimensions
- 3) Spacing of core limbs
- 4) Equivalent diameter or cross-sectional area of limbs/yokes
- 5) Material description: thickness, grade, supplier, laser-etched, etc.
- 6) General description of core manufacture and assembly

PUBLIC VERSION

- 7) General description of core face lamination design used to minimize temperatures in this region
- 8) Thickness and material of lamination insulation
- 9) Oil duct and/or solid insulation description
- 10) Method of binding limbs together and clamping yokes
- 11) Description of inactive part (clamps)
- 12) Grounding of active and inactive parts
- 13) Measures used to minimize circulating currents and stray losses in the inactive part
- 14) Total core weight
- 15) Flux density distribution in limb/yoke for nominal and maximum excitation
- 16) Core temperature rise and flux distribution in each core limb/yoke for nominal and maximum excitation
- 17) Flux shielding locations, design and construction
- 18) Maximum residual flux, in % of nominal excitation
- 19) Maximum burr height allowed on lamination edge.

8.4 Windings and Leads

Seller shall provide the following data at the DR:

- 1) Winding circuit schematic diagram
- 2) Winding layout, including coil types for each winding (disk, layer, helical, pancake, etc) Number of turns in each disc, layer, or pancake
- 3) Physical location of taps, crossovers, and static, turn and ground shields
- 4) Number of discs, layers or pancakes in each winding
- 5) General description of conductor arrangement in each disc, layer or pancake
- 6) General description of any transpositions and interleaving used
- 7) Number and size of axial and radial spacers used in circular windings
- 8) Inside and outside diameters, and compressed height of each circular winding
- 9) Inside and outside dimensions of each rectangular pancake section
- 10) Compressed height of each winding package in shell form transformers
- 11) Dimensional spacing between each winding package in shell form transformers
- 12) Diameters and physical description of each winding tube in core form transformers
- 13) Number of insulating barriers between windings and the thickness of each barrier and oil gap
- 14) Description of the cooling fluid path within the winding structure and a range of the fluid flow and heat transfer rates.
- 15) Identification of the special materials and methods, e.g., high strength, continuously transposed, or bonded conductors, high strength winding tubes, high density pre-compressed spacers, etc.
- 16) Clamping structure description, including materials used for phase blocking, end rings, pressure plates and special components or systems used
- 17) Basic description of static, ground and other dielectric shields
- 18) General description of where winding conductor joints are permitted and quality control procedures employed to ensure their integrity
- 19) Lead construction, including support, shields and barriers
- 20) Electrical and physical details of connections between adjacent windings, including connections between windings, crossover leads and connections to bushings
- 21) Variable resistors or semi-conducting elements used to protect the winding(s).

PUBLIC VERSION

8.5 Major Accessories

Seller shall provide descriptions and data at the DR for major accessories:

- 1) Bushings, including shielding and the design tests that have been performed on the bushings
- 2) Details of connections to the bottom end of bushings, including the number of leads, bolt arrangement and sizes
- 3) Tap changer, including basic construction and dielectric, thermal, ampacity and mechanical capabilities
- 4) Current limiting reactors, including basic construction and impedance characteristics.

8.6 Bushing Draw Lead Conductors

Seller shall provide the following information regarding the bushing draw lead conductors:

- 1) Diameter of draw lead conductor
- 2) Thickness and material of insulation on draw lead conductor
- 3) Maximum continuous operating temperature of insulation on the draw lead conductor
- 4) Continuous loading capability of the draw lead conductor, with its insulation, inserted into the bushing.
- 5) CT's

8.7 Insulation Design Evaluation

Seller shall describe insulation design details at the DR. Calculated transient (high frequency) and low frequency dielectric stresses with commensurate design capabilities shall be provided for all tap positions for all operating conditions defined in **Section 4** for the locations listed below and all dielectric tests defined in **Sections 9.3 - 9.7** and **Section 9.9**. The basis of the calculations shall be stated for all analyses. Additional calculated values for conditions or tests required by the Ordering Specification shall be included in the insulation design evaluation analysis. If the prospective impulse wave shape voltages during testing do not meet the requirements stated in **Section 9**, then calculated data shall be provided for both the required and the prospective wave shapes. This information shall be used to determine the most stressful operating situations and the no-load tap settings required for dielectric tests. Under these conditions, the magnitude and location of dielectric stresses and the associated withstand capabilities shall be provided for the following regions or conditions:

- 1) Dielectric stresses in the most highly stressed regions of oil, including leads and bottom region of EHV bushings
- 2) Dielectric stresses in windings including the following:
 - a) kV to ground of each terminal
 - b) kV to ground of each node (defined below)
 - c) kV differential between adjacent nodes
 - d) kV differential across each high-low space
 - e) kV differential between adjacent line, crossover and tap leads
 - f) kV differential between critical leads and adjacent discs or layers

PUBLIC VERSION

- 3) Voltage wave shapes producing the dielectric stresses in 1) and 2) above
- 4) Description of how design limits were developed and applied.

The nodes referred to in 2) are defined as follows: a) the winding terminals and the connection points between the layers for a layer type winding, b) the winding terminals and the connection points between the disks representing no more than 10 % of the total number of turns for a disk type winding, c) the winding terminals at the middle of the winding cylinder for a helical type winding.

Seller shall provide a cross-section sketch of the transformer assembly. Each major region of the insulation structure (i.e., main gap between windings, shielding and/or ground insulation at winding ends, inner winding to core, outer winding to tank, axially along windings, and around all EHV and tap leads) shall be identified with the test or operating condition which is most critical to its dimensioning and design. A brief summary of the dielectric stresses in the critical regions for each test or operating condition shall be included on or with the sketch.

Seller shall supply dielectric capability curves in graphic and Microsoft Excel spreadsheet form.

8.8 Through-Fault Design

Seller shall describe the through fault design at the DR as specified below:

8.8.1 Generated Forces

A summary of calculated forces generated during all possible external faults on each winding at all tap positions. For each type of fault, the total force acting in each direction and on each winding shall be given. Local maximum pressures shall also be given. All assumptions and estimated parameters used to compute these forces shall be included in the summary.

8.8.2 Failure Mode Analysis

A summary of the worst case mechanical stress in each winding, and a description of the design and construction used to withstand this stress, for each of the following mechanical failure modes: hoop buckling, axial compression, clamping failure, hoop tension, beam bending and mechanical resonance. A sketch shall be provided which shows the various regions of the windings and the type of fault that dictates the winding strength in that region.

8.8.3 Structural Support

Seller shall provide a description of the axial and radial loading of the windings and support structure.

8.8.4 Winding Preparation

Seller shall provide detailed description of all preliminary coil sizing and stabilization procedures, including preload clamping pressure applied to windings and the clamping system used. This description shall include pressures,

PUBLIC VERSION

temperatures and drying processes, time, dimensional tolerances allowed, and the purpose for each step in the winding preparation.

8.8.5 Leads and Supports

A summary of worst case forces acting on all leads and crossovers. The ability of these leads and their supporting structures to withstand these forces shall be described.

8.8.6 Through-Fault Temperatures

The worst-case temperatures that occur in each winding, and the condition which causes these temperatures, and the mechanical properties of the conductor materials at these temperatures, shall be described.

8.8.7 Supporting Evidence

Evidence shall be provided to support the Seller's design approach. Certification of successful short-circuit test experiences with full-sized transformers shall be reviewed in detail as it relates to contemporary design practice. Design strength of materials used and design margins over the levels tested in the certified designs shall be presented. The effect of manufacturing processes on these materials' strength shall be described, e.g., the effect of conductor joints, use of epoxy bonded conductors, winding treatment during drying, preliminary winding compression, etc.

8.9 Thermal Design and Loading

Seller shall present a thorough description of the thermal design of the transformer. Information shall include the following at the maximum rating of the transformer:

- 1) Loss calculations for the core, windings and structural members.
- 2) Hydraulic design and directional controls for the oil flow, and calculated velocities and heat transfer rates of the oil flow,
- 3) Average and hot spot temperature calculations for each of the above components
- 4) Calculated top, average and bottom oil temperature rises
- 5) Locations of hottest spot temperatures within each winding
- 6) Location and magnitude of hottest oil temperature within each winding.

Seller shall substantiate these calculations by presenting plots of the magnetic field pattern to reveal where and how losses are generated, particularly as affected by the stray flux. Further substantiation shall be provided by showing results of measurements that confirm the calculations on previous transformers.

The load capability as a function of time shall be defined by Seller but shall meet the minimum requirements specified in **Section 4.1**. A plot of load-time capability shall be provided. Seller shall also define load capability as a function of time with partial and complete loss of cooling. Seller shall revise this data following temperature rise test if test results vary significantly from calculated values.

PUBLIC VERSION

8.10 Insulation Processing

All steps of factory insulation processing shall be described for the specific transformer on order. Seller shall also provide recommended field processing procedures and the criteria used for determining adequacy of dryness for both factory and field processing.

8.11 Test Proposal

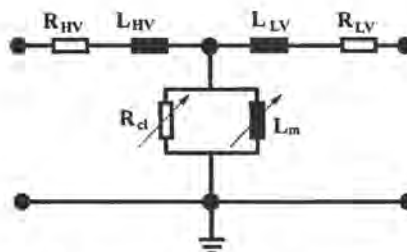
Seller shall provide a detailed test proposal at the time of the design review meeting. This proposal shall include an approximate schedule sequence and methodology for all required testing, as well as any deviation from this specification or the reference industry standards.

8.12 Equivalent Circuit Parameters

8.12.1 Single Phase 60 Hz Model

Seller shall provide a 60 Hz impedance network model that reasonably describes the 60 Hz steady-state operation of the transformer. Models shall be provided for center and extreme tap positions. Seller shall describe how the model was developed and shall advise what relationship the parameters have to actual physical quantities such as flux in core limbs and yokes. **Figure 11** shows the simplest acceptable 60 Hz impedance model for a GSUT. More accurate models are encouraged. For complicated winding arrangements, the model shall account for the increased complexity of the impedance network. As a minimum, the model shall include the following parameters, also shown in **Figure 12**:

- 1) Magnetizing inductance, L_m vs. applied voltage magnitude
- 2) Core loss resistance, R_{cl} vs. applied voltage magnitude
- 3) HV and LV winding leakage inductances, L_{hv} and L_{lv} , respectively
- 4) HV and LV winding loss resistances, R_{hv} and R_{lv} , respectively.



Single-Phase 60 Hz Impedance Model
Figure 12

The model shall be valid for voltages from 0.9 through 1.5 p.u., at GSUTs loads from 0.0 to 1.25 p.u. Parameters (1) and (2) shall be provided in the form of a table and/or plot of true crest amps versus true crest volts. The air-core reactance or leakage inductances shall be provided for each winding.

PUBLIC VERSION

8.12.2 Equivalent Terminal Impedances

Equivalent terminal-terminal and terminal-ground inductances and capacitances (including bushings) shall be provided at 60 Hz, switching (10 kHz) and lightning impulse (250 kHz) frequencies. Seller shall verify these parameters by measurement in the factory on all transformers.

8.12.3 Saturation Curve

Seller shall provide an estimated saturation curve of the transformer to Owner.

8.13 Transient Model

When required in the Ordering Specification, seller shall provide a detailed transient model of the transformer for use by Owner to represent the transformer in system transient studies. The transient electrical model shall include damping due to losses and, as a minimum, contain all phases and terminals of the transformer and shall be applicable for a frequency bandwidth of 60 Hz to 100 kHz. The transient model shall consist of resistive, inductive and capacitive elements and shall be compatible with the Electromagnetic Transients Program (EMTP) input data. The transient model shall be provided for at least the center tap position. Transient model parameters shall be submitted in both hardcopy plot form and on magnetic disc compatible with an IBM PC, in ASCII format with the data specification identified in the submittal package.

8.14 Verification of Transient Model

The following frequency and time domain responses shall be calculated using the transient model specified in **Section 8.13** on the first transformer of a new design. In the case of frequency response calculations (**8.14.1 - 8.14.2**), the frequency range shall be from 60 Hz to 100 kHz and the frequency increment shall be sufficiently small to clearly reveal all maxima and minima.

An electronic type sinusoidal voltage variable frequency generator shall be used to measure the required responses. Measurements shall be made on all terminals, tap points and accessible crossovers of each phase on a fully assembled, oil-filled transformer with the neutral terminal grounded. Data shall be submitted in the manner described in **8.13**.

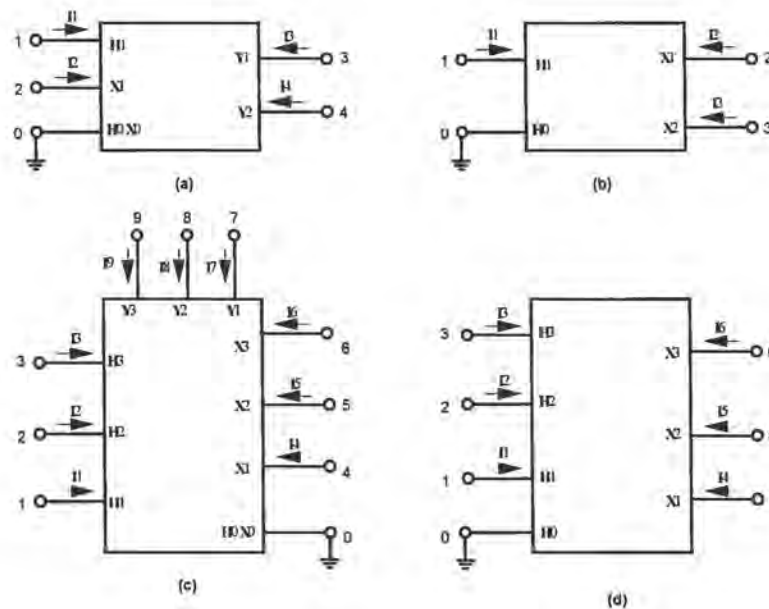
8.14.1 Short-Circuit Admittance Functions

Seller shall make short-circuit admittance calculations and measurements (magnitude and phase angle vs. frequency) for the cases specified in **Table 13**. **Figure 13** shows the terminal designations for these calculations and measurements.

PUBLIC VERSION

Table 13
Conditions for Short-Circuit Admittance Functions

Type of Transformer	Figure No.	Condition No.	Terminal Conditions		Admittance ($Y_{mn}=I_n/V_m$)
			Supply Terminal (m)	Shorted to Ground (n)	
1-Phase GSUT	11b	B1	1	2,3	Y_{11}, Y_{12}, Y_{13}
		B2	2	1,3	Y_{22}, Y_{23}
		B3	3	1,2	Y_{33}
3-Phase GSUT	11d	D1	1	All except 1	$Y_{11}, Y_{12}, \dots, Y_{16}$
		D2	2	All except 2	Y_{22}, \dots, Y_{26}
		D3	3	All except 3	Y_{33}, \dots, Y_{36}
		D4	4	All except 4	Y_{44}, Y_{45}, Y_{46}
		D5	5	All except 5	Y_{55}, Y_{56}
		D6	6	All except 6	Y_{66}



Terminal Identification for Short-Circuit Admittance Functions
Figure 13

PUBLIC VERSION

8.14.2 Open-Circuit Voltage Transfer Functions

Open circuit voltage transfer functions (magnitude and phase angle vs. frequency) shall be calculated and measured for the combinations specified in **Table 14**. The voltage transfer function for an open-circuited terminal is defined as the ratio of voltage appearing on the open-circuited (O) terminal to input (I) voltage. In the case of delta-connected windings it is acceptable to give the voltage transfer functions between the delta-connected winding with one corner grounded and the other windings that would have one terminal grounded. The neutral terminal(s) shall be grounded.

8.14.3 Step Function Response

The voltage response at all open-circuited terminals, for each condition specified in **Table 14** shall be calculated and measured for a low voltage step wave applied to the input terminal. The applied step wave shall have a rise time of not more than 1.0 λ s. If a step generator is unavailable, a pulse generator may be substituted provided that the 1.0 λ s rise time is met and the transient due to the leading edge of the pulse damps out before application of the lagging edge. Neutral terminal(s) shall be grounded.

Table 14
Conditions for Open-Circuit Voltage Transfer Functions

Transformer	Condition	H1	H2	H3	X1	X2	X3	Y1	Y2	Y3
1- Φ GSUT	F1	I			O	O				
	F2	O			I	G				
3- Φ GSUT	H1	I	O	O	O	O	O			
	H2	O	O	O	I	O	O			

I= Input Terminal; O= Open; G= Grounded

8.14.4 Comparison of Calculated and Measured Results

Seller shall compare calculated and measured results described in 8.14.1 through 8.14.3 and based on this, assess the validity of the transient model supplied in **Section 8.13**. This assessment shall include an explanation of the causes of:

- 1) Any frequency, amplitude or phase discrepancies greater than 10 % between measured and calculated local maxima and minima in the required frequency responses; and
- 2) Amplitude and oscillation frequency discrepancies greater than 10 % between measured and calculated step function responses.

The Seller shall explain the implications of these discrepancies on insulation design safety margins.

NOTE: Depending on the transformer system operating conditions, the Seller may be asked to provide only partial information on the requirements in paragraphs **Sections 8.13** and **8.14**. Indication of such shall be noted on the Ordering Specification

PUBLIC VERSION

8.15 Comparison with Design Criteria

Data calculated in **Section 8.7** for the dielectric stresses shall be compared with the design capabilities of the insulation structure. Seller shall identify which conditions result in dielectric stresses in excess of design recommended values and shall give the technical explanations to justify the disparity.

8.16 Loss Measurement Accuracy

Seller shall present information regarding the accuracy of equipment used for load, no-load and auxiliary loss measurements. Data shall be presented for magnitude error and phase angle error for the complete test system as well as for individual devices, including potential transformers, current transformers, voltage and current dividers, voltmeters and all other equipment in the measuring circuit. If certification by an independent testing service for the complete test system is unavailable, then the complete system error shall be calculated per Section 8 of NBS Technical Note 1204 (See Reference [1] in **Section 3.3**).

8.17 Geomagnetically Induced Current (GIC) Capability

Seller shall present information regarding the capability of the transformer to withstand GIC. Information shall include estimated flux, time constants and resulting temperatures at critical locations in the magnetic circuit and structural components at dc current levels of 10, 25, 50 and 100 Adc for a five-minute duration in the wye-connected windings. Seller shall also present information on past experience and testing of similar designs.

8.18 Inspections

OE shall be permitted to inspect the equipment during any stage of manufacture. Upon arrival at Seller's facility, Seller shall give OE a complete status report of all portions of the apparatus in question with respect to its location and expected procedures and assembly work which will occur during the visit. Notification requirements for specific production milestones are specified in **Section 11.24**.

9. TEST REQUIREMENTS

9.1 General

Tests on transformers and their bushings shall conform to the latest approved standards specified in **Section 3.1** unless otherwise specified herein or in the Ordering Specification. In many cases, additional "design" tests as described in this Chapter are required for a prototype unit. All required test values and measurements to be recorded in the test report (11.20). Test failures and troubles or failure to meet guaranteed values shall be reported per **Section 11.21**. All waveforms shall be recorded by digital devices.

9.2 Resistance and Turn Ratio

The dc ohmic resistance of all windings shall be measured at all tap positions for the prototype. The turn ratio shall be measured between all windings within each phase at all tap positions.

PUBLIC VERSION

9.3 Dielectric Tests General Requirements

Dielectric tests shall comply with the latest standards referenced in **Section 3.1** except as specified herein, e.g. in **Sections 11.9 - 11.16**, or in the Ordering Specification. Transformers shall be fully assembled during dielectric tests per **Section 6.19**. Reduced FW and FW waveforms shall be shown on same trace and scales per ANSI guideline.

9.3.1 Test Sequence

Table 15 specifies the prototype and routine test sequences.

Table 15
Required Dielectric Test Sequence

Test Description	GST-1 Section	Prototype Sequence	Routine Sequence
Fast Front Switching Impulse (FFSI)	9.4	1	N/A
Switching Impulse (SI)	9.5	2	1
Special Termination Lightning Impulse (STLI)	9.6.2	3	N/A
Standard Lightning Impulse (LI)	9.6.1	4	2
Applied voltage (AV)	9.7	5	3
Induced voltage (IV)	9.8	7	4
Insulation Power Factor (IPF)	9.9	8	5

9.3.2 Test Voltage Magnitude and Waveshape

Impulse test voltage magnitudes are specified in **Table 16**. Crest voltage tolerance for impulse tests (**Sections 9.4 - 9.6**) shall be minus 0.5 %. The impulse circuit and measuring connections shall remain unchanged during calibration and full wave tests.

If Seller is unable to attain the required 1.2/50 μ s waveshape for the LI or STLI within the (+)30 % front or (-)20 % tail time tolerances, then they shall state in their quotation that they are unable to attain the standard waveshape, and shall also state the guaranteed attainable impulse waveshape for each test. Failure to obtain at least the guaranteed waveshape shall be grounds for rejection of the LI test.

The required crest voltage for the LI and STLI tests shall be increased if the actual front time exceeds 2.0 μ s or the actual tail time (time to 50% crest value) is less than 40 μ s. If the front time exceeds 2.0 μ s, then the crest test voltage of both the full and chopped waves shall be increased by 2 % per each additional 0.1 μ s above 2.0 μ s. The total increase will be limited to 15 % of the crest value in **Table 16**.

A generic electrical schematic of the impulse generator used for the impulse voltage tests shall be provided per **11.20.1**.

If the time to 50 % crest value is less than 40 μ s the crest test voltage of the full wave impulse shall be increased such that the kV-seconds above 80 % of the rated full wave voltage (e.g., as integrated by a digital oscilloscope) for the adjusted

PUBLIC VERSION

impulse wave equals the kV-seconds above 80 % of the BIL for a 2.0/40 μ s (double exponential) wave. In the event that the front exceeds 2.0 μ s and the tail is less than 40 μ s, the increases in required test voltage shall be applied additively, e.g., a 10 % increase for the front and 4 % increase for the tail result in a required increase of 14 % in the crest test voltage.

Neutral terminal LI waveshapes shall have a maximum front time of 5.0 μ s and a minimum time to 50 % crest value of 40 μ s. The test voltage shall be adjusted in a similar manner as described above should these criteria not be met, with the exception that the front shall be increased 2% for each additional 0.1 μ s above 5.0 μ s. The total increase will be limited to 15 % of the crest value in **Table 16**.

Table 16
Dielectric Test Voltages

Reference Section	Nominal System Voltage (kV)	FFSI Crest Voltage (kV)	SI Phase-Gnd Crest (kV)	<u>LI</u>	
				Full Wave Crest (kV)	Chopped Wave Crest (kV)
		9.4	9.5	9.6	9.6
	765	1300	1700	2050	2255
	500	900	1290	1550	1705
	345	590	890	1050	1155
	230	375	685	900	990
	161	275	575	750	825
	138	235	540	650	715
	69	-	-	350	385
	46	-	-	250	275
	≤ 34.5	-	-	200	220

NOTES: The above requirements are to make certain that adequate efforts were made to obtain the proper impulse voltage wave shape. The OE shall be advised on all measures taken to obtain the proper impulse voltage wave shape during the impulse tests.

In case of a tail time less than 40 μ s, resistors up to 40 ohms may be allowed at the grounded terminal if the test results show that the peak value of the voltage across the winding and the resistor connected in series do not coincide with peak value of the current flowing into the series combination of the winding and resistor. Resistors at the grounded terminal may be used in case of low voltage windings with high BIL insulation level such as the series windings in the series transformers for transmission line MVA flow control.

9.3.3 Voltage Tap Position

OE shall select voltage tap positions for the dielectric tests. For the prototype unit, tap positions for each impulse voltage test will be specified following the Design Review based on data provided by Seller in accordance with **Section 8.7**. OE shall specify tap positions for subsequent units following successful completion of the tests on the prototype. OE may also require impulse tests for three-phase

PUBLIC VERSION

transformers to be performed at different tap positions on each phase. Seller shall not proceed with tests until such notice has been provided for each transformer.

9.3.4 Procedures

The prototype of single phase units shall receive two complete sets of standard impulse tests on all terminals, including the neutral, at the voltage levels and the durations indicated in **9.3.2**. The impulse tests shall be at tap positions selected by OE as described in **9.3.3**. Different tap positions may be used for the individual phases on three phase transformers. The test sequence listed in Table 16 of **9.3.1** shall be followed.

The IV test shall be performed with the DETC in the highest voltage position when the voltage source supplies the LV winding.

The impedance at the winding's grounded terminal during impulse tests shall not exceed 2 Ohms. Increasing this impedance in order to increase the impulse voltage tail time is not permitted unless conditions in **9.3.2 NOTES** are met.

The interval between the final impulse waves on any impulse test shall be as short as practicable and shall not exceed the durations specified below. Intentional delays are not permitted. For FFSI and SI tests (**Sections 9.4 and 9.5**), the interval between the final two full impulse waves shall not exceed ten minutes. For STL and LI tests (**Section 9.6**), the test interval between the last full chopped wave (CW) and the last full LI wave shall not exceed three minutes.

In the case that the transformer fails any test in its test sequence and the transformer is reprocessed for any reason, all tests, including those that were successful prior to the failure, shall be repeated.

9.4 Fast Front Switching Impulse (FFSI) Tests

An FFSI test shall be performed on each terminal rated 138 kV and above of the prototype. The applied voltage waveshape shall have a 1.2 μ s virtual front and 4200 μ s actual time to the first voltage zero. One reduced and two full waves shall be applied. Neutral terminals shall be grounded. All other non-impulsed terminals shall be open-circuited. Oscilloscope traces of voltages at the non-impulsed terminals located on the same phase with the impulsed terminal are required.

9.5 Switching Impulse (SI) Tests

SI tests shall be performed on each high voltage terminal. Reduced and both full voltage waveshapes shall match until core saturation takes effect. Connections on three-phase transformers under test shall be such that 1.5 times the applied voltage is generated between phases.

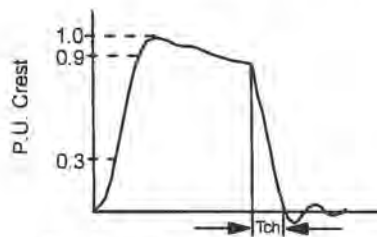
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9.6 Lightning Impulse Tests

9.6.1 Standard Lightning Impulse (LI) Tests

Standard LI tests (FW and CW) are required on all line and neutral terminals. Neutral terminals do not require chopped waves.

Special requirements for the chopped wave are: 1) Actual chopping time, T_{ch} , from the instant of chopping to the time of first voltage zero shall not exceed $0.65 \mu s$ as shown in **Figure 14**, 2) Overswing magnitude after chopping shall not be limited artificially to less than 40 % of the chopped wave crest value, 3) The current trace, with a sweep time of 10 to $25 \mu s$, shall be recorded and compared before and after the chop during the chopped wave tests.



T_{ch} = Allowable Chopping Time
Chopped Wave Characteristics
Figure 14

9.6.2 Special Termination LI (STLI) Tests

The prototype shall receive STLI tests in addition to the standard LI tests. STLI tests shall be performed in a similar manner to the standard LI tests except as described below. These tests shall be performed on each line terminal for: all single-phase transformers and at least the center phase and one outer phase of three-phase transformers. Non-impulsed line terminals shall have special terminations to simulate operating conditions not covered by ANSI standard test methods. **Table 17** specifies the terminations to be used on the non-impulsed terminals for the STLI tests. Voltage tap position selection is described in **9.3.3**.

The proposed arrester connections for the STLI tests should be discussed with the OE. The OE will share with the MFG, the experience AEP has acquired with the STLI tests on previous similar units. For information, the arrester connections for the STLI tests on a three-phase 345/138-13.8 kV unit, which has been used in the past, is shown in **Figure 14**.

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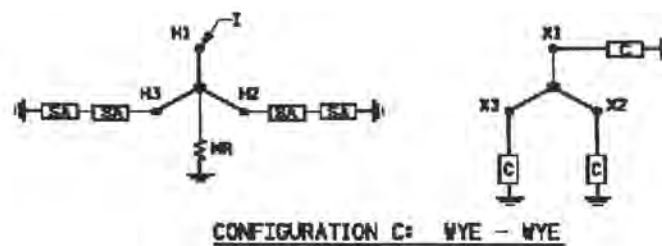
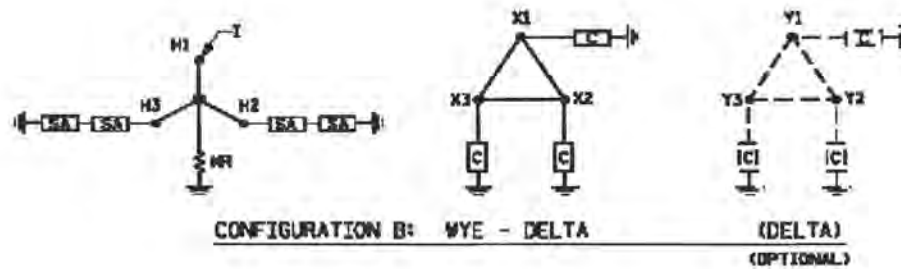
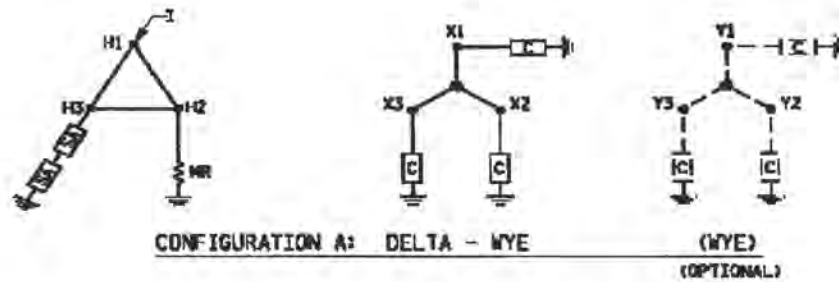
Table 17
Termination Requirements for Special Termination Lightning Impulse Tests
(Only Phase 1 Test Given to Illustrate Method)

H1	H2, H3	H0	X1	X2, X3	X0, Y0	Y1	Y2, Y3
GSUTs							
I	SA	G	C	C	-	C	C
AUXs							
I	SA	G	C	C	G	C	C

I = Input, SA = Surge Arrester, G = Grounded, C = Capacitance

PUBLIC VERSION

CONNECTIONS FOR STLI TESTS ON HV WINDINGS FOR DIFFERENT
TRANSFORMER WINDING CONFIGURATIONS



Example of Connections for STLI Tests on a 345/138-13.8 kV Auto
Figure 15

9.6.2.1 Surge Arrester Ratings

Maximum Continuous Operating Voltage (MCOV) ratings of SA terminations shall be as specified in **Table 18**. An open circuit is an acceptable substitute for a SA at Seller's option.

PUBLIC VERSION

Table 18
Line Terminal Arrester Requirements for STLI Tests

Terminal Voltage kV Rating	765	500	345	230	161	138	69	34.5		13.8	
								Delta	Wye	Delta	Wye
Arrester MCOV kV Rating	700	525	336	252	193	168	117	31.5	58	17	31.5

NOTES: The arrester MCOV ratings in **Table 18** are for testing of single-phase units. For three phase units (345 kV and below) the ratings in **Table 18** are for the arresters to be installed on the non-impulsed winding terminals that are located on the same phase with the impulsed winding terminal. The arresters on the non-impulsed terminals on the other phases than the phase where the impulsed winding is located shall be approximately half of the MCOV ratings in **Table 18**.

9.6.2.2 Capacitance Values

The value of capacitance connected to the LV terminals of GSUTs during the STLI tests shall not exceed the value stated in the Ordering Specification, or if not stated therein, 3000 pF per phase

9.6.2.3 Test Procedures

The voltage waveform at the non-impulsed winding terminals located on the same phase with the impulsed winding and the current waveform in the corresponding SAs shall be measured and recorded. Test voltage shall be increased in steps of approximately 50, 70, 90 and 100 % of the required full crest value in order to distinguish between non-linear SA effects and a possible failure.

If projected voltage at non-impulsed terminals, based upon the incremental voltage method described in the foregoing paragraph, will exceed the BIL rating during the first 10 μ s or will exceed the SI rating thereafter, then the MCOV value of the SA may be reduced by modifying the sections composing the SA in order to compensate for this condition. OE must approve the revised composite MCOV value prior to proceeding with the test.

9.7 Applied Voltage (AV) Test

The AV test voltage shall be as defined in ANSI C57.12.00. Consideration should be given by the MFG to the test circuit to prevent self-excitation of the AV test generator that is supplying a capacitive load.

9.8 Induced Voltage (IV) Test

The IV test shall be performed on all transformers in accordance with applicable standards, including ANSI/IEEE C57.12.90, except as specified below and in the Ordering Specification.

PUBLIC VERSION

9.8.1 Procedure

One complete IV test is required on all prototype or duplicate units as specified in Section 9.3.4. The test voltage shall be raised to the 1 hr test voltage for a period of at least 5 minutes before being raised to the enhancement level. PD shall be measured and recorded at the beginning and end of this pre-enhancement period. The voltage shall then be raised to the enhancement level for at least 1500 cycles or 5 seconds, whichever is greater. During the enhancement period, PD shall be measured at all line terminals. Measurements on terminals having bushings with no capacitance voltage taps shall be achieved with freestanding capacitive voltage dividers. The voltage shall then be reduced to not less than the 1 hr test voltage and held for the remainder of the test. During this long duration period of the test, PD measurements shall be made at 3-minute intervals. All results shall be recorded in the test report.

All RIV and apparent charge measurements shall be continuously recorded, where possible. A strip chart recorder is a suitable means for continuous recording. For three-phase transformers, simultaneous measurement of PD on all three phases should be available such that all readings are visible and recorded at the same time. The use of a single meter with a multiple position switch that limits observation to only one phase at a time is undesirable. If no other means for monitoring PD is available, the selector switch shall be operated frequently to observe PD activity in between the 3-minute intervals.

Transformers with forced oil cooling shall have all pumps running during IV test. Pumps shall be started prior to the test and continue running for the period of time required for leakage current to stabilize. This time period shall be determined as specified in 9.8. Pumps shall not be turned off prior to beginning of the test.

9.8.2 Test Voltage.

The test voltage is defined in P.U. of the voltage rating of the tap at which the test is performed. The 1 hr and enhancement test voltages shall be 1.8 P.U. and 2.0 P.U., respectively.

9.8.3 Acceptance Criteria

The PD acceptance criteria include apparent charge method. The PD results shall be considered acceptable provided that: 1) maximum PD measured on each line terminal during the 1 hr. period does not exceed 300 pC apparent charge; and 2) the increase in PD does not exceed 100 pC when compared to the corresponding PD measurement made just prior to the enhancement period. There is no guaranteed PD limit required at the enhancement level.

9.9 Insulation Power Factor (IPF) Test

Insulation power factor tests are required for each transformer and shall be performed per Method II (guard circuit method) of ANSI/IEEE C57.12.90, Table 1. This power factor shall be less than 0.5 %, when measured between 10 °C and 30 °C winding temperature. Results and a description of the method used shall be recorded in the Test Report.

PUBLIC VERSION

9.10 No-load Loss and Excitation Current

No load loss and excitation current shall be measured at 70, 90, 100, 105, 110, 112.5, 115 and 120 % (or the highest possible value permitted by the source considering the transformer's capability) of rated voltage. Three-phase transformers shall be tested with three-phase excitation with the three-wattmeter method per Figure 15 of ANSI/IEEE C57.12.90-1999 and results shall be reported for all three phases. Maximum error of the complete test system, as determined and certified by an independent testing service or as calculated per Section 8 of NBS Technical Note 1204 [1], shall not exceed 3 %. Guaranteed no load losses and exciting current shall be at 20 °C and measurements for these quantities shall be performed with average oil temperature between 10 °C and 30 °C. In the case of three winding core-form transformers, voltage shall be applied to the winding physically located nearest to the core.

Harmonic analysis results shall be provided for the no-load voltage and excitation current time functions at the voltage levels specified above. Instead of harmonic analysis, source voltage and current waveforms shall be simultaneously measured on the prototype as a function of time and recorded with a digital oscilloscope. The magnitude scale shall be adjusted to obtain as near a full-scale deflection as possible. The time scale shall be selected to capture at least one full cycle but not more than three cycles of applied voltage. Data shall be submitted on both hard copy, plot form and on magnetic disk. For transformers with taps in the common winding, the no-load loss and the excitation current shall be measured at all tap positions. No-load test measurements shall include kW loss, peak Amperes, and average Volts. The test report shall present a table of all measured values.

9.11 Audible Sound

Audible sound level shall be measured on the prototype. The acceptance level shall be in accordance with NEMA standards.

9.12 Impedance and Load Loss

Impedance and load loss shall be measured at all tap positions. Losses in three-phase transformers shall be measured with the three-wattmeter method per Figure 20 of ANSI/IEEE C57.12.90-1987. Maximum error of the complete test system, as determined and certified by an independent testing service or as calculated per Section 8 of NBS Technical Note 1204 [1], shall not exceed 3 %. For multi-winding transformers, impedance and load loss shall be measured between each combination of two windings.

9.13 Zero Sequence Impedance

The zero sequence impedance (Z_0) shall be measured for all three-phase transformers. For multi-winding transformers, Z_0 shall be measured for each combination of two windings. Z_0 measurement is required at center tap and extreme tap positions. Z_0 values shall be expressed as P.U. quantities based on the transformer's nameplate MVA and center tap kV ratings. Actual voltage, current and power measurements used to derive Z_0 values shall be recorded in the Test Report in addition to the Z_0 values themselves. Seller shall compute the equivalent circuit of Z_0 impedances ($R_0 + jX_0$) in percent per ANSI C57.12.90 and include a copy of this figure in the test report, clearly stating the MVA and kV bases.

PUBLIC VERSION

9.14 Temperature Rise (TR) Tests

Design tests shall be performed on each prototype transformer. An accelerated TR test shall be performed as a routine test on all subsequent units. In all cases, the tap connection(s) giving the highest winding rise shall be used. Dissolved gas analysis shall be performed before, during and after each TR test (9.15.3). A leakage current test (9.8) shall be performed immediately following the design TR tests.

9.14.1 Design Tests

The following design tests are required:

- 1) The standard TR test(s) shall be performed per ANSI Std. C57.12.90 and IEEE C57.119 (Draft 13.2) at 0.7, 1.0 and 1.25 p.u. of the maximum nameplate MVA rating, and where applicable due to the cooling classes on the nameplate (e.g., ONAN/ONAF/ONAF), also at the base MVA rating. Stabilized conditions shall be as defined in Section 11.2(1) of C57.12.90.
- 2) The following customer specified load cycle for temperature rise test, as specified by Section 11 of IEEE C57.119, shall be performed with full compensation for core losses:
 - a) **GSUTs.** 0.75, 1.0 and 1.1 p.u. of the maximum nameplate MVA rating for eight hours.
 - b) **RAT's and UAT's** 1.33 or 1.35 p.u. maximum nameplate MVA rating after a preload of 1.0 or 0.7 p.u. maximum nameplate MVA, at 10°C ambient temperature, for four hours. P.U. loading may be changed to suit available test conditions, i.e., ambient temperature and load duration, as specified in **Table 19**. Interpolations between these ambient temperatures may be used.

The following limitations apply to this load cycle test: Hottest spot temperature not to exceed 140°C, top oil temperature not to exceed 110°C and loss of life not to exceed 1.0% per incident.

Table 19
Minimum p.u. loading as a Function of
Ambient Temperature and Load Duration

Ambient Temperature	4-Hour Test		8-Hour Test	
	0.7 p.u Preload	1.0 p.u. Preload	0.7 p.u Preload	1.0 p.u. Preload
40	1.165	1.145	1.133	1.137
30	1.229	1.210	1.197	1.194
20	1.289	1.271	1.255	1.251
10	1.347	1.330	1.310	1.307
0	1.403	1.386	1.363	1.359

PUBLIC VERSION

9.14.2 Routine Tests

An accelerated TR test is required for all units other than the prototype. A test current of 1.1 times the maximum nameplate rated current shall be circulated in the HV and LV windings in a short-circuit test arrangement for a period of four hours.

9.14.3 Infrared Scans

Infrared scans of the transformer shall be taken during the maximum loading condition of the TR test. Scans shall include each side of the transformer, all coolers, HV & LV connections, bushing, flanges, turrets and cover plates.

All hot spots shall be clearly identified on the scan. Each scan shall have time, date, ambient temperature and loading conditions during the test. No temperature shall exceed the maximum allowable temperature stated in **Section 5.2.3**.

An electronic copy of the IR scans shall be provided as well as snapshots included in the test reports.

Information about the IR scan software shall be provided in the test plan.

9.14.4 Dissolved Gas Analysis (DGA)

DGA samples shall be taken during all design and routine TR tests as follows:

- 1) At least seven samples are required for the standard TR test: one just prior to start of test, four at equally spaced intervals during test, one just prior to shutdown, and one after cool-down.
- 2) At least five samples are required for the overload TR test: one each just prior to 90 % preload, at the end of 90 % preload just prior to applying the overload, at two hours after overload is applied, just prior to shutdown and after cool-down.
- 3) At least four samples are required for the accelerated TR test: one each just prior to start of the test, in the middle of test, just prior to shutdown and after cool down.

9.14.5 Required Data

TR data which shall be reported for both standard and prototype tests include: measured top and bottom oil TR; calculated average oil TR; measured average winding TR for all windings; calculated (and measured, if possible) hot spot TR over average ambient temperature for all windings; time constants for each winding and the oil, and measured total Watts loss for the supply circuit used for test. These parameters shall all be determined at both, the maximum self-cooled and the maximum forced-cooled MVA ratings of each winding. The test report shall state whether the oil flow in each winding is directed or non-directed.

Load cycle data shall be recorded for both prototype and routine tests. This shall include all currents and the duration for which they were applied.

PUBLIC VERSION

When TR data are based on a previous transformer of identical design, all above specified values shall be adjusted by calculation to reflect the difference in losses between the transformers unless total losses of the latter unit vary by less than 2 % from the prototype. TR data and serial number of the prototype shall be indicated on the test report.

9.15 Tests on Auxiliary, Control and Protection (ACP) Equipment

Seller shall test all ACP equipment for proper function before shipment. Improper function shall be reported to OE along with proposed remedial action. ACP equipment and their wiring shall withstand the following 60 Hz, 60 s, test voltages. Test voltages (to ground) shall be 2500 Vrms, for equipment rated 250 Vdc and 1500 Vrms for all other voltage ratings. Test voltages across open contacts shall be 1500 Vrms for contacts rated for tripping and 1000 Vrms for contacts not rated for tripping.

Proper phasing and phase sequence of both supplies to ACP equipment shall be verified.

CT testing shall be reported and include Saturation, Ratio, and Voltage Polarity tests.

9.16 Through-Fault Testing

When agreed upon during negotiations, through-fault testing and subsequent verification of satisfactory performance shall be performed per Section 12 of ANSI/IEEE C57.12.90, except that no visual signs of movement shall be present during the final inspection.

9.17 Sweep Frequency Response Analysis (SFRA)

SFRA testing shall be performed with a Doble Model M5100 prior to disassembly at the plant. Results of this test shall be recorded electronically and forwarded to Owner.

10. TRANSPORTS, HANDLING AND STORAGE

10.1 General

All criteria of this chapter must be met to ensure Owner's acceptance of the transformer. Seller shall follow IEEE C57.150 - Guide for the Transportation of Transformers and Reactors Rated 10,000KVA or Higher. If there is a conflict between this specification and IEEE C57.150 this specification shall take precedence. Approved Heavy Hauling and Rigging Contractors are identified in the AEP Ordering Specification. Transformers shall not be transported from the factory until all specified tests have been successfully performed and the OE has released the transformer for transport. Seller shall also provide transport notification and documentation. Transformers shall be delivered by rail unless otherwise authorized by Owner.

10.2 Factory Preparation for Transport

Seller shall prepare transformer and accessories for transport such that all parts are protected from damage or deterioration in transit to site and that Owner receives adequate equipment and instructions for complete and proper assembly on Site.

PUBLIC VERSION

10.2.1 Insulation Condition

Seller shall take all precautions necessary to insure that the transformer insulation is as dry as practicable upon both departures from factory and arrival at Site. Transformers shall be filled with dry air for transport. Seller shall test internal pressure and moisture level immediately before departure from factory. Time from completion of dry air filling until these measurements are made shall be sufficient to allow equilibrium inside the tank between dry air and cellulose (24 hr minimum).

Upon departure from factory, internal pressure and dew point temperature shall meet the following conditions: Pressure shall be not less than 0.5 psig (105 kPa) and dew point shall not exceed -42 °C when corrected to 20 °C dry bulb temperature and measured between 0.5 and 2.0 psig (105 and 115 kPa). The measured dew point temperature, coincident dry bulb temperature, internal pressure, and date of measurement shall be permanently stenciled on the tank near the base or shown on a permanent, small information plate mounted on the tank before departure.

During transport, transformers shall maintain internal pressure and dew point level at all times such that the following conditions are met upon arrival: 1) internal pressure shall be between 0.5 and 2.0 psig (105 and 115 kPa); and 2) the dew point temperature shall not exceed -42 °C when corrected to 20 °C dry bulb temperature and measured between 0.5 and 2.0 psig (105 and 115 kPa). A valve, so designated on the Outline Drawing, shall be available for accomplishing pressure/vacuum measurements upon arrival.

10.2.2 Identification and Match-Marking

All parts shall have identifying tags or markings. All parts that require specific assembly orientation shall be match-marked. All identification or match marks shall be clear and legible when received on site.

10.2.3 Special Assembly Tools

If special assembly tools, not commercially available, must be used for transformer assembly, two sets of such tools shall be supplied per transformer.

10.3 Delivery of Accessories

All parts and accessories removed for transport to site shall arrive on Site at the same time as the transformer main tank. Seller shall coordinate this regardless of whether the accessories are shipped together with the transformer or by alternate means or routing. Regardless of the means of shipment, each container shall be clearly marked with at least the following markings:

- 1) Point of destination
- 2) Owner's Order number
- 3) Serial number of the transformer.

PUBLIC VERSION

Each container shall have a detailed packing list identifying items and their quantities contained within. Packaging of critical accessories, for example, those that include insulation materials, shall be sufficient to avoid contamination or moisture absorption. Transport of such items shall be made with adequate environmental control.

10.4 Impact Recorder

Two (2), three way impact recorders shall be mounted on the transformer and one (1) on each rail car used for transport of bushings during all modes of transport to site. Seller shall discuss pros and cons of mounting recorder on the core of the transformer with Owner. Recorders shall be functional throughout the transport duration, be mounted and effectively guarded to prevent their damage en route and provide a complete record of the impact experience during transport. Owner shall have access to impact recorder records. Impact recorder charts that indicate rough handling shall be grounds for Owner's refusal to receive the transformer.

10.5 Special Transport Requirements

Transformers designed without the need for special bracing are preferred. Special bracing required to support internal or external parts during transport shall be reusable or easily and economically reproduced. Seller shall provide drawings and installation instructions including any bracing details for the event that Owner needs to relocate the transformer or return it for repair.

Special train, accompanied by a rider, shall deliver transformers and accessories traveling to site by rail. Seller shall submit a thorough written report to the OE detailing the rider's rail transport log of events.

Truck shipments of equipment to site shall be made with open top trucks.

10.6 Oil Delivery

Oil shall be delivered to site by tanker truck unless otherwise approved by OE. Oil shall conform to the requirements specified in **Section 6.17**. Seller shall notify Owner in writing at the time of placement of the order for oil.

10.7 Shortages and Delivery Delays

Equipment shortages and delivery delays shall be avoided by Seller with all reasonable means. In event that either should occur, Seller shall provide immediate notification to Owner. Seller shall provide revised shipment date(s).

Until the equipment has completed its required factory testing, notification of shipment delay and its cause shall be given to Owner immediately upon its discovery, even if there is a good chance the delay will be avoided. Delays after this point, due to shipping constraints, shall be reported to Owner's expeditor.

PUBLIC VERSION

10.8 Storage

Transformers shall be capable of storage in dry air for up to six months after arrival on Site. Seller shall provide recommended maximum dry air storage time instructions. Seller shall also advise of any special insulation processing requirements following extended storage in dry air. Suitable packaging and instructions shall be provided for spare parts and accessories such that they can be stored indefinitely without deterioration.

10.9 Acceptance Inspections and Criteria

Seller is responsible for their representative's timely field inspections upon delivery to site, in coordination with Owner.

10.10 Uprighting/Rigging Requirements

Seller shall provide accessories required for uprighting and assembling transformer at site. For example, if a transformer requires transport in a laid down position, or other special rigging accessories, Seller shall provide all rockers or other accessories required for uprighting. This also applies to special cradles or jigs for installing bushings, insulation components and so-forth. These shall be delivered in the same manner specified for accessories in **Section 10.3** above.

10.11 Gaskets

A complete set of new gaskets other than those used for shipping to site shall be supplied for use at installation.

11. DOCUMENTATION

11.1 General

This section specifies documentation requirements for drawings (**Section 11.2-11.17**), instruction books (**Section 11.18**), photographs (**Section 11.19**), transformer and bushing test reports (**Section 11.20**), trouble reports (**Section 11.21**), special engineering reports (**Section 11.22**), schedules (**Section 11.23**) and notification requirements (**Section 11.24**).

All Seller's documents shall be written in English language. Documents other than approval drawings shall be printed on plain white paper, 8.5 X 11 in. (22 X 28 mm) in size, unless prior approval is obtained from OE. Additional requirements for documentation shall be as specified in the Contract or as mutually agreed upon by Seller and OE during the course of executing Contract.

11.2 General Drawing Requirements

Drawings shall be submitted in accordance with "EPFS Operating Instruction Vendor Document Submittal," Rev.0, dated June 8, 2011. In addition to the formats listed in "Engineering Guide Vendor Document Submittal," Rev.0, dated May 25, 2004, AutoCAD format (.dxf) is acceptable. Additional submittal requirements are specified below. Requirements for review and approval of drawings are specified in **Section 11.3**.

PUBLIC VERSION

11.2.1 Transmittal Letter

The transmittal letter and the drawings shall be mailed to the OE. The Ordering Specification number shall also appear on the transmittal letter.

11.2.2 Required Drawings

Seller shall furnish the following drawings for each transformer order. Drawings marked by an asterisk (*) require no approvals by Owner. They are for record purposes only and shall be included in Instruction Books.

11.2.2.1 Physical Drawings

- 1) Outline (11.5)
- 2) List of Parts and Accessories (11.6)
- 3) Transport Outline (11.7)
- 4) Bushing(s) Outlines (11.8)
- 5) Nameplate (11.9)
- 6) Piping Schematic (11.10)
- * 7) Conservator Air Cell (11.11)
- * 8) Installation Details (11.12)

11.2.2.2 Electrical Drawings

- 1) Control Schematic (11.13)
- 2) Wiring Connection Diagram (11.14)
- 3) Cabling Diagram (11.15)
- 4) Control Panel Layout (11.16)
- 5) BCT Certified Test Curves (11.17)

11.2.3 Title Block

All drawings except standardized bushing and BCT drawings shall have Owner's title block that states the following:

- 1) Ordering Specification number and revision date
- 2) Contract number, or Purchase Order number if Contract is not used
- 3) Transformer Serial Number(s), if available
- 4) Transformer MVA and kV ratings, unless shown elsewhere on drawing
- 5) Seller's Shop Order Number

In addition to the Title Block, Seller shall provide a clear space, at least 4 in. wide by 5.25 in. high (105 x 135 mm) near the lower right hand corner of each drawing. This space is for Owner's internal routing and approval form that will be fixed to each drawing.

11.2.4 Required Information

Information required to appear on drawings is specified in **Sections 11.5 - 11.17.**

PUBLIC VERSION

11.2.5 Physical and Electrical Units

Physical quantities such as mass (weight), length, area, volume, force, velocity, flow rate, etc., shall be given in English units with metric (SI system) units provided in parentheses. Electrical quantities shall be metric, except motor horsepower ratings are permissible when motor efficiency and power factor are also provided.

11.2.6 Lettering Height

Lettering shall be at least 0.125 in. (3 mm) tall.

11.3 Drawing Review

Seller shall submit drawings for OE approval as specified by the submittal procedure in **11.2.2**. Information specified to appear on the specific drawing per **Sections 11.5 - 11.17** will be supplied on initial approval drawings in order to minimize the need for OE to repeat specified requirements as comments. If Owner's review of Seller's approval drawings reveals disregard for specified requirements, the drawings may be considered "not approved" without further review. Delays caused by Seller's disregard for specification requirements shall be responsibility of Seller.

The submittal schedule and review procedure shall be as specified in **11.3.1 -11.3.5** below. OE will review approval drawings and will respond to seller, within four (4) weeks after receipt, in a Drawing Review Disposition letter.

11.3.1 Approval Drawing Submittal Schedule

Initial approval drawings shall arrive at the address designated by OE within 16 weeks after Seller's receipt of order. Initial submittal shall include all required physical approval drawings (**11.2.2.1**), except the Piping Schematic, together with the Control Schematic and calculated BCT curves.

The Piping Schematic shall arrive at the required address within six weeks after Outline drawing is "Approved in General" by Owner. The date of this approval shall be defined as the date of Owner's disposition letter. All remaining Electrical drawings (**11.2.2.2**) shall arrive at the designated address within six weeks after the Control Schematic has been "Approved in General" by Owner.

Seller shall revise, within six weeks of the date of disposition letter, all drawings that are "Not Approved" By Owner. Drawings, which are "Approved Except as Noted" by Owner, will be revised within five (5) weeks of the date of the disposition letter. Seller shall make all drawing revisions required in order to resolve "Not Approved" or "Approved Except as Noted" comments by Owner. Each drawing shall be resubmitted as many times as necessary until it has been "Approved in General" by Owner.

PUBLIC VERSION

11.3.2 Final Drawing Submittal

Final Drawings are required within six weeks of the date of approval or two months before delivery, whichever is earlier. For duplicate transformers, Seller shall submit final drawings as specified in 11.3.4.

11.3.3 As Built Drawings

If, due to Seller's need or due to field modifications for which Seller is responsible, some change is required which will affect accuracy of final drawing(s), Seller shall issue revised drawings which shall be identified as "As Built" drawings and shall provide a clear written description summarizing what has been changed and for what purpose the change was required.

11.3.4 Drawings for Duplicate Transformers

When a transformer is ordered by Owner as a duplicate of one previously supplied by Seller, approval drawings are not required unless otherwise specified by Owner with the order, or if substantive changes in drawings are necessary for Seller. Duplicate drawings shall be issued as final drawings (11.3.2). The only change required on drawings shall be that a revised title block (11.2.3) must identify the duplicated transformer. In this case Seller shall submit final drawings within six weeks of Seller's receipt of an order.

Wherever possible duplicate designs shall have the same serial number with a unit specific number. If this is not possible a reference shall be made to the original design serial number on nameplate, drawings, and documents. If for some reason Seller's drawings will not be duplicates of prior drawings, Seller shall notify OE within one month of receipt of an order and approval drawings shall be required.

11.3.5 Changes

If drawing comments involve a price change, Seller must so advise OE in writing prior to implementation. Owner must approve the change.

11.4 Correctness of Drawings

Approval of drawings by OE shall not relieve Seller of responsibility for correctness, or for consequences arising from error or omission. Where variations exist between approved drawings and Ordering Specification, the Ordering Specification requirements shall apply unless specific approval in writing is granted by OE for each variation.

11.5 Outline Drawing

Seller shall show the Outline in five views: A top view and four elevation views. A base detail shall be provided as described in (15) below. The Outline need not be limited to one page. However, it is desirable that the Outline not exceed five pages. When the location of an item is specified to appear on the Outline, its distance, in two views, from centerline and its height above the base shall be provided either directly or by addition/subtraction between not more than two dimensions. In addition to the title block, the following information shall appear on the Outline:

PUBLIC VERSION

- 1) Total mass of assembled transformer
- 2) Untanking mass
- 3) Core and coil mass
- 4) Mass and volume (at 25 °C) of oil (total)
- 5) Mass and volume (at 25 °C) of oil in coolers, radiators, LTC compartments, and expansion tanks
- 6) Mass of removable major components such as coolers/radiators
- 7) Mass of all paper and pressboard insulation
- 8) Total number of coolers or radiators on the transformer and the mass of each individual cooler/radiator
- 9) Location/size of all items for Owner connections or accessory mounting, e.g.: SA, BPD brackets; bushing terminals, bus duct flanges, ground pads and cable clamps, cabinet entry plate (7.7.1)
- 10) Control cabinet size, door swings, door lock mechanism type, location, height, detail of removable bottom plate, location of Seller's entry points
- 11) Center of gravity, fully assembled
- 12) Table of minimum strike distances, as specified in 6.8 and 6.9
- 13) Approximate location of all gages (± 3 in.)
- 14) Height or distance to remove all bushings
- 15) Complete structural layout of transformer base including detail of bearing area of internal structural supports or recommended supporting beam/pier placement
- 16) Detail sketch and/or description of ground pads, cable clamps, arrester and BPD brackets, untanking sketch, and bus duct flanges
- 17) Color of paint and bushing porcelain. Items galvanized or treated by means other than paint will be identified
- 18) Bushing draw lead size and material, if applicable
- 19) All items shall be identified with an part number for reference to the Parts List (11.6)
- 20) An asterisk (*) shall appear adjacent to the item number of all items removed for transport or requiring field assembly
- 21) Location and means of access of core ground bushing
- 22) Bushing cantilever strength and all other bushing data required by 11.8, when not provided on the bushing Outline, or Parts list
- 23) Location and size of manholes
- 24) Flood level (assumed at control box bottom if not otherwise shown)
- 25) Description of area and type of non-magnetic portions of tank
- 26) Designated valve for pressure/vacuum measure if gauge not provided
- 27) Place(s) of manufacture and final assembly of the transformer and major components.

11.6 Parts List

A Parts List shall be provided either separately or as part of the Outline. If the Parts List appears on the Outline then all required information below shall instead appear on the Outline.

Parts shall be numbered to correspond with part numbers shown on the Outline. The quantity of each part shall appear on the list. Parts removed for transport to be indicated by an asterisk (*). For purposes of future maintenance and spare parts inventory, each part shall be described by its vendor name and complete catalog, style, model or type designation, including any special suffix or code that identifies specific features. Owner

PUBLIC VERSION

shall accept neither the drawing nor the part until this complete description is provided. This information must appear on the drawing beginning from initial submittal for approval. The following additional items and information shall appear on the list:

- 1) All valves and fittings, including types and sizes
- 2) All devices, gauges, indicators and accessories mounted on the transformer (devices in control cabinet are covered in 11.13)
- 3) Fans and pumps with NEMA frame size and ratings, including: number of phases, kW, kVA, rated current and voltage, starting current and torque, speed, Service Factor, and insulation class. Fan CFM, and pump GPM and static head shall also be provided
- 4) Control cabinet and terminal box description, e.g. dustproof, shock mounted, etc.
- 5) Tap changer model no., rated current, BIL contact-contact and contact-ground
- 6) Bushings including: conductor type (draw lead, bottom connected, etc.), draw lead size and material, BIL, current rating, top terminal description, and cantilever strength. If not shown on Outline, this data may be provided on the Bushing Outline
- 7) Conservator air cell, if applicable
- 8) Gasket material, if other than Nitrile rubber.

11.7 Transport Outline

The following information shall appear on a separate Transport Outline Drawing:

- 1) Transport mass
- 2) Transport dimensions, including clearance dimensions to bushing flanges
- 3) Transport center of gravity
- 4) Transport profile
- 5) Transport condition (insulating fluid or dry air filled)
- 6) Location, detail sketch of jacking, lifting and pulling facilities
- 7) Impact recorder location(s) and impact limits
- 8) Height over highest non-removable part
- 9) Other pertinent data as specified below.

The shipping profile shall show x-y (width-height) coordinates of transformer at all pertinent discontinuities in order to establish clearance through tunnels, bridges and other transport profiles. The shipping profile need not be drawn to scale and may be presented as a table of coordinates. For transformers shipped on Schnabel cars, composite car unit weight, axle loading and minimum turning ratios of loaded car shall appear on Transport Outline.

11.8 Bushing Outline

The following bushing information shall appear either on the Bushing Outline drawing or on the assembled transformer Outline:

- 1) Nominal System Voltage
- 2) BIL
- 3) Lead size and material, and inside diameter for draw rod or lead
- 4) Top terminal dimensions, material and thread description
- 5) Current ratings (dual rating where applicable)
- 6) Minimum creep distance
- 7) Wet switching surge voltage for bushings rated 345 kV and above

PUBLIC VERSION

- 8) The cantilever strengths (lbs and N) available at top end of each bushing for Owner's cable leads, etc.

11.9 Nameplate

The following information shall appear on the nameplate and Nameplate drawing in addition to information specified by ANSI C57.12.00:

- 1) All internal electrical components and their connections including current limiting reactors, series transformers, tap changers, non-linear resistors or protective devices, current transformers, fuses, etc.
- 2) BCT ratios and accuracy classifications, including hot spot CTs
- 3) Tap position designations shall be numerals, arranged from maximum to minimum turns ratio, e.g., {1=max, 2, 3=nominal, 4, 5=min} for five-tap designs, or {1=max, 2=nominal, 3=min} for three-tap designs
- 4) Winding form (cylindrical or shell) and conductor material.

11.10 Hydraulic Schematic

A piping schematic shall be provided which shows the location, size, connection, valving, and other fittings for all pipes external to the tank. The cooling circuit piping and gas collection and/or sampling piping shall be included. The valves and fittings description may appear on this drawing in lieu of the Outline or Parts list.

11.11 Conservator Air Cell

Seller shall provide a drawing of the air cell for the conservator including a complete specification of material required.

11.12 Installation Details

Complete installation drawings shall be provided with the IB giving complete detailed sketches and instructions for any internal and external field assembly required. Any special transport bracing which must be removed shall appear with its details on the drawings. If this bracing is required for future transport, this shall also be stated on the Installation Details. The drawings shall provide specific instructions on the color and labeling of parts for removal.

11.13 Control Schematic

The following information shall appear on the Control Schematic drawing:

- 1) Power circuit and control scheme for fans and pumps (or for future cooling equipment)
- 2) Description of all temperature, pressure or other settings of each device using contacts.
- 3) Alarm and trip development scheme
- 4) Make, type, description and rating of all control and protective components
- 5) Voltages of all systems
- 6) Cooling equipment full load power requirements, including motor starting inrush current
- 7) Owner's power supply method: voltage and connection (Delta, Wye, etc.).

PUBLIC VERSION

11.14 Wiring Connection Diagram

The Wiring Connection Diagram shall be issued for approval after the Control Schematic is approved. The following information shall appear on the Wiring Connection Diagram:

- 1) Terminal block arrangement (7.6) with Owner's connection side clearly shown for each block
- 2) A unique number or alphanumeric designation shall identify each block and terminal.
- 3) Each BCT terminal block shall be clearly referenced to its associated bushing and BCT
- 4) BCT ratio and accuracy classifications
- 5) Point to point connections of all devices by means of a wiring diagram is preferred. However, a table of point-to-point connections is acceptable. When a table is used, the table shall include a description of the path taken by the wire
- 6) Terminal block description (7.6.3) for all blocks
- 7) Wire description for all wires including conductor and insulation information.

11.15 Cabling Diagram

The Cabling Diagram shall be issued for approval after the Control Schematic is approved. The following information shall appear on the Cabling Diagram: The connection of all motors, including a description of junction boxes, power cable description and description of all electrical connectors and terminals.

11.16 Control Panel Layout

The Control Panel Layout shall be issued for approval after the Control Schematic is approved. An internal layout of the control panel including all devices and terminal blocks shall appear on this drawing. The drawing should be to scale or generally dimensioned, especially indicating the location of terminals for Owner's power supply connection and the minimum clearance available at the bottom of the control box and between terminal blocks.

11.17 BCT Curves

A complete set of measured BCT excitation and ratio correction curves shall be provided for each BCT at every BCT tap position. Certified test results shall be provided.

11.18 Instruction Books (IB)

11.18.1 General

IBs are required for each transformer as specified below.

11.18.2 Approval

Two advance copies of IB shall be submitted by Seller to OE, a minimum of twelve (12) weeks before scheduled shipment. If drawings are not finalized at that time, the latest revision of all drawings shall be included in the advance IBs. The remaining contents shall be as complete as possible and omissions shall be clearly identified.

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OE will review advance IB for completeness, clarity and compliance with required contents as described below. OE will then return comments to Seller within four (4) weeks of receipt. Seller shall revise IB to incorporate these comments. Review by OE is not for purposes of approving Seller's installation and maintenance procedures, although clarifications may be required.

11.18.3 Number of Copies

One (1) copy of the final IB shall be shipped with each individual transformer. These should be placed inside the control cabinet. In addition, the quantity of copies specified in the table below shall be submitted to the OE a minimum of one (1) month prior to shipment of the transformer.

Quantity of Transformers Ordered	Number of Instruction Books
1	6
2	9
3	12

For greater quantities of transformers, three (3) additional IBs shall be provided for each additional transformer ordered.

Two electronic copy shall be submitted to the OE.

11.18.4 Contents

Instruction manuals shall be contained in hard cover, ring binders and contain at least the following:

- 1) Cover page
- 2) Table of Contents/Index Tabs
- 3) Drawings, Diagrams and Schematics, Winding configuration
- 4) Transport and Handling Information
- 5) Accessories, Control and Protection Equipment Information
- 6) Installation, Maintenance and Storage Instructions
- 7) Renewal Parts List
- 8) Photographs (photocopies of originals are acceptable)
- 9) Performance Characteristics Information per **Section 9**
- 10) Seller's Insulating Oil Specification
- 11) Other Information supplied by Seller or required by Owner

The following items further specify documentation required to appear in IB:

11.18.4.1 Binding Edge Label

The binder shall have a flat binding edge that bears a permanent label. The label shall identify, as a minimum, the following: type of transformer

PUBLIC VERSION

(e.g. GSU transformer or unit aux transformer), Seller's name, serial number(s), and power and voltage ratings. Additional information can be provided if possible, such as IB number, Contract and purchase order numbers, Ordering Specification number and Owner's name.

11.18.4.2 Cover Page

The cover page shall include at least the following: type of transformer, serial number(s), Owner Contract and Order numbers, Ordering Specification identification and date, Seller's shop order number, location of manufacture, and other pertinent Seller references.

11.18.4.3 Table of Contents

The Table of Contents can be provided in either of the following methods. One method is to provide a general table of contents following the cover page at the front of the manual referring to major sections. Each major section shall have an index tab, and immediately following the index tab, a complete listing of contents in that section of the manual. Another method is to provide a complete table of contents at the front of the manual, following the cover page. In either method, the listing of contents shall identify the contents completely, including the revision number and/or date of instruction/information bulletins.

11.18.4.4 Drawings, Diagrams and Schematics

All drawings, diagrams and schematics specified in **11.2.2** shall be included.

11.18.4.5 Winding Configuration

Information concerning the winding configuration as specified in **Section 8** shall be included.

11.18.4.6 Transportation and Handling

At least the following shall be included: transport drawings, and instructions for handling, rigging and receiving.

11.18.4.7 Performance Characteristics

Performance characteristics information shall include general information required by **Section 8** and the Ordering Specification, such as overload and over-voltage capability data, a general winding schematic and a 60 Hz impedance model. More detailed design review data, such as impulse distribution, detailed design review data, short circuit capability, etc., is considered as confidential engineering information and shall not be published in the instruction book in order to maintain confidentiality.

PUBLIC VERSION

11.18.4.8 Assembly Information

Complete assembly instructions shall be provided. Gasket details per 6.14 shall be included. Lead taping instructions must be supplied in detail. A description of match marking methods and shipping brace markings and removal instructions are required. If a desiccant material is used within the transformer during transport, the location and instructions for removal shall be provided.

Insulation processing instructions shall be provided in detail, including: criteria for dryness used by Seller both in factory and in the field; vacuum and filling procedures that are consistent with the dryness criteria provided.

11.19 Photographs

Two sets of photographs sufficient in number and perspective to reveal the complete core and coil assembly details shall be made prior to tanking each transformer. In no case shall less than three photographic angles be made. In addition, each purchase order shall have two sets of photographs made of: the assembled core before landing the coils, each coil section (inner, middle and outer windings) before assembly, view showing all of the inside walls of the tank and views showing all sides and ends of the assembled transformer. These photographs shall be made of each phase of the transformer. Photographs shall be sent to OE as soon as they become available but not later than two weeks prior to delivery. Photocopies of these prints shall be included in the IB (11.18).

As required in 11.21, if a factory failure should occur, photographs shall be taken of the areas of failure and one full set of such photos shall be supplied with the failure report to OE.

11.20 Certified Test Reports

The required test reports include Seller's certified transformer test report, bushing design test report and bushing routine test values as described below. All test reports are required to be received by OE no later than two weeks following completion of transformer tests. "Certified," indicates that Seller's appropriate engineering or QA representative signed the test report. Actual measurements and associated guarantees or standards to which they are to be compared shall be reported. This includes actual and standard waveshapes.

11.20.1 Seller's Test Report

Six (6) paper copies and one (1) electronic copy of Seller's certified transformer test report are required. Test results of individual units shall be submitted as individual test reports.

The transformer test report shall contain all data on each test required in Section 9. Transformer test reports shall also include a general circuit schematic including representation and description of:

PUBLIC VERSION

- 1) Impulse generators (capacitance, resistance, initial voltage, number of stages installed)
- 2) Circuit resistors and capacitors (for example, lumped elements used in impulsive tests)
- 3) Measuring impedances (divider descriptions, shunts, etc.)
- 4) Measuring instrumentation (connections & descriptions)
- 5) Test object (tap position, connections/terminations, impedances of all terminations)
- 6) Alternating current generators (MVA, kV, no. phases, frequency)
- 7) Calibration measurements (for dielectric tests)
- 8) Actual waveshapes achieved
- 9) All other data required by 9.10.

Seller's test report shall state the name of the inspector who represented Owner at the dielectric tests and/or power tests. If no one attended the test to represent Owner, this shall also be noted.

11.20.2 Bushing Test Reports.

Six (6) paper copies and one (1) electronic copy of bushing certified test values shall be provided including bushing serial numbers, capacitance, and power factor measurements on condenser bushings rated 23 kV class (150 kV BIL) and above. This data shall be provided on a single sheet unless the amount of data exceeds that which can be legibly presented on a single sheet.

One (1) certified test report of bushing design tests required by ANSI/IEEE C57.19.00 shall be provided for each bushing, or set of identically designed bushings, to be applied at or above 138 kV, (line-line) system voltage. Only one copy of this report is required per order, regardless of quantity of transformers ordered. This requirement will be waived for each bushing design for which a certified test report has been previously submitted to OE. Seller must receive confirmation from OE that this requirement has been waived.

11.21 Trouble Reports

Test failures, questionable test results, failure to meet any guaranteed or specified requirements, and important quality defects shall be brought immediately to the attention of OE for resolution by Seller prior to proceeding with fabrication, repair, testing or shipment. Seller shall advise OE and provide OE the opportunity to witness teardown. Seller shall provide a detailed failure report to OE including photographs of the damaged or defective items. Seller shall provide electromagnetic field plots and other supporting data upon request, where appropriate to the mode of failure.

Seller shall not initiate repair of failed or defective components as specified above until OE has agreed to the proposed repair, procedure or modification.

11.22 Special Engineering Reports

A special engineering report shall be submitted with all performance and design review data specified in **Section 8** and in the Ordering Specification. Detailed Design Review data shall be held as confidential and proprietary. This report shall be issued in one complete book, e.g., a binder similar to that provided with the IB.

PUBLIC VERSION

11.23 Schedules

A production schedule shall automatically be provided to the OE beginning six weeks after Seller's receipt of an order with updates submitted at six-week intervals thereafter. Additional updates shall be provided as requested by the OE.

11.24 Notification of Manufacturing and Testing Stages

OE shall be notified as early as possible (minimum of three weeks) prior to the following events so that travel arrangements can be approved for witnessing each of these steps:

- 1) Placing coils on core, before assembling top yoke
- 2) Tanking of core and coils
- 3) Dielectric tests (impulse and induced tests)
- 4) Temperature rise tests

Until notified otherwise by OE, Seller shall assume that OE shall attend each of the above events. Failure to provide proper notification of these events may result in the need for Seller to delay proceeding with production or testing until OE is able to arrange to witness these events at the factory.


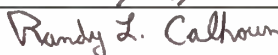
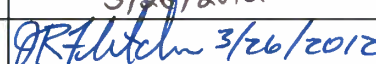

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SPECIFICATION COVER SHEET

TITLE: Fleet Control Data Communications Design Criteria

SPECIFICATION NUMBER: DC-ICE-005

PROJECT: Fossil & Hydro Generation Projects	
REVISION: 0, SUPERCEDES DC-FGD-SCR-011	
DATE: 3/26/2012	
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INTERNAL APPROVAL SIGNATURES	
	Original Issue
AUTHOR: Brian E. Newell	 3/26/2012
REVIEWED BY: Randy L. Calhoun	 3/26/2012
APPROVED BY: James R. Fletcher	 3/26/2012
Timothy V. Riordan	 3/26/12

Specification: DC-ICE-005	Revision: 0	Page 1 of 12
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REVISION HISTORY

REV.	SCOPE OF REVISION	REV. DATE	PREPARER/ REVIEWER	APPROVAL
0	Initial issue		Not Applicable	Not Applicable

Specification: DC-ICE-005	Revision: 0	Page 2 of 12
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PUBLIC VERSION

TABLE OF CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1.0	PURPOSE.....	4
2.0	APPLICABILITY.....	4
3.0	DEFINITIONS.....	4
4.0	CRITERIA.....	6
4.1	ARCHITECTURE.....	6
4.2	COMMUNICATIONS MEDIA.....	7
4.3	COMMUNICATIONS EQUIPMENT.....	8
5.0	EXCEPTIONS.....	8
6.0	EXAMPLES.....	10

Specification: DC-ICE-005	Revision: 0	Page 3 of 12
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PUBLIC VERSION

1.0 PURPOSE

This document provides criteria for the application of data communication network technology within an AEP electric generating facility. Included is a description of architecture, hardware, and media. It is not the intention of this document to dictate the design of every possible network implementation at the hardware level but to define a consistent approach to developing the high level configuration and the interconnectivity of these systems. Adherence to this document shall provide a consistent interface and design approach for the networks at each AEP electric generating facility. The networks discussed include the following types: Distributed Control System (DCS) Networks, Programmable Logic Controller (PLC) Networks, Monitoring Equipment Networks, Plant Business Local Area Networks (LAN) and Corporate Wide Area Networks (WAN).

Examples of network topology have been included in section 6.0 of this guide.

2.0 APPLICABILITY

- 2.1 This document is applicable to any organizations performing work at an American Electric Power electric generating facility.
- 2.2 This document shall be used for all AEP projects where microprocessor-based networks (e.g. DCS, PLC) are added or modified.
- 2.3 This document shall be used as the basis for interfacing the DCS Networks, PLC Networks, Plant Business LAN, and Corporate WAN as defined and discussed below. Specific guidelines for the Plant Business LAN and Corporate WAN are by AEP IT and are not addressed in this guide.
- 2.4 Any request for deviation from this guide requires written approval from the AEP Engineering Services Instrumentation and Controls Engineering Section Manager.

3.0 DEFINITIONS

- 3.1 Communication Protocol – Method of addressing data so it can be transferred to and/or from the appropriate network devices. Typical Ethernet protocol utilizes the TCP/IP (Transmission Control Protocol/Internet Protocol) standards. Modbus or proprietary communications can be used as well.
- 3.2 Standard Ethernet (10BASE-T) - 10Mbps using the IEEE 802.3 data communication standard, TCP/IP protocol, and twisted-pair copper cable.
- 3.3 Fast Ethernet – 100BASE – X Ethernet Systems using the IEEE 802.3u data communication standard, TCP/IP protocol, and either copper or fiber-optic cable.
- 3.4 Gigabit Ethernet – 1000BASE – X Ethernet Systems using the IEEE 802.3ab data communication standard, TCP/IP protocol, and either copper or fiber-optic cable.

Specification: DC-ICE-005	Revision: 0	Page 4 of 12
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- 3.5 Corporate Wide Area Network (WAN)** – This is the AEP Corporate Network to which each of the AEP Plant Business Local Area Networks are connected
- 3.6 Plant Business Local Area Network (LAN)** – This is the network on which the plant management, plant business support, and plant engineering staff's business computers reside.
- 3.7 DCS Operations Network** – This is the network of HMIs (operator consoles) that communicate with DCS Control Networks.
- 3.8 DCS Control Network** – This is the network on which the process controllers reside and communicate the various control commands and functions for operation of the units.
- 3.9 PLC Operations Network** – This is the network of HMIs (operator consoles) that communicate with PLC Control Networks.
- 3.10 PLC Control Network** – This is a network to which multiple PLCs are linked. In addition, it can provide a means for the plant personnel to access PLC programming and diagnostics using configuration software.
- 3.11 Monitoring Equipment Network** – This is a network of additional monitoring equipment that does not perform control or protection functions.
- 3.12 DMZ (demilitarized zone) Network** - A middle ground between a protected internal network (DCS Operations Network, DCS Control Network, PLC Operations Network, or PLC Control Network) and an external network (Plant Business LAN or AEP Corporate WAN). The DMZ is a sub-network (subnet) that resides behind firewalls or Data Diode communications equipment. This network is designed to provide Plant Business LAN access to unit operational data. There are two types of DMZ's: (1) Essential DMZ – A grouping of controls, monitoring, or protection equipment that is considered essential to the reliable operation of the generating unit(s). (2) Non-essential DMZ – A grouping of control, monitoring, or protection equipment that is not considered essential to the reliable operation of the generating unit(s).
- 3.13 Switch** – Provides interconnectivity between nodes on a network, making it possible for multiple communications between nodes.
- 3.14 Router** – Similar to a switch, however, a router has additional intelligence features that enable it to filter and direct (i.e. manage) data between the various networks.
- 3.15 Firewall** – Network access control device(s) programmed to limit access to data, applications, or devices across multiple networks.
- 3.16 Node** – Control processors, monitoring processors, operator stations, and servers on a network.

Specification: DC-ICE-005	Revision: 0	Page 5 of 12
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3.17 Data Link – Provides digital communication between the DCS and various third-party devices (e.g. PLC, protective relays, analyzers).

4.0 CRITERIA

4.1 ARCHITECTURE

- 4.1.1** The DCS Control Network, DCS Operations Network, and PLC Control Network shall be segmented from the Plant Business LAN as shown in figure 6.3. DMZ segmentation must be reviewed and approved by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager.
- 4.1.2** If establishing a Plant Business LAN connection to the DMZ, DCS Operations Network, or DCS Control Network a Firewall or Data Diode shall be used. All connections between the Plant Business LAN and these networks shall be reviewed and approved by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager. Firewall and Data Diode equipment will be supplied and configured by AEP.
- 4.1.3** No connectivity shall be permitted between the Essential DMZ and the Internet. All connections between the Non-essential DMZ and 3rd party or vendor networks shall be reviewed and approved by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager.
- 4.1.4** The DCS Control Network and DCS Operations Network shall be fault-tolerant, utilizing redundant hardware including communications equipment, communications media, and power supplies/sources where applicable. Figure 6.1 and 6.2 represent typical architectures. The specific requirements of the DCS shall dictate which network shall be used.
- 4.1.5** Connections between the DCS Operations Network and the DCS Control Network shall be through Ethernet or a proprietary communications connection. (i.e. ABB Computer Interface Unit or APACS Network Interface Module)
- 4.1.6** HMIs, historians, data servers, and engineering stations shall be connected to the DCS Operations Network. They shall be able to maintain a line of communications to the DCS Control Network as well.
- 4.1.7** Process information from the DCS Control Network and PLC Control Network shall be capable of interfacing with an OSI PI Historian.
- 4.1.8** The proposed use of data links between a PLC Network or Monitoring Equipment Network and a DCS Network shall be reviewed and approved by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager.

Specification: DC-ICE-005	Revision: 0	Page 6 of 12
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4.1.9 Data links shall not be used for control. Hard wired I/O shall be used for high-level commands, for example: start, stop, interlocks, trips, and set point changes.

4.1.10 Data links shall be limited to providing monitoring capabilities to the DCS operator workstation.

4.2 COMMUNICATIONS MEDIA

4.2.1 COPPER/FIBER

4.2.1.1 The DCS Control Network shall operate at a minimum of 100Mbps.

4.2.1.2 The DCS Operations Network shall operate at a minimum of 100Mbps.

4.2.1.3 Fiber-optic network cable shall be multimode 12-pair (minimum). Maximum length for multimode fiber optic communication cables is 2 kilometers (approx. 6500 feet). AEP approved fiber optic patch panels, break-out or fan-out kits should be used to terminate fiber prior to connection to equipment.

4.2.1.4 Copper network cable shall be twisted-pair. Maximum length for copper communication cables is 100 meters (328 feet).

4.2.1.5 Network cable shall be installed in dedicated conduit. Redundant network cables shall be routed in separate conduits or raceways.

4.2.1.6 Interconnection between switches, routers, and nodes shall be via copper cable when these devices are less than 100 meters apart. Fiber-optic cable shall be used for all other installations and where electrical noise or grounding concerns prohibit the use of copper.

4.2.2 DIGITAL BUS TECHNOLOGY

4.2.2.1 Digital bus technology is not approved by default. Any proposed use of digital bus technology for control and monitoring shall be reviewed and approved by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager. This includes the use of control buses (e.g. Foundation Fieldbus, PROFIBUS), device buses (e.g. DeviceNet, PNet, and SDS) or bit-level sensor buses (e.g. Seriplex, AS-i).

4.2.3 WIRELESS

Specification: DC-ICE-005	Revision: 0	Page 7 of 12
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- 4.2.3.1** Wireless and radio technology are not approved by default. Any proposed use of wireless and/or radio technology for control and monitoring shall be reviewed and approved by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager. This includes the use of wireless transmitters and wireless network communications equipment.
- 4.2.3.2** When approved, wireless technology shall meet IEEE 802-11a, 11b, 11g, or 11n.
- 4.2.3.3** When approved, wireless or radio communications are encrypted at the hardware or application layer with sufficient security to prevent unauthorized snooping. AEP has accepted AES 256 bit encryption at the application layer as adequate. Security by Obscurity (i.e. a proprietary vendor protocol) is not a substitute for packet encryption. Wireless access points shall use WPA2 encryption. WPA, WEP and Open networks are not permitted.
- 4.2.3.4** When approved, all data packets shall include a sequence number or timestamp before encryption so no two transmitted packets are the same. This is to prevent packet spoofing. The receiving end shall recognize and reject an out-of-date or out-of-sequence packet.
- 4.2.3.5** Any battery operated wireless element shall have a low battery indicator and alarm to help prevent loss of data in mid-operation. The alarm shall operate for a minimum of 8 hours before battery exhaustion. Battery life shall be greater than one year.

4.3 COMMUNICATIONS EQUIPMENT

- 4.3.1** Firewalls, Switches, and Routers shall be an approved model from an AEP Engineering Services Instrumentation and Controls Engineering approved vendor.
- 4.3.2** Modems shall not be installed as part of or in devices connected to control, monitoring, or protection system network.
- 4.3.3** Media and protocol converters shall be an approved model from an AEP Engineering Services Instrumentation and Controls Engineering approved vendor.

5.0 EXCEPTIONS

Network technology is a continuously advancing art. Communication protocols and equipment features from both a hardware and software viewpoint are changing and evolving. With this background, it is understood that implementation procedures play a major role in the actual deployment of new control networks as well as the upgrade and maintenance of existing systems.

Specification: DC-ICE-005	Revision: 0	Page 8 of 12
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Any exceptions to this Design Criteria shall be presented and reviewed prior to purchasing the control system equipment. Final approval of these exceptions shall be by the AEP Engineering Services Instrumentation and Controls Engineering Section Manager.

Use the following procedure for requesting an exception to Design Criteria:

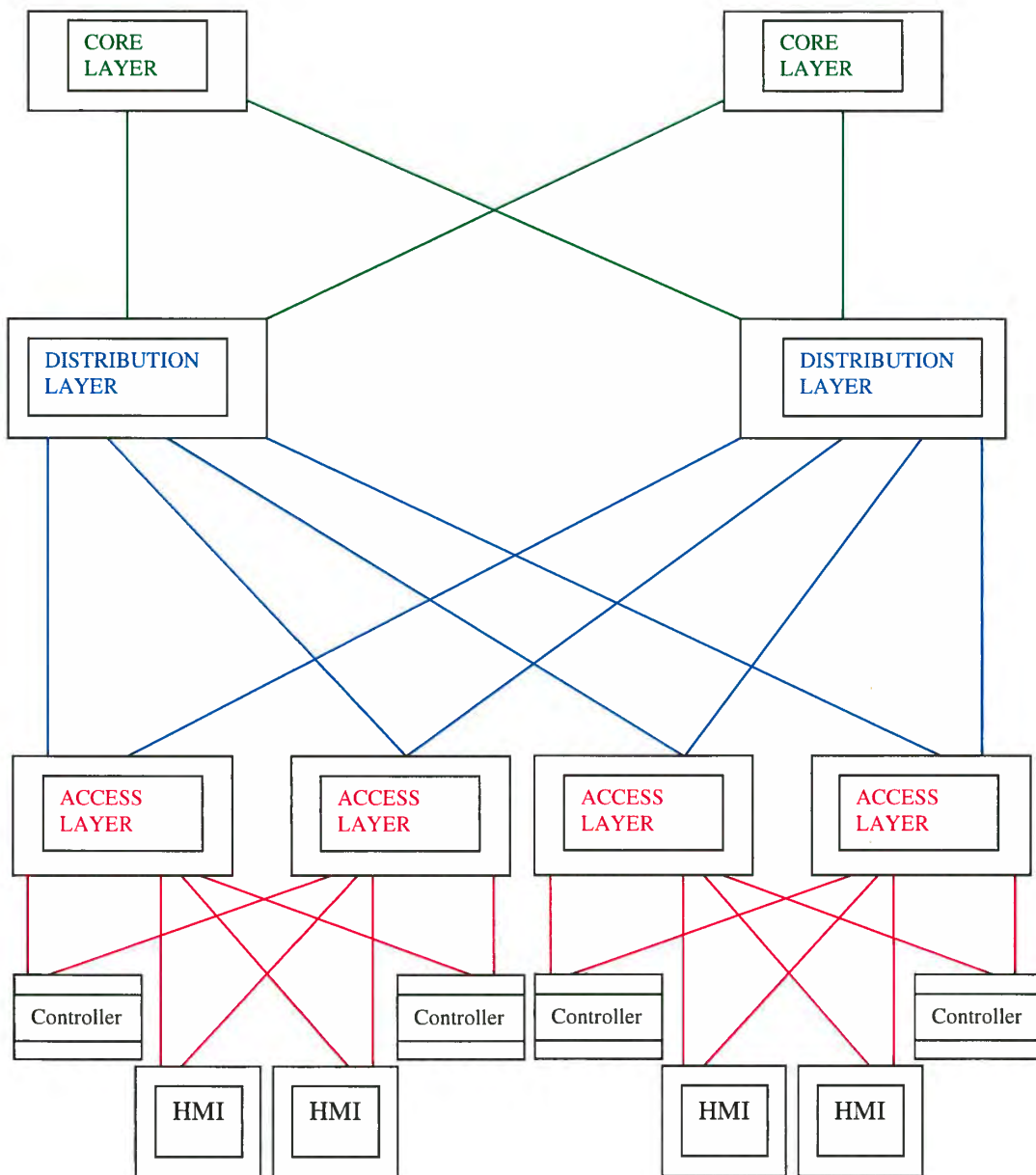
1. Develop a functional description of the intended network operation. This shall be at a high level, listing items such as the ultimate intent of the system, the major networks or sub networks, and the major pieces of equipment to be served. The functional description shall also detail the network parameters that impact succeeding decisions such as protocols, data rate, interconnection media, and security measures.
2. Develop a preliminary network architecture sketch. This shall be developed in sufficient detail to promote discussion but not in such high detail that it masks the basic structure of the network and the dataflow. It shall have a well-defined border for each of the sub-systems and show any intended hardware gateways or firewalls between the networks.
3. When the functional description and the preliminary architecture have been completed a configuration meeting shall be held with representatives from each of the interfacing system owners. Information to be reviewed in the meeting shall be sent to all participants for review at least 14 days prior to the meeting date. The following representatives are recommended for attendance to the configuration meeting:
 - a. Plant operations and maintenance personnel
 - b. Plant engineering
 - c. AEP Engineering Services Instrumentation and Control (I&C) Engineering
 - d. Major equipment vendor personnel such as the DCS vendor, turbine vendor, plant historian vendor (if not provided as part of the DCS).
 - e. Architect Engineer (if engaged)
 - f. AEP Corporate IT (as required)
 - g. Network Integrator specialists (as required)

Specification: DC-ICE-005	Revision: 0	Page 9 of 12
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6.0 EXAMPLES

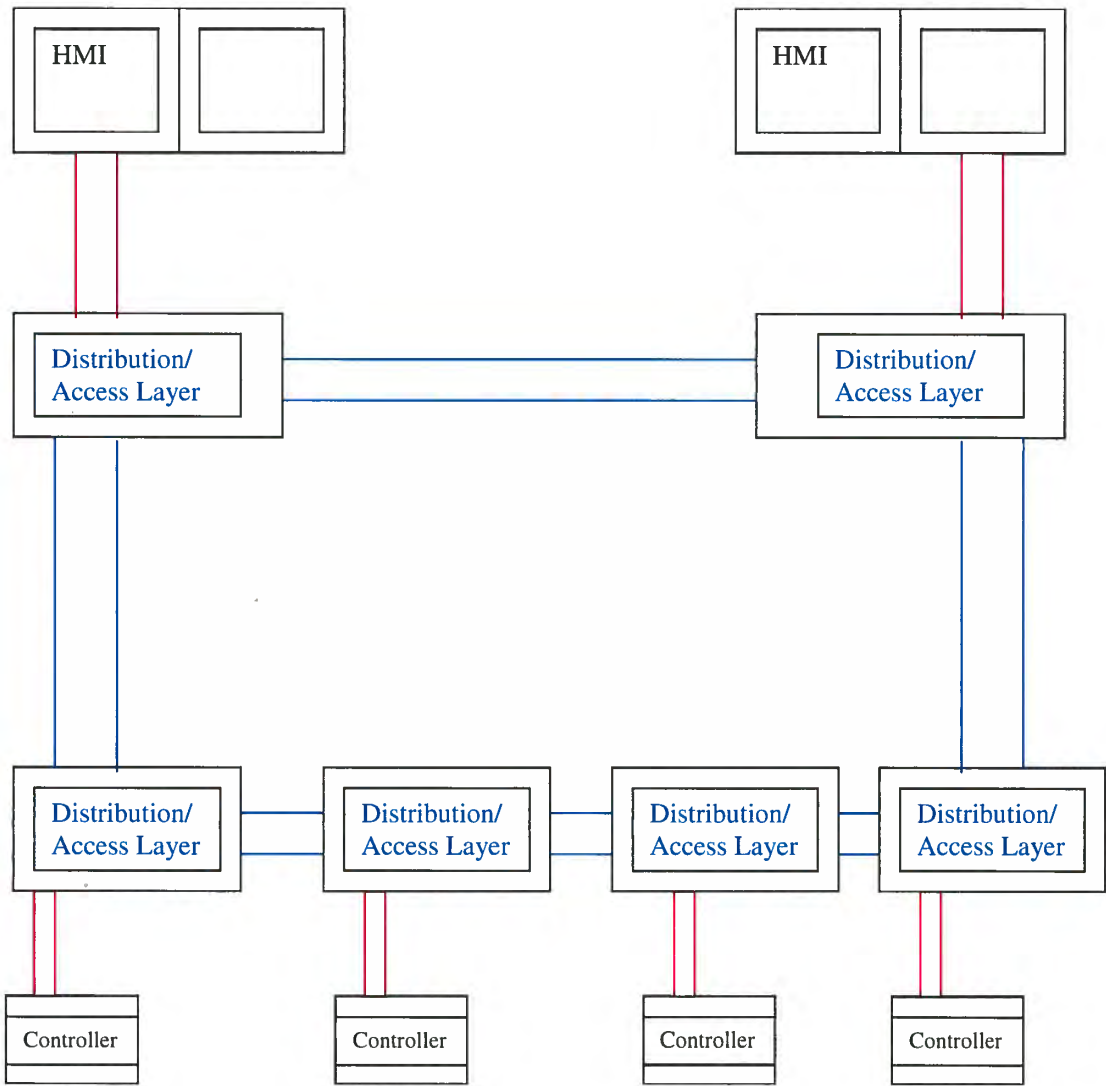
**FIGURE 6.1
HUB & SPOKE NETWORK TOPOLOGY**



Specification: DC-ICE-005	Revision: 0	Page 10 of 12
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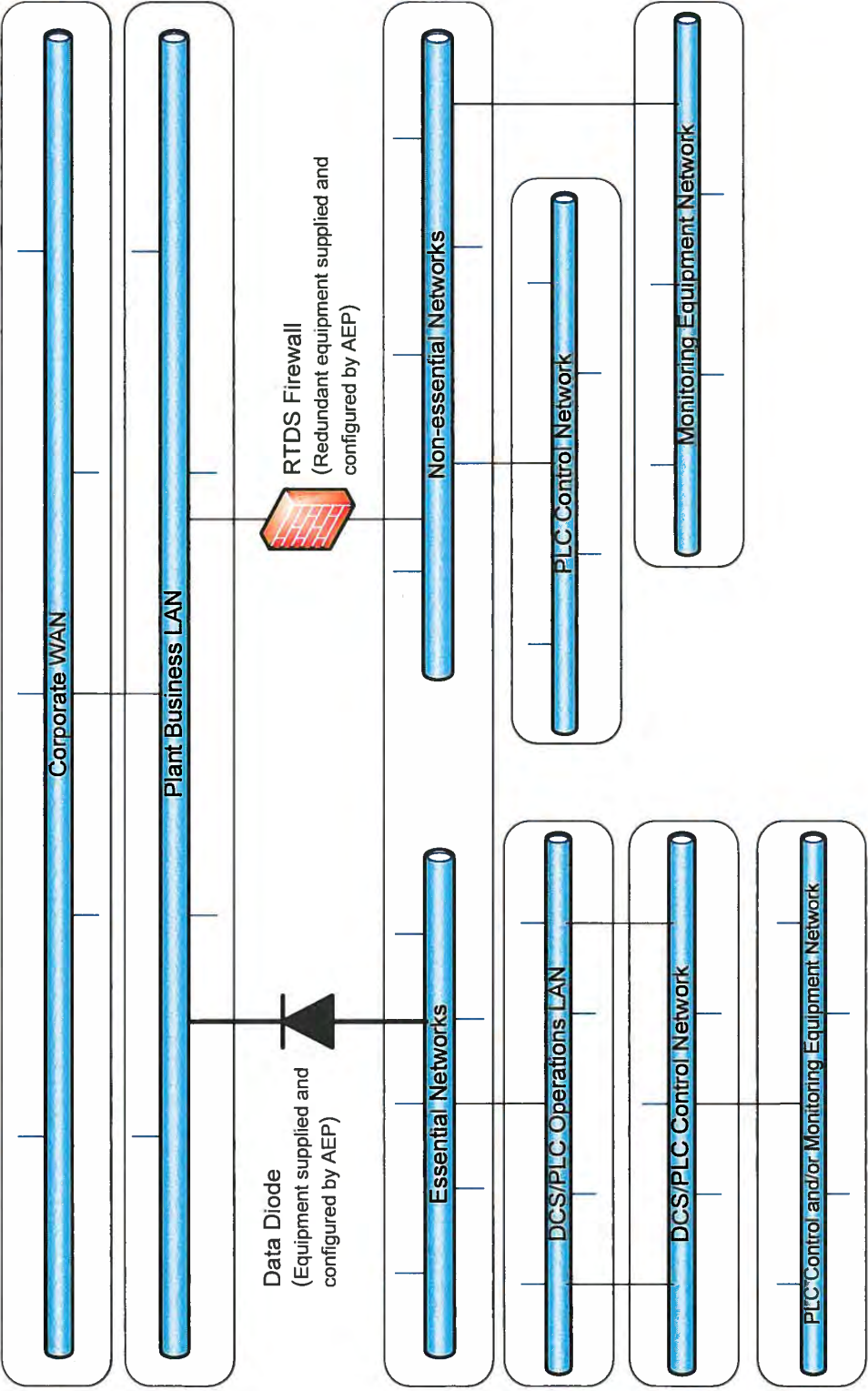
FIGURE 6.2
RING NETWORK TOPOLOGY



Specification: DC-ICE-005	Revision: 0	Page 11 of 12
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FIGURE 6.3 TYPICAL NETWORK HIERARCHY



Specification: DC-ICE-005	Revision: 0	Page 12 of 12
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**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 6
AEP GENERATION SCHEDULING REQUIREMENTS
REVISION 9, DATED 07/30/2015**

AEP PROJECTS INVOICING REQUIREMENTS REVISED 4/17/2017

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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AEP GENERATION SCHEDULING REQUIREMENTS REVISION 9, DATED 07/30/2015

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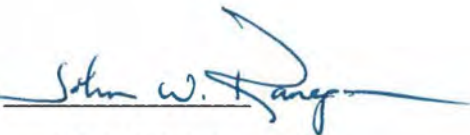
PUBLIC VERSION

AEP Generation Scheduling Requirements

Revision 9

Date: 07/30/15

Approved: _____



John W. Ranegar

Approved: _____



Brian D. Sherrick

For Contract: _____

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1.0 INTRODUCTION

- 1.1** The following AEP Generation (hereafter AEP) schedule development and schedule maintenance requirements are included as part of the contract. The purpose is to describe the responsibilities and interface requirements to prepare for, monitor performance and implement a planned project and/or unit outage. If you are unsure of the specific requirements please contact AEP's contract administrator or project manager.

2.0 SCHEDULE REQUIREMENTS

- 2.1** Unless otherwise designated, AEP Project Controls and AEP Outage shall act as the "Integration Scheduler" and they are responsible for establishing the schedule standards for the Integrated Project Schedules (IPS). The Integration Scheduler is responsible to coordinate and maintain the overall Integrated Project Schedule. AEP, in conjunction with the Integration Scheduler (if applicable), will establish the schedule using the Primavera P6 platform for the execution of the work as described in paragraph 2.6.

- 2.2** AEP and each contractor or designee involved in the project are responsible for providing their portion of the Integrated Project Schedule and updates to the Integration Scheduler in accordance with the scheduling deliverables outlined in paragraph 2.6.1.

2.3 Scheduler Requirements/Qualifications

- 2.3.1** Upon schedule submittal, the Contractor shall designate in writing a competent scheduler or scheduling representative in the Contractor's organization who shall be responsible for coordinating with AEP during the preparation and maintenance of the Project Schedule.
- 2.3.2** The Contractor's scheduling representative is considered key personnel by AEP. As such, AEP shall have the right to review the qualifications of the individual assigned as the scheduling representative. The Contractor's scheduling representative shall have complete authority to act on behalf of the Contractor in fulfilling the Project Schedule requirements of the Contract. The Contractor shall notify AEP in writing of any proposed changes in this position.
- 2.3.3** The Contractor's key personnel, the scheduling representative, and to the extent applicable the personnel responsible for developing and inputting information into the Project Schedule shall attend schedule related meetings. For onsite construction labor contracts, Contractors shall provide a qualified onsite scheduler.
- 2.4** The Integrated Project Schedule shall be a logic driven, resource loaded schedule utilizing the Critical Path Method (CPM). The schedule detail will be sufficiently delineated and defined to isolate individual activities within a subsystem as defined in the project Work Breakdown Structure (WBS). The end product will consist of a time scaled network that can be printed in a bar chart format (GANTT). A resource loaded and leveled schedule

PUBLIC VERSION

(to resource availabilities and reconciled with budgets/staffing plans) will be provided for baseline review within expected timeframe. Updates to the Integrated Project Schedule shall be based on physical percent complete and accurate remaining durations.

2.5 The requirements for input to the Integrated Project Schedule shall include, but not be limited to, the following:

2.5.1 Assure realistic schedule showing the sequence of activities required to complete all of the work as set forth in the Scope of Work and Compensation sections of the RFP.

2.5.2 For Outage related Projects, the schedules shall represent the period from unit shutdown to release for 100% load dispatching, and must include major pre-outage work, if critical to achieve the outage duration.

2.5.3 Assure adequate planning and execution of the Work by the Contractor and its subcontractors.

2.5.4 Incorporate and assure coordination of the Work of the Contractor with the activities of the Owner and its other Project contractors.

2.5.5 Assist both the Contractor and Owner's designated Project Manager or designee in:

- Evaluating contract performance relative to the Integrated Project Schedule
- Progress reporting (as defined in Section 3.0)
- Proposed Schedule/Scope modifications
- Daily interaction, including change control

2.6 Primavera P6 Project Management Version 7.0 or newer (hereby referred to as P6) will be utilized on the project through the **AEP LAN or by VPN connection to the Primavera Enterprise database** to allow for integration of all schedules. The common schedule will contain the necessary Activity Code structure, see attached appendix "A". Critical decisions required by Owner shall be key milestones in the Integrated Project Schedule. Each contractor will develop a detailed schedule under an EPS Node designated by AEP for that contractor in the master project. This node will provide specific access restrictions and security as to prevent competitors from obtaining confidential information.

For project related activities, the contractor's schedule shall be developed in accordance with the guidance and principles set forth in the AEP Project Scheduling Handbook (available on request). For outage related activities, the contractor's schedule shall be developed in accordance with the guidance and principles set forth in the AEP Outage Scheduling Desktop Guide. These documents provide guidance for:

- Activity ID structure

PUBLIC VERSION

- Minimum required activity codes
- Autocost Rules
- Required P6 settings
- Baseline Process
- Activity Fragnets
- Integration Methods
- Quality Assurance Program

Questions concerning the AEP Project Scheduling Handbook and its requirements should be directed to the AEP Project Controls Department prior to acceptance of these terms.

Questions concerning the AEP Outage Scheduling Desktop Guide and its requirements should be directed to the AEP Outage Scheduling Department prior to acceptance of these terms. Latest versions of these guides are available upon request through the Integration Scheduler.

2.6.1 The following information will be furnished by the contractor to the AEP integration scheduler as a minimum for each non-Level of Effort activity:

- Preceding and succeeding Activity ID, Relationship Type, and (if applicable) Lag. Use of Lag must be identified by contractor and approved by the Project Manager and the Integration Scheduler.
- Meaningful activity description
- Estimated duration of activities
- Early start date (unless the activity dates are to be calculated by AEP)
- Early finish date (unless the activity dates are to be calculated by AEP)
- Actual start date (once the activity has begun)
- Actual finish date (once the activity has completed)
- Late start date (unless the activity dates are to be calculated by AEP)
- Late finish date (unless the activity dates are to be calculated by AEP)
- Total float in hours according to the activity's calendar (unless the activity dates are to be calculated by AEP)
- Activity percent complete (usually specified as the physical percent complete type)
- Budgeted units and specific resources required to accomplish the activity.
- Appropriate Roles for activities with resources assigned

PUBLIC VERSION

- Budgeted Non-Labor Units and specific commodity resources required for commodity related activities
- Unit rates/rules of credit for commodity driven activities.
- Activity Calendar by which the work is to be performed
- Activity Codes (Required by guidelines and as applicable) refer to Appendix A.
- AEP WBS Structure
- Key Milestones as directed, including Contract Payment/ Completion.

2.6.2 Level of Efforts without budgeted units will be allowed for summarizing groups of activities. LOEs with budgeted units will be allowed for indirect work that are not commodity driven or do not have a measurable deliverable. The following information will be furnished by the contractor to the AEP integration scheduler as a minimum for each Level of Effort activity:

- Preceding and succeeding activity ID number
- Activity description
- Activity percent complete
- Activity Codes (as applicable to tasks)
- WBS number
- Responsible Group
- Calendar on which work is to be performed

2.6.3 The Primavera P6 detailed schedule will be developed to include meaningful logic in a Level 4 detail, with the ability to roll up to Level 1 or Level 2. Schedule development is performed in a series of evolutions outlined below starting at a summary level and ending with a detailed and executable implementation plan for all organizations. Schedule Levels are defined in the Glossary in Appendix B.

2.7 Schedule Submittals

All schedule submittals, including the proposed Authorized Baseline schedule, will be forwarded to the AEP scheduler and be subject to acceptance by AEP. The following tables will describe the required timeline for schedule submittals.

Major Projects	
Schedule Type	Project Work
Level 2 Submittal	With Contract Bid Proposal
Level 3 Pre-Submittal	NLT 21 Days After Contract Award

PUBLIC VERSION

Level 3 Submittal (For Project Baseline Review)	NLT 30 Days After Contract Award
Integrated Authorized Baseline Approval	NLT 45 Days After Contract Award

*Level 1 schedule will be developed and maintained by Integration Scheduler.

Outage Related Projects	
Schedule Type	Outage Work
Level 3 Initial Submittal (For Project Baseline Review) (PC-6)	Outage Start (- 5) Months
Level 3 Rev B Schedule Review and Approve (PC-10)	Outage Start (-4) Months
Level 4 Rev C Review and Incorporate comments (PD-3)	Outage Start (-2) Months
Level 4 Rev O Schedule Review and Issue (PD-8)	Outage Start (T-1) Months
Integrated Authorized Baseline Approval	Outage Start (-48) Hours

2.8 Outage Schedule Reviews

2.8.1 Rev B - Level III (Schedule confidence – Low/Medium)

Content - Work Order activity level schedule issued at approximately T-4 months. Preliminary Critical path for the outage is identified and schedule contains all identified work scope and available planning information. System windows are established and inter-window logic ties are made. Activity durations are based on best information from planning templates or past experience, implementing departments are assigned and resources are estimated. All scoped activities are included based on best information available; at a minimum work orders are scheduled as a single activity (includes all contractor/vendor work). Template activities for operations shutdown, commissioning and performance testing and startup activities are included.

Review – Organization assignments are validated and crew assignments are made, durations are validated or revised and resource assignments established. Shift work calendars are assigned and additional activity subtask logic is established as required. Work to be performed by contractors or vendors is integrated. Outstanding items are documented and assigned for resolution prior to issuance of the Rev B schedule.

2.8.2 Rev C – Level IV (Schedule confidence- Medium)

Content - Issued at approximately T-2 months. Resource assignments are completed and resource leveling is performed, Critical path and near Critical Paths is defined with detailed schedules developed for all critical sequences. Operations

PUBLIC VERSION

clearance activities and system logic is included. Detailed schedule input has been received from outside vendors and contractors and integrated within system windows. Detailed, hourly-based activities for Environmental, Retrofit and PPB projects work and testing activities are integrated into the outage schedule. Support activities for scaffold, insulation, power, system draining/filling etc. are included and logic tied. Usage of equipment such as cranes and rigging, lay-down/staging areas, floor loading etc have been incorporated into the schedule logic.

Review - Final reviews are performed by all organizations for crew and resource assignments, activity predecessor and successor relationships etc. Craft resource loading is reviewed for schedule requirements vs. planned availability. System restoration and testing is fully integrated into the schedule and reviewed by Operations. Schedules provided by contractors are validated and include all required logistics for equipment usage, area proximity and manpower loading. Vertical slice reviews are performed to identify conflicts with system integration and equipment usage or work area logistics.

2.8.3 Rev 0 – Level IV (Schedule confidence- High)

Content – Schedule issued at approximately T-1 month. All comments have been incorporated and any emergent items are included in the schedule. Pre-outage work is in-progress and validated that work will be achieved prior to start of the outage. Outstanding Material deliveries are reviewed for impact and activities are scheduled as required. Work package walk down information is finalized and incorporated. The schedule is considered static and available to perform final vertical slice reviews along with critical path and resource analyses.

Review- Final reviews are performed and confirmations are provided by implementing organizations that the schedule is achievable and executable as written. All groups have performed integrated reviews by day and any logistic concerns have been identified and resolved.

2.8.4 Baseline (Schedule confidence- High)

Schedule created from a copy of the current integrated outage schedule at or near the start of the outage, which establishes a formal reference for comparison and verification of subsequent efforts, progress, analysis and control.

- 2.9** Contractor shall submit for approval a Level 2 Budget Loaded CPM network schedule with their bid response documents. Initial submittal for review purposes will be submitted in legible-sized file to the Integration Scheduler.

- 2.9.1** As requested, the Contractor will participate in a review and evaluation of the proposed CPM network schedule and analysis for the Level 2 and all subsequent

PUBLIC VERSION

(Level 3 and 4) submittals with the Integration Scheduler. Revisions will be resubmitted within (10) ten days of the schedule review meeting(s).

- 2.9.2** The quantities and hours expressed in Contractor's CPM network schedule activities will represent the breakdown of values defined by the contract Form 1.
- 2.9.3** The Integration Scheduler will create a backup copy of the approved schedule for each level that will become the authorized baseline. Once a baseline has been established no modifications between corresponding activity IDs in the current schedule and baseline will be made. Budget shifts and reductions, significant logic revisions i.e.: work flow changes due to material issues, construction related engineering issues etc, will need to be reviewed and approved by the Integration Scheduler prior to implementation into the current schedule via the Schedule Change Notice (SCN), refer to Section 2.10.2. Revisions or re-baselining of a schedule will require the approval of AEP and be required to meet specific guideline criteria.
- 2.9.4** Contractor schedule updates shall be conducted on regular intervals as determined by the Project and Outage Management Team (Outage Work). Typically frequency for projects will be weekly and Monday, Wednesday, and Friday for outage work.
- 2.9.5** Contractors may be required, at the request of AEP to further refine Level III schedule activities, which are to be executed during a 'tie-in' outage, to a Level IV detail, as described in Appendix B of this document.

2.10 Performance/adherence to the project schedule shall be monitored based on the Schedule Performance Index (SPI) and the Cost Performance Index (CPI).

- 2.10.1** All schedules shall provide schedule performance metrics, including schedule variance and Schedule Performance Index (SPI), with supporting details. For project work that involves time and material and/or cost reimbursable methods of payment, Cost Performance metrics, including Cost Variance and Cost Performance Index (CPI) shall be provided with supporting details.

- 2.10.2** The following method of CPI and SPI calculations shall be followed.

The method of calculation for CPI is Earned Value Hours (EV) divided by Actual Hours (AC). Example: Weekly Earned Hours = 400, Weekly Actual Hours = 410, $400/410 = .975$ Weekly CPI.

The method of calculation for SPI is Earned Value Hours (EV) divided by Planned Value Hours (PV). Example: Weekly Earned Hours = 400, Weekly Planned Hours = 390, $400/390 = 1.02$ Weekly SPI. Calculation of Earned Hours shall be measured against 100% of the Early Start / Finish Dates and be measured against the "Mutually" agreed baseline planned hours as indicated in P6.

PUBLIC VERSION

For Project Related Contracts: It is expected and required that the contractor will perform proper and consistent baseline maintenance, in accordance with PMI (Project Management Institute) scheduling principles, as a means of ensuring alignment between the planned budgets in the baseline and the correlating activities against which those budgets are earned in the current schedule. It is the contractor's responsibility to notify the AEP scheduler when baseline maintenance must be performed, a Schedule Change Notice (SCN, detailed) must be processed for all changes to the Authorized Baseline. The SCN must detail all changes and be approved by project management team. All adjustments to the baseline will be made by the Project Integration Scheduler. Changes to the baseline and adjustments to the baseline that do not need a formal SCN must be made by the Project Integration Scheduler. Note for clarity purposes that baseline maintenance is not synonymous with re-baseline. Please direct any questions concerning this process to the AEP Project Scheduling department.

Change control will be supported by contractor through Schedule Change Notice (SCN) documentation or Extra Work Order (EWO). Contractor will not make changes to authorized baseline or current schedule's budgeted units without approval of Integration Scheduler. Once a SCN/EWO is approved, contractor will work with the Integration Scheduler to implement changes (refer to the handbook).

- 2.10.3** The SPI and CPI shall be based on resource loaded logic driven schedule with budgeted labor-hours associated with the project. The Construction phase shall be based on all direct craft associated with the project below the General Foreman designation, examples being Foreman, Journeymen, Apprentice, etc.

Indirect craft and overhead associated with the project shall be contained separately in the schedule, progressed and reported as an operating cost associated with the contract. A written labor report submitted weekly to AEP or as coinciding with designated schedule progress cycle, describing by craft, the average headcount for the week and total hours worked. This requirement is for all contractor work at AEP sites and is for fixed price work as well as T&M contracts.

For commodity based schedule activities, unit rates and the resulting rules of credit for each designated commodity shall be submitted to the AEP scheduler. For example; Activity A – Install small bore pipe for coolant pump (80 lf), should have a resource (ex. Pipe Fitter), a budget (ex. 120 mhrs), a rate (ex. 0.66 lf/hr) and the resulting rule of credit would be for every (1) linear foot of pipe installed then (1.5) hours of budget are earned; therefore, after earning (1.5) hours, or installing (1) linear foot, the physical percent complete would be 1.25%. The rules of credit are independent of the activity duration.

PUBLIC VERSION

- 2.10.4** Critical paths will be established and their respective total float will be reported on a cycle coinciding to the schedule progressing periods, weekly for project work and up to daily during an outage if work performance requires. The critical paths will be agreed upon by both AEP and the contractor. Various paths, i.e., primary, secondary, tertiary, etc. will be developed as necessary to track scheduled work and execution efforts. Float will be calculated from a point agreed to by project team.

For Projects, CPM schedule calculations shall be performed using the following settings: retained logic; contiguous activity durations for individual activities; total float based on activity finish dates; fixed duration and units; physical percent complete.

- 2.10.5** Each particular contractor will be responsible for their specific section of the schedule including progress updates; reports and schedule maintenance (refer to section 3). During Outage related projects; following the acceptance of the Level IV Rev. 0 Schedule, all updates and schedule maintenance will be performed by the Integration Scheduler.

The entire Integrated Project Schedule will be limited to having only (2) open ended activities. These activities will consist of an initial start milestone and a completion milestone.

Constraints may be used; however, their use should be kept to a minimum and will be subject to review and approval by the Integration Scheduler. It is the full intent and expectation of AEP that schedules are developed with sound logic. Mandatory Start and Mandatory Finish constraints are prohibited for all Projects unless appropriate approval and documentation from Project Controls Supervision. For Outage related projects the Start On, Start On or After, Finish On, and Finish on or After constraints are also prohibited.

During schedule progress, the following schedule errors and warnings will be corrected prior to submitting the schedule to the Integration Scheduler.

- Open Ends – Activities without Predecessors or Successors
- Activities with Actuals > Data Date
- Out of Sequence Activities
- Milestone Activities with Invalid Relationships
- Activities with unsatisfied constraints
- Activities with unsatisfied relationships
- Other checks to support Projects QA/QC process (as needed)

PUBLIC VERSION

2.11 Commodity curves will be required for tracking both outage and construction related work and will be developed by the contractor. The intention will be to validate and provide a higher level of confidence in the physical progress of activities and quantities relating to the schedule.

2.11.1 The curve data may reside within the schedule and be produced from the software or may be developed within an offline system; however, the installation curve must coincide with the timescale logic of the associated schedule activity.

2.11.2 The reporting cycle for the updating and distribution of the commodity curves will coincide with the required schedule progress updates.

2.11.3 Curves for tracking each specific commodity will be tied to awarded contract quantities. Adjustments, including refined engineering quantities, should be approved through AEP Project Team. Commodity curves shall be developed and submitted prior to commodity work (install or remove) being initiated.

2.11.4 Required minimum data for commodity curves shall include:

- Early and Late Planned, installed, and forecasted commodities by reporting period.
- Accumulative 'S' curves for planned (total contract duration), installed (actual), and forecasted (remaining) commodities.

Establishment of the curves relating to specific installation commodities to be tracked will be determined by AEP site construction and outage management. These curves will generally be held to major items associated on or near the primary, secondary or tertiary critical path of the schedule. Typical items include but are not limited to tons of steel, cubic yards of concrete, number of instruments, total number of completed tube welds, number of platens removed, number of platens installed, linear feet of small and large bore pipe, linear feet of cable, linear feet of electrical conduit, number of terminations, etc.

3.0 PROGRESS SUBMITTALS FOR PROJECT RELATED WORK

3.1 Project Submittals

3.1.1 Weekly Progress Submittals

The comprehensive Weekly Progress Submittal is prepared by the Contractor and is typically due to the Integration Scheduler no later than 11:00 AM Monday after the close of the prior week, unless otherwise negotiated or authorized. The reporting period will be from 07:00 Monday morning through the end of backshift Sunday night. The schedule data date will be set at 07:00 Monday. The Weekly Progress Submittal will be utilized for the weekly conference/meeting. Please Note: Any project related work which requires completion or integration with a

PUBLIC VERSION

'tie in' outage shall have an indicated period of time in which the update reporting cycle will re-align with the update cycles required for the integrated project and outage schedule. The contractor will be notified in advance of this occurring and will be advised as to the new update cycle. Typical outage update cycles are on Mondays, Wednesdays, and Fridays, but can be as frequent as daily. The contractor shall be cognizant of this requirement in order to support overall schedule integration and shall make provisions to support this effort.

- Weekly Progress Submittal will include the following information:
- Level 3 – Three week look-ahead schedule, including:
 - Progress bars for Project Baseline, Last week, and Current Week.
 - Percentage Complete and Remaining Duration on all in Progress Activities
 - Actual Completion Date and Time on all Completed Activities
 - Expected Start for Activities scheduled to start in the next reporting period.
- A progress curve with bar chart detailing information to date (cumulative), and this period (current update period) with the following parameters: planned hours/dollars, earned hours/dollars. The progress curve will indicate the plan including cumulative remaining early, the cumulative remaining late and the cumulative earned and actual.
- Schedule status of labor-hour resource loaded activity based schedule including progressed schedule computations and SPI
- Updated Commodity Curves
- Resource (Staffing) Histogram with weekly actual hours (by trade or discipline) and weekly Estimate to Complete (by trade or discipline).
- Variance (Slip) Report, as required by the AEP scheduler.
- Approved Logic change report, identifying and detailing changes for the Integration Scheduler.
- Schedule Action Item List of Issues/Restrictions that includes description of activities, responsible person, due dates, and the actions being taken to meet target dates.

3.1.2 Monthly Progress Submittals

The Comprehensive Monthly Progress Submittal is prepared by contractor, submitted to the Integration Scheduler and is required by AEP no later than the tenth business day of the calendar month to support internal AEP reporting requirements to upper management. The submittal will be prepared for the close of the prior business calendar month.

PUBLIC VERSION

Monthly Progress Submittal will include the following information:

- Executive Summary
- Milestone Schedule Summary detailing Milestones completed to date and in the last month and a recovery plan for Milestones not completed as scheduled.
- A written assessment including, if required, a recovery action plan of critical path and near critical path activities
- Cost/Schedule Status of labor-hour resource loaded activity based schedule including progressed cost and schedule performance computations and CPI and SPI as required by contract payment method
- Contract Financial Status including estimate to complete (ETC) and estimated at completion (EAC)
- Action Item List of Issues/Restraints will include description of activities, responsible person, due dates, and the actions being taken to meet target dates
- Identify changes to the project critical path and any changes to dates that are recognized as hand-off points to other contractors, AE's, etc., and an additional narrative describing the changes, their related causes, as well as recovery actions if required.

A schedule layout of the top (3) critical and near critical paths along with a descriptive narrative including explanation for any negative migration of the paths from the baseline.

PUBLIC VERSION

3.2 Outage Project Submittals

The Outage Schedule update cycle shall be determined by the Outage Management Team based on the overall outage status and need. The schedule will be updated through the update report markup process and will be provided to the Integration Scheduler. All schedule updates will be provided no later than 0900 on date of the cycle. The update will consist of / but is not limited to the following information:

- Percentage Complete and Remaining Duration on all in Progress Activities
- Actual Completion Date and Time on all Completed Activities
- Expected Start for Activities scheduled to Start in the next reporting period.
- Updated Commodity Curves
- Approved Logic changes will need to be identified and detailed for the Integration Scheduler
- Schedule Update must be approved by the Assigned Coordinator prior to submittal to the Integration Scheduler.

PUBLIC VERSION

APPENDIX-A – REQUIRED CODES

Required Activity Codes for all Projects		
Activity Codes	Name	Activity Code Description
RC-01	RC-01 Direct/Indirect Labor	Used in support of EV calculations. Direct work is for activities associated and driving specific work product. Indirect work is for activities not directly aligned.
RC-02*	RC-02 Outage Code	Used for enterprise alignment of outage related work. Outage dates defined by MSC tables.
RC-03	RC-03 Unit	Supports multiple unit planning in common schedules.
RC-04	RC-04 Owner	Used to support accountable organization/owner of activity and associated metrics.
RC-05	RC-05 Discipline	Identifies Craft or Functional area performing the work (e.g. IC = Instruments & Controls, ME = Mechanical).
RC-06	RC-06 Schedule Segment	Identifies the project phase of work being accomplished. Supports Level 1 summarization. (Milestone Schedule code not to be used by EWC).
RC-07	RC-07 Schedule Level	Defines the detail of the scheduled activity. Supports summarization of scheduled activities to various levels for reporting purposes.
RC-08	RC-08 Funding Phase	Identifies the Funding Phase of the Project (1, 2, 2A, 2B, 3).
RC-09*	RC-09 Team Critical Milestone	Used for summarization of identified critical milestones integrated into schedule(s). To be defined by Project Leadership team, applied by project scheduler(s).
RC-10	RC-10 WBS1 Project Type	1st level grouping identifies technology and unit being implemented (ie. FGD, SCR, ESP, Boiler, etc)
RC-11	RC-11 WBS2 System Area	2nd level grouping identifies systems or areas work is being applied to. (ie. Superheater, Aux Xfmr, Coal Conveyor, etc)
RC-12	RC-12 WBS3 Category	3rd level group, identifies a particular component work is associated with (ie. Pipe Hangars, ductwork, electrical equipment, etc)

*Not required; use as applicable

PUBLIC VERSION

APPENDIX-A – REQUIRED CODES (cont'd)

Required Activity Codes for Outage Related Projects	
Activity Codes	Activity Code Description
'Direct/Indirect Labor	Used in support of EV calculations. Direct work is for activities associated and driving specific work product. Indirect work is for activities not directly aligned.
'Outage Code	Used for enterprise alignment of outage related work. Outage dates defined by MSC tables.
'Unit	Supports multiple unit planning in common schedules.
'Responsible Group	Used to support accountable organizational owner of activity and associated metrics.
*Discipline	Identifies Craft or Functional area performing the work (e.g. IC = Instruments & Controls, ME = Mechanical).
*Schedule Segment	Identifies the outage phase of work being accomplished. Supports Level 1 summarization. (Pre-Outage, Shutdown, Outage, etc...).
*Organization	Identifies groups performing the work, used to support schedule reporting and auditing. (ie. ARA Contractor, Startup, RSO, Construction, etc...)
*Scope	Identifies whether the activity was part of the original work scope or added / emergent scope.
'Area-Primary	Identifies systems or general areas work is being applied to. (ie. Steam Generator, Turbine, FGD, etc...)

* Note – The ' and * in the activity code name were used for sorting in Primavera and is part of the code name.

** Note – Typically, these codes required for outage related activities in Project Schedules.

PUBLIC VERSION

APPENDIX-B - DEFINITIONS

Term	Description
Activity Constraint	Constraint Dates specify a point in time, which may be used to control or override the logical calculation of dates in a schedule network. The addition of constraint dates may artificially create negative float in the network; therefore, their use should be minimized.
Activity ID	Each activity should be labeled with a unique identifier (alpha/numeric). Activity ID formulation varies depending on the type of task being described and may be comprised of identifiers such as: contract numbers, contract code numbers, contract line numbers, plant site designations, unit numbers, and/or work category designators. The activity ID should contain a methodical intelligence relative to the project and work being performed and should not contain any spaces, commas, periods, etc within the string.
Activity Relationships	<p>The dependency between two schedule activities and or milestones, the four possible types of logical relationships as described below are: (FS) – finish to start, (FF) – finish to finish, (SS) – start to start, and (SF) – start to finish. The terms precedence relationship, logical relationship, and dependency are interchangeable.</p> <ul style="list-style-type: none"> • Finish to Start – The relationship where start of the successor activity depends upon the completion of work of the predecessor activity. • Finish to Finish – The relationship where completion of the work of the successor activity cannot finish until the completion of the predecessor. • Start to Start – The relationship where start of the work of the successor schedule activity depends on the start of work of the predecessor. <p>Start to Finish – The relationship where the completion of the successor schedule activity is dependant upon the start of the predecessor activity.</p>
Activity Status	The state of completion of an activity. A planned activity has not yet started. A started activity is in progress. A finished activity is complete.

PUBLIC VERSION

Term	Description
Actual Cost Of Work Performed (AC)	The sum of costs actually incurred in accomplishing the work performed.
Baseline	An approved plan for a project, plus or minus approved changes. It is compared to actual progress performance to determine if performance is within acceptable variance thresholds. Generally refers to the current or authorized baseline.
Budget At Completion (BAC)	Budget At Completion is the budgeted total cost through activity completion. Computed as Budget At Completion = Budgeted Labor Cost + Budgeted Non-labor Cost + Material Cost + Budgeted Expense Cost
Cost Breakdown Structure (CBS)	A system for dividing a project into Cost Accounts and Cost categories. This provides management with a basis for analyzing accumulated cost and data for continued estimating of future activities.
Cost Performance Index (CPI)	The ratio of earned value (EV) costs to actual (AC) costs. CPI is often used to predict the magnitude of a possible cost overrun. A positive value (i.e., greater than 1) indicates that costs are running under budget. A negative value (i.e. less than 1) indicates that costs are running over budget.
Cost Variance (CV)	The difference between EV and AC showing how actual expenditure compares with the budget. This can be shown as a numeric difference, where positive values indicate costs running under budget and negative values indicate cost overruns.
Critical Path	The sequence of activities that determine the duration of the project. It is the longest path through the project. The critical path is usually defined as those activities with the least amount of total float.
Critical Path Method (CPM)	A schedule network analysis technique used to determine the amount of schedule flexibility (the amount of float) on various logical network paths in the project schedule network, and to determine the minimum total project duration. Early start and finish dates are calculated by means of a forward pass using a specified start date. Late start and finish dates are calculated by means of a backward pass starting from a specified completion date, which is generally referred to as the project early finish date determined during the forward pass calculation.
Direct Costs	Those costs (labor, material, and other direct costs) that can be consistently related to work performed on a particular project. Direct costs are best contrasted with indirect costs that cannot be identified to a specific project.

PUBLIC VERSION

Term	Description
Earned Value (EV)	A measure of the value of work performed so far. Earned Value uses original estimates and progress-to-date to show whether the tasks are ahead or behind the baseline plan for planned value (PV) or Cash Flow.
Earned Value Analysis	A method for comparing cost and productivity to schedule productivity on a given activity. Earned value analysis translates both schedule and budget measures into dollar values and tracks them against the original planned expenditure of effort translated into its dollar value. By analyzing variances, a PM can spot developing problems in time to take appropriate action before they become serious. The two variables used to make the schedule variance measurements are PV and EV.
Estimate at Completion (EAC)	The expected total cost of an activity, a group of activities, or of the project as a whole, when the defined scope of work is completed. Most techniques for forecasting EAC include some adjustment of the original cost estimate based on project performance to date. Also shown as "estimated at completion." Computed as the actual total cost plus the estimate-to-complete cost; Estimate at Completion = Actual Cost (ACWP) + Estimate to Complete (ETC).
Estimate to Complete (ETC)	The expected additional cost of an activity, a group of activities, or of the project as a whole, when the defined scope of work is completed. Most techniques for forecasting ETC includes some adjustment of the original cost estimate based on project performance to date. The Estimate to Completion may be determined by: (BAC-EV) / CPI to obtain an optimistic value, and (BAC-EV) / (CPI*SPI) to obtain a pessimistic value.
Float	Total Float - The amount of time in work periods based upon the assigned calendar that an activity could be delayed from its early finish without delaying the project finish date or violating a schedule constraint. It is calculated using the CPM technique and determining the difference between the early and late finish dates. Free Float - The amount of time in work periods that a schedule activity can be delayed without delaying the early start of the immediate following schedule activities.
Gantt Chart	A graphic display of schedule related information. In the typical Gantt Chart, activities are listed down the left side of the chart, dates are shown across the top, and planned activity durations are shown as date-placed horizontal bars. Also called a "bar chart."
Indirect Cost	Resources expended which are not directly identified to any specific contract, project, product or service, such as overhead.

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Term	Description
Integrated Project Schedule (IPS)	A single, computerized network of all activities required to execute the project through the outage from pre-outage to unit shut down thru release for 100% load dispatching. Usually a CPM Schedule that is compiled from other related project schedules and constitutes the combined level 3 / 4 detailed work plans for a single project/outage.
Integration Scheduler	<p>The Integration Scheduler is directly responsible for the overall scheduling effort including the total scheduling product. Integration Scheduler shall be responsible for many scheduling functions, including but not limited to the following:</p> <ul style="list-style-type: none"> • Support and enforce good scheduling practices. • Manage schedule logic, including inter-project ties • Analyze scheduling information in support of the project/outage and AEP Corporate needs. • Provide guidance and advice to Project and/or Outage Management Team on scheduling issues. <p>Maintain a master schedule with subordinate schedules as necessary.</p>
Key Performance Indicators (KPI)	Those project management indicators that are determined at the beginning of the project. KPI's reflect directly on the key objectives (goals) of the project and provide the basis for project management trade-off decisions during the course of the project.
Level of Effort (LOE)	Support type activity (e.g. vendor or customer liaison) of indirect cost that does not readily lend itself to measurement of discrete accomplishment. It is generally characterized by a uniform rate of activity over a specific period of time.
Level 1 Schedule	<p>Milestone and Team Critical Activities: The Level 1 project schedule provides a bar chart format of major milestone events and Team Critical activities, which must occur in a timely sequence to achieve the successful completion of the project. The items are so defined as to represent the status of major work efforts for groups of activities. For Outage related schedules, Level 1 contains summary line items for each major scope and required outage evolutions for shutdown, testing and plant startup. Durations are based on current information available or past experience for similar activities. This schedule validates the duration assigned within the long-range fleet business plan and identifies any potential impacts.</p>

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Term	Description
Level 2 Schedule	Subproject Group / System / Responsible Group: The Level 2 project schedule summarizes the Level 3 Project Schedule and divides the project into the major project phases: Engineering, Procurement, Construction, and Startup as well as by major system and area. In Outage Schedules, refined activities will reflect component/equipment or area interfaces, removal/installation windows and plant system windows. Activities are included for all scoped Capital, O&M and PPB projects. Major system and equipment work windows are defined and logic tied as applicable.
Level 3 Schedule	Work Package: The Level 3 project schedule will contain a further breakdown of the systems and subsystems divided into manageable components to provide better definition and control. For the engineering effort, activities shall be single discipline responsibility with assigned resource requirements, including vendor interface activities. For the construction effort, the schedule may be further broken down by the individual work packages within contract packages or based on schedule details provided by the successful contractor including craft resource requirements. Typical schedule activities at this level would be no greater than 96 calendar hours in duration and less than the equivalent of 500 man-hours in budget. For Outage related work, activities are to be broken down into logical steps or sequences to perform work or accomplish a task. Handoffs and interfaces between work groups are defined along with work area logistics and plant equipment and system interfaces. All "task dependent" activities will have resources and budgeted units assigned to them.

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Term	Description
Level 4 Schedule	For Outage related and select Project construction work, a more detailed breakdown of the daily work schedule which includes fully resource loaded and budgeted activities. Level IV schedules are required to better define critical or near-critical path sequences. Separate activities are required for each "Handoff" between groups/subcontractors and/or discipline/resource and include a more detailed breakdown of logic sequences between work groups or planned evolutions. Activity duration shall be kept to a length to allow progress to be determined during the course of the work (no longer than 96 clock hours). Some activities may be longer in duration but must have a quantifiable measure to track progress. These activities shall have a distinct definition of quantifiable measure to clearly identify when the activity starts/finishes and the rate of progress. Project related work that requires this amount of detail will be decided by the AEP Project Management Team through the Project Integration Scheduler.
Milestone Schedule	A list of important activities with expected completion dates to ensure completion of the project from initiation to closeout. The completion of these activities is important to interfacing groups to ensure that they start and complete their required activities.
Outage Management Team	<p>The Outage Management Team shall include, but is not limited to, the following members:</p> <ul style="list-style-type: none"> • Plant Manager • Site Outage Manager ▪ Site Construction Manager • Regional Outage Manager <p>P&FS Project Manager (if applicable)</p>

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Term	Description	
Outage Preparation Milestone	PC-6	Major Contractors provide a level 3 schedule to the Integration Scheduler.
	PC-10	Level 3 Rev. B schedule has been reviewed and comments incorporated into the schedule. Schedule is issued to Outage Management Team.
	PD-3	Level 4 Rev. C schedule reviews are conducted.
	PD-8	Level 4 Rev. 0 schedule is issued following incorporation of comments from the Level 3 Rev. C reviews.
Percent Complete (PCT)	A ratio comparison of the completion status to the current projection of total work.	
Planned Value	Planned Value is the portion of the budgeted total cost of the activity that is scheduled to be completed as of the project data date, according to the baseline. Calculated as $\text{Planned Value} = \text{Individual resource Budget At Completion} * (\text{Data Date of current project} - \text{Baseline Assignment Start Date}) / (\text{Baseline Assignment Finish Date} - \text{Baseline Assignment Start Date})$.	
Project Controls (PC)	The activities involved in defining, monitoring, controlling and reporting project scope, schedule, and cost. The role of project controls includes anticipating future events, facilitating project planning, and forecasting where the project is headed to provide a sound basis for management decisions.	
Resource (RES)	An item required to accomplish an activity. Resources can be people, equipment, facilities, funding or anything else needed to perform the work of a project.	
Schedule	A time sequence of activities and events that represent an operating timetable. The schedule specifies the relative beginning and ending times of activities and the occurrence times of events. A schedule may be presented on a calendar framework or on an elapsed time scale.	

23 of 25

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Term	Description
Schedule Performance Index (SPI)	The ratio of Earned Value (EV) to work scheduled/planned (PV). The SPI describes what portion of the planned schedule work was actually accomplished. A positive value (i.e. greater than 1) indicates that work is ahead of schedule. A negative value (i.e. less than 1) indicates that work is behind schedule.
Schedule Variance (SV)	The difference between EV and PV. Schedule variance shows how the current schedule compares with the baseline schedule (in terms of time progress). This can be shown as a numeric difference, where positive values indicate that the schedule is ahead of the baseline schedule and negative values that indicate that work is behind schedule.
Scope	The work content and products of a project or component of a project (such as a contract). Scope is fully described by naming all activities performed, the resources consumed and the end products that result, including quality standards. A brief background to the project, or component, and the general objective(s) should introduce a statement of scope.
Scope of Work (SOW)	The work content of a project or any component of a project, such as a work package or a cost class, e.g., a summary description of the work involved in constructing a project. Note: Scope of Work describes the work involved in producing the product or service of the project, whereas 'Scope' or the 'Scope Statement' describes the resulting product or service.
Variance	The difference between the baseline and scheduled task or resource information. Variances occur when you set a baseline plan and begin entering actual information into your schedule or cost spreadsheet.
Variance Analysis	The analysis of the following : <ul style="list-style-type: none"> • Cost Variance = EV – AC • % Over/Under = 100 x (AC -EV) / EV, • Unit Variance Analysis, • Labor Rate, • Labor Hours/Units of Work Accomplished, • Material Rate, • Material Usage, and • Schedule Variance = EV – PV,
Variance at Completion	The budget at completion less the estimate at completion. A negative result indicates that the project is over budget. = BAC - EAC

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Term	Description
Vendor Change Order (VCO)	A document that authorizes a vendor a change in scope, schedule, cost or quality of the project.
WBS Dictionary	A document that describes each element in the WBS including a Statement of Work, describing the work content of the WBS element, and a Basis of Estimate, describing how the budget of the element was developed.
Work Breakdown Structure (WBS)	A task oriented detailed breakdown of a project, which defines the work packages and tasks at a level above that defined in the networks and schedules. The WBS initiates the development of the Organizational Breakdown Structure (OBS), and the Cost Breakdown Structure (CBS). It also provides the foundation for determining Earned Value and activity networks. The WBS is most useful in aligning performance information and cost and schedule into summary levels for hierarchical reporting of project progress.
Work Order (WO)	A generic term for a unit within a work breakdown structure (WBS) at the lowest level of its branch, not necessarily at the Lowest level of the whole WBS. It may be used to refer to a unit of work performed within the organization, while 'Commitment Package' may be used for work contracted or purchased outside The organization.

25 of 25

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AEP PROJECTS INVOICING REQUIREMENTS REVISED 04/17/2017

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Projects Invoicing Requirements

Separate invoices shall be submitted for each project, contract and contract release.

General information to be included on each invoice:

- ✓ AEPSC “Project Title and Plant Unit Number”.
- ✓ AEPSC eight digit Contract and four digit Release Number.
- ✓ Invoice Date: MM/DD/YYYY.
- ✓ Invoice Period: MM/DD/YYYY through MM/DD/YYYY.
- ✓ Vendor contact name and invoicing contact’s telephone number.
- ✓ Remit address.
- ✓ Retention amount withheld (if applicable).
- ✓ Charges for labor, expenses, and material shall be segregated.
- ✓ Participants in ARIBA discount program must clearly mark terms & discount on invoice cover, otherwise, contract terms will apply.
- ✓ Final Invoices must be marked as such for both Contract and Field Extra Work Orders.

* Invoices not containing the detailed information above will be returned to the contractor for correction. The invoice acceptance date is the date that a properly submitted invoice is accepted by AEP Project Cost Management. Payment terms are based from that date, not the Invoice Date itself. A properly submitted invoice includes a correct CCR and all required supporting documentation

Actual quantity of work and percent completed will be verified and approved by Owner’s representative prior to submission of invoices and Contractor Cost Reports (CCR). The approvals must accompany the invoice as back up documentation. All invoices for milestone based contracts must contain an approved milestone payment schedule as back up documentation.

Invoices shall identify base contract invoicing detail using the Contractor Cost Reporting Form. In addition, separate invoices will be required for each additional Field Extra Work Order(s) if applicable with an individual Contractor Cost Reporting Form for each instance.

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The Contractor Cost Reporting form (CCR) form is an Excel spreadsheet preloaded with contractually dictated pricing data.

- ✓ The CCR reporting period may be daily, weekly or monthly at the discretion of AEP Project Cost Management.
- ✓ Monthly reporting is done on an exception basis and only with the advanced approval of the Principal Cost Coordinator, AEP Project Cost Management. In these cases, the reporting timeline will be addressed and at the sole discretion of Principal Cost Coordinator, AEP Project Cost Management. Weekly reporting period will be from first shift on Monday through third shift on Sunday and submitted to AEP Project Cost Management by close of business the Monday following the completion of the period.
- ✓ Daily reporting will be from start of first shift through end of third shift and submitted to AEP Project Cost Management by noon the day following the completion of the period.

For invoices that involve cost reimbursable methods of payment, time and expense details will include the following:

- ✓ Time and Equipment sheets signed by the contractor and approved by an AEP Construction Coordinator.
- ✓ Itemized Employee and Project Expense(s).
- ✓ Per Diem support documentation must be included with each invoice.
- ✓ Copies of all receipts for any reimbursable expenditure of \$25.00 or greater.
- ✓ Subtotal Expense Amount.
- ✓ This information will be reported on Contractor Cost Reporting form (CCR).

For work that involves cost reimbursable methods of payment and fixed fee, the fixed fee will require a separate invoice accompanied by a separate CCR if retention is to be withheld.

Contractor invoicing based on milestones requires submission of a copy of the milestone payment schedule with each milestone invoice.

Based on a mutually agreed method of invoice submittal, the Contractor shall submit a single (1) copy of an invoice. Owner will accept only one (1) method of submittal; either by U.S. Mail, UPS, FedEx or electronically. Invoices submitted to any AEP location other than the Cheshire Cost Center will be returned and payment date will be based on receipt of the resubmitted invoice at the Cheshire Cost Center.

Contractor shall submit all invoices within 60 days from final acceptance (excluding retention invoicing, if applicable) including each Extra Work Order as completed. Contractor need not wait until completion of Extra Work to invoice. Partial invoicing is acceptable based on owner's approvals as long as the last invoice for each Extra Work Order is marked "Final".

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Submittal (hardcopy) Information: Mailing Address:

M. K. Godich
American Electric Power
Cost Control Center
PO Box 301
Cheshire, OH 45620

Electronic Invoicing: (On an exception basis, Project Cost Management will accept invoicing by email. The decision will be based on file sizes, invoicing frequencies, etc. and is at the sole discretion of AEP).

Email invoice will be sent to **Construction_Cost_Control@aep.com** with a copy to the designated Cost Coordinator/Technician.

Invoicing and payment inquiries are to be directed to the assigned Cost Technician and Mary Godich, Supervisor (mkgodich@aep.com) Phone: 740-266-3073.

Email invoice must contain the AEP Plant, Project and Contract Number in the “Subject Line”.

Prior to commencement of work, contractor shall contact Project Cost Management by email to Mary K Godich (mkgodich@aep.com) who will schedule a Project Controls kick off meeting. This meeting will require the contractor to have representation from the Cost Management, Scheduling and Invoicing department of their company. This meeting will determine the processes, contacts and requirements for the project as it relates to Project Controls.

Projects Cost Reporting Requirements

Contractors performing work on AEP Projects managed by Project Organization are required to provide owner required reports in accordance with contract terms and customary construction practices. For any work performed under a cost reimbursable method, AEP Project Cost Management expects all timesheets, equipment sheets and associated documents to be presented to AEP in a timely manner and in an acceptable format.

Prior to commencement of work the contractor is required to ensure they have submitted all Form A's for all subcontractors and Form B's for equipment rental rates have been submitted and approved by Contract Administration. Items not approved by Contract Administration through the Form A & Form B process will not be recognized for invoicing. For this reason, contractors need to update these form and receive approval prior to use if the intend to be reimbursed.

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On projects staffed by Project Cost Management (PCM) all reports will be delivered by the contractor to Project Cost Management. No other entity is authorized to receive either daily or weekly cost reports.

The following items, though not all inclusive, are the minimal acceptable requirements.

All Documents:

- ✓ Though handwritten is acceptable, all forms must be legible.
- ✓ If multiple part documents are utilized, AEP shall be provided with “part one” of the document. Carbon sheets are unacceptable.
- ✓ All sheets must be sequentially numbered. (i.e. 1 of 20, 2 of 20, 3 of 20 and etc.)

Timesheet Requirements (Cost Reimbursable):

Labor details will include the following on a daily timesheet submitted to Project Cost Management the day following performance of the work. The reporting timeline will be as determined by Site Management but in no case later than noon.

- ✓ Employee Name.
- ✓ Employee Classification (Standard abbreviations are acceptable). Supervision will be listed by exact title approved in the contract.
- ✓ Employee ID # (Must be able to cross reference to payroll if audited). The use of Social Security Numbers on any submittal is strictly forbidden.
- ✓ Straight, Time and Half and Double Time Hours by Employee.
- ✓ Charges must be reported by PMM Cost Activity / Code and a brief description of the work performed.
- ✓ Hourly Rate(s) (Base Union Labor Rates Only)
- ✓ Cover Sheet (Attachment #2 - PCMA-21) with the Total Hours by Classification and Cost Activity

Equipment Reports

- ✓ Each piece of equipment must be listed separately.
- ✓ Each piece of equipment must be identified by a unique equipment number (This number must be clearly displayed on equipment).
- ✓ Equipment description must be that as specified in the contract equipment rate sheet (Form B).
Contractor must monitor and report equipment which is paid based on a monthly rate with a set number of hours per month. Once the monthly hour limit is reached, the contractor should either apply the reduced rate or stop charging the equipment, whichever is applicable. An audit of the monthly tracking sheet to the weekly CCRs for billing accuracy will be performed on the contracts with monthly hour limit equipment

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Expense Reporting (when contractually allowable)

- ✓ AEP's Policy is to reimburse Consultant / Contractor for reasonable transportation, lodging, meals, and other services necessary to conduct official business. Since every situation encountered while traveling on business cannot be anticipated, each Consultant / Contractor shall exercise good judgment and fiscal responsibility when doing business for AEP. Any inappropriate and excessive expense will be reduced or disallowed.
- ✓ Expenses are a necessary and appropriate part of service delivery and AEP will reimburse expenses promptly. When traveling out of town, economy class air travel with maximum advance purchase and reasonable ground transportation, food, and lodging must be considered. Conference calls, transfer of information electronically, and video conferencing should be considered as alternates to travel. For each invoice, an itemization of expenses, including date and total cost should be provided.
- ✓ Use of personal vehicle will be reimbursed at the current IRS allowable mileage rate.
- ✓ Travel related expenses including ground transportation, food, lodging, mileage and airfare will be billed at actual cost with no markup. Receipts are required for charges over \$25.00.

AEP Project Cost Management will not accept nor consider for payment any cost reimbursable charges which do not meet the minimum standards above. All owner's required reports must be submitted by the time designated in the contract or by the project requirements. Late submittal of cost reports may negate AEP's responsibility for reimbursement.

Prior to the commencement of work the contractor is required to submit a Craft Rate Export request (CRA-001) to CraftRates@aep.com. AEP Craft Rate Administrator will supply the contractor an extract of craft rates and fringes. The Contractor will respond in writing (email or hard copy) that they are in agreement with the rates in the CCR. This will be required with each rate and/or markup change.

Contractors are not permitted to commence work on a Field Extra Work Order without written authorization. Doing so will negate owner's responsibility to reimburse contractor for work performed prior to issuance of the written authorization. Upon completion of the Extra Work, the contractor shall notify the AEP Construction Coordinator who will verify satisfactory completion. The Construction Coordinator will submit a EWO Closure Form to contractor for signature to verify completion of work and invoicing. Contractor will sign off on closure form and submit to Project Cost Management who will close EWO.

All Contractors are required to utilize a Contractor Cost Reporting (CCR) form (Electronic and hard copy) at the intervals specified by the project. AEP Project Cost Management is the only entity that can waive this requirement. Each CCR should be accompanied by timesheets, equipment sheets and associated documents. The Contractor is

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responsible for ensuring that the support documentation balances to the CCR. The Contractor is responsible to ensure compliance by sub contractor in both accurate and timely reporting as specified above.

On projects staffed by AEP Material Management Services, the contractor will be issued materials through the AEP Material Coordinator. The contractor is expected to provide ample notice to allow time for the Material Coordinator to stage for issue. The contractor shall designate those individuals within their organization with the authorization to receive materials. Upon receipt of the material, the contractor assumes care and custody and shall be responsible the cost of repair or replacement of lost or damaged materials. In no case is an employee of the contractor authorized to remove materials without a signed Request for Material Issue (MMS-Form 501).

Should AEP request the contractor to purchase material not contractually defined in the contract. The contractor shall submit in writing a material request to be approved by the AEP Site Construction Manager or his designee prior to purchasing the materials. This request will be made using the Contractor Material Purchase Request Form (MMS-200C). The original form will be submitted to AEP Material Management Services (Site Material Coordinator) and a copy must accompany the CCR Reporting and contractor invoicing.

All Cost Reporting and Invoicing Requirements shall flow down from the main contractor to their sub contractors. Compliance of all sub contractors is the responsibility of the main contractor.

ATTACHMENTS:

1. Contractor Cost Reporting form (CCR)
2. AEP Cost Report Cover Sheet A-21
3. Request for Material Issue MMS-501
4. Request for Material Issue MMS-200C

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Contractor Cost Report

Save File

Enter Entry Dates

Clear Entry Dates

Print Rate & Eqpt List

Print Data

Export to PDF

Version Number: 6.30
June 2015
**DO NOT Remove Protection
From This Report**
For Assistance and Questions
Call: 740-925-3099

Standard Rules for CCR Data Entries

...CCR Cannot Span Months. A New CCR Must be Created if Work Occurs in Separate Months.
...Do Not use Microsoft Menu Bar to Save Data. Data Must be Saved Using the "Save File" Button

Files are Saved in a 32-bit Format with File Name Consisting of :



C = Cost ~ I or E = Import or Export ~ Contractor Code ~ A, B, or C = Contract Type ~ Four to Five Digit Contract Number ~ the Remaining File Name = MMddYYYYhhSS (MonthDayYearHourSeconds)
...This Makes Each File Unique, so if You Need to Make a Correction to a Date, it is Done by a File that Adds or Subtracts Data for the Same Date.

The Standard Reporting Period is set by AEP Project Cost Management

Equipment Reference Number:

A Serial Number or Company Inventory Number that Must be **Unique** for Each Piece of Equipment Rented Under the Contract Provisions Capping Equipment Hours, Typically at 176 hours.

Prior to submittal of a new CCR the Contractor is responsible to verify all rates and calculation in the CCR. This can be done by using the "Print Rate & Eqpt List" button to extract all rates with in the CCR



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Contract: 0	Contractor Code: 0
Rel-PwrEAS:	Date From:
LOA #:	Date To:
Plant Code: 0	Outage Code: 0

SHIFT 1

Resource	Job Ref Type	Job Ref	ST Hours	TH Hours	DT Hours	Shift Prem Hours	Per Diem Units	Travel Exp	Comments	Local	Agmt Seq No	Rate Sch	Rate Sch Rev	Rate Sch Line	Rate Ref No	Rate Pwr EAS Ref	Shift	Contr Sub	ST Rate	ST Dollars	TH Rate	TH Dollars	DT Rate	DT Dollars	Per Diem Rate	Per Diem Dollars	Total Dol (w/Travel)	Hours On? (H / N)
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Contract:	0	Contractor Code:	0
Rel-PreEAS:		Date From:	
LOA #:		Date To:	
Plant Code:	0	Outage Code:	0

Enter Consumables/Supplies below: Include only those billable consumables and supplies to be included on the invoice.

[illegible]

Total Consumables	0		\$0.00
Total Reimbursables	0		\$0.00
Total Labor	0		\$0.00
Total Equipment	0		\$0.00
Total Material	0		\$0.00

PUBLIC VERSION

Contract:	0	Contractor Code:	0
Rel-PreEAS:		Date From:	
LOA #:		Date To:	
Plant Code:	0	Outage Code:	0

Enter Rental Items and Time Periods in this section:

[illegible]

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PCM-A21

AEP Cost Report Cover Sheet

Date _____

Contractor _____

Conclusion / Relevance

Job Site _____

Total Number of Time /Equipment Shoots attached: _____

Total [illegible]

Completed by Contractor

Attached to or Cover to Timberheat

[illegible]

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Material Management Services						
Request for Material Issue MMS-501						
Date: _____			Page: _____ of _____			
Requested BY: _____			Date/Time Needed: _____			
Phone Number: _____			How to be used: _____			
Company: _____			MIR Number _____			
	Tag #	Ident #	Req# / PO#	QTY Needed	UM	Description
1						
2						
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Notes: _____						

Material Coordinator				Receiving Party		
Signature _____				Signature _____		

Revised 04.17.2017

DocuSign Envelope ID: 4502034B-00F3-4FE4-8E7C-E62021C82C8B

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American Electric Power Contractor Material Purchase Request MMS-200C					
<div> <div>Plant: _____</div> <div>Project: _____</div> <div>Unit Number: _____ Work Order #: _____</div> </div>					
<div> <div>Request # _____</div> <div>Requestor's Name: _____ Date Requested: _____</div> </div>					
<div> <div>How to Be Used: _____ Required on Site Date: _____</div> <div>_____</div> <div>_____</div> <div>_____</div> </div>					
Contractor's Name: _____					
Contract and Release No. _____					
Contractor's Phone: _____ Contact Name: _____					
Line	QTY	Description & Part No.	U/M	Price Each	Total Line
1				\$	-
2				\$	-
3				\$	-
4				\$	-
5				\$	-
TOTAL:					\$ -
Contractors Mark Up %					\$ -
Billable Tot					\$ -
SITE MANAGER: _____ DATE: _____					
Original to: AEP Site Material Management Service					
CC: AEP Construction Coordinator & AEP Project Cost Management with Invoice					
Comments:					

Revised 04.17.2017

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**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 7
GEOTECHNICAL REPORT, AEP SOUTH BEND SOLAR
PROJECT PREPARED BY TERRACON CONSULTANTS
12/27/2017**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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Geotechnical Engineering Report

AEP South Bend Solar Project

Granger, Indiana

December 27, 2017

Terracon Project No. N4175437

Prepared for:

American Electric Power
Columbus, Ohio

Prepared by:

Terracon Consultants, Inc.
Columbus, Ohio

Offices Nationwide
Employee-Owned

Established in 1965
terracon.com

Terracon

Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

PUBLIC VERSION



December 27, 2017

American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215

Attn: Mr. Robert Follmer
P: [614] 716 2046
E: blfollmer@aep.com

Re: Geotechnical Engineering Report
AEP South Bend Solar Project
Granger, Indiana
Terracon Project Number: N4175437

Dear Mr. Robert:

Terracon Consultants, Inc. (Terracon) has completed six test borings for the AEP South Bend solar project located in Granger, Indiana. This study was performed in general accordance with our proposal number PN4175437 dated October 24, 2017 and Blanket Contract No. 787002X103. The Owner's Work Order Number for this project is X11866001.

The subsurface exploration phase for this project was completed on November 29, 2017. The final boring logs are presented in Appendix A of this transmittal letter. A Field Exploration Description is also enclosed as Exhibit A-3. The report provides geotechnical recommendations regarding the design of foundations, and equipment slabs for the proposed solar project. Results of chemical testing program are also included.

We appreciate the opportunity to be of service to you on this project. Please contact us concerning any questions that may arise during review of the report, or if you require additional information as you proceed through the final design and construction stage of this project.

Sincerely,
Terracon Consultants, Inc.

A blue ink signature of Sushanta Bhusal, consisting of a stylized 'S' and 'B' followed by a horizontal line.

Sushanta Bhusal, E.I.
Senior Staff Geotechnical Engineer

A blue ink signature of Prasad S. Rege, featuring a series of connected loops and a final horizontal stroke.

Prasad S. Rege, P.E.
Senior Principal/ Division Manager

Review By: Bruce E. Rome, P.E.

SME Review By: Scott D. Neely, P.E., G.E.

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TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	i
1.0 INTRODUCTION	1
2.0 PROJECT INFORMATION	1
2.1 Project Description	1
2.2 Site Location and Description	1
3.0 SUBSURFACE CONDITIONS	2
3.1 Site Geology	2
3.2 Typical Soil Profile	2
3.3 Water Level Observations	3
4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION	3
4.1 Geotechnical Considerations	3
4.2 Foundations Design and Construction	4
4.2.1 Driven Pile Foundation Design Recommendations	4
4.2.2 Construction Considerations	6
4.2.3 L-Pile Soil Parameters	6
4.3 Equipment Slab	6
4.3.1 Equipment Slab Design Recommendations	7
4.3.2 Slab Construction Considerations	8
4.3.3 Mat Foundations	8
5.0 GENERAL COMMENTS	9
	Exhibit No.
APPENDIX A – FIELD EXPLORATION	
Site Location Plan	A-1
Boring Location Plan	A-2
Field Exploration Description	A-3
Boring Logs	A-4 to A-9
APPENDIX B – LABORATORY TESTING	
Laboratory Testing	B-1
Atterberg Limits Results	B-2
Grain Size Distribution	B-3 to B-5
Chemical Laboratory Test Report	B-6
APPENDIX C – SUPPORTING DOCUMENTS	
General Notes	C-1
Unified Soil Classification System	C-2
Subsurface Profile	C-3

PUBLIC VERSION

Geotechnical Engineering Services
AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



EXECUTIVE SUMMARY

Terracon Consultants, Inc. (Terracon) has completed a field exploration program for the South Bend Solar project to be located along Bittersweet Road in Granger, Indiana. Six (6) soil borings, designated B-1 through B-6, were performed to a depth of approximately 15 to 30 feet below the existing ground surface (bgs).

Based on the information obtained from the subsurface exploration, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- The subsurface profile can be generalized as surficial soil (topsoil) underlain by predominately native granular soils to the depths explored (15 to 30 feet bgs) except at boring location B-6 where native cohesive soil was encountered up to an approximate depth of 3.5 feet.
- Based on the borings, driven piles can be used to support the proposed solar array panels. Steel piles should bear on a suitable soil below the existing surface grade. The actual pile depths should be determined by the designer considering applicable design load conditions.
- A "turned down" concrete slab-on-grade is recommended for lightly loaded equipment pads. Native granular soils or new structural fill material is considered suitable for direct support of the equipment pad. A mat foundation is recommended if the equipment pad is expected to carry heavy loads (area load in excess of 300 psf). Additional subgrade preparation will be required in that case.
- Frost heave and uplift of the soils should be considered in design of pile, slab and mat foundations. The typical frost depth for North Indiana for foundation design frost considerations is 42 inches (3.5 feet)
- Groundwater was encountered at depths ranging from about 3.8 to 5.8 feet bgs. Significant groundwater seepage is anticipated in shallow excavations for this project. However, groundwater levels fluctuate over time and should be evaluated at the time of construction. The contractor is responsible for employing appropriate dewatering methods to control seepage and facilitate construction.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. Section **5.0 GENERAL COMMENTS** should be read for an understanding of the report limitations.

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Geotechnical Engineering Report
AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) has completed a subsurface exploration for the South Bend Solar project to be located along Bittersweet Road in Granger, Indiana. Six (6) soil borings, designated B-1 through B-6, were performed to a depth of approximately 15 to 30 feet below the existing ground surface (bgs). Logs of the borings and a boring location plan are included in Appendix A of this report.

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout	See Appendix A, Exhibit A-2: Boring Location Plan
Project Description	AEP is constructing a ground-mounted photovoltaic panel array. The solar photovoltaic system will include multiple solar panels mounted to steel piles.
Structural Loads	Pile Foundation Loads <ul style="list-style-type: none">■ Downforce: 1 to 2.5 kips (assumed)■ Uplift: 2.5 kips (assumed)■ Lateral: 2.5 kips at 4 to 7 feet above grade (assumed)
Maximum allowable movements	The maximum allowable deflection for the piles under axially loading is anticipated to be about ¼ inch, and under lateral loading about ½ inch measured at the ground surface.
Grading	A site grading plan is not available. Based on our field observations, we have anticipated minimum site grading (cut/fill up to 2.5 feet) will be required to match the proposed finished grades.
Equipment pads	It is anticipated that equipment pads will be constructed as a part of the solar array development process.

2.2 Site Location and Description

Item	Description
Location	The proposed solar array is located on an approximate 210-acre parcel located along Bittersweet Road in Granger, Indiana.
Current ground cover	The site is an existing agricultural field.
Existing topography	Topographic mapping information was not provided. Based on observation during our site visit, it appears to be relatively level.

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Geotechnical Engineering Report
AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

The project site is located in the St. Joseph Drainageways section of the Northern Moraine and Lake Physiographic Region of Indiana. This area consists of a thick and complex deposit of glacial materials from the Saginaw Lobe of the late Wisconsinan ice sheet, which was up to 450 feet thick in some places. Topography is complex, characterized by knobs, kettles, kames, valley trains, and outwash plains.

Bedrock at the site can be described as Ellsworth Shale, deposited during the Devonian through the Mississippian Period. The bedrock is sedimentary, containing predominantly silty shale, with minor components of siltstone and sandstone, which is gray to greenish gray in color. It is 300 to 500 feet thick, locally. The formation is overlain by the Sunbury Shale, and underlain by the Antrim Shale.

3.2 Typical Soil Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Surface	7 inches	Topsoil	Not applicable
Native granular soils loose to medium dense Native cohesive soils (B-6 only)	12 feet	Native granular soils: poorly graded sand, well graded sand, silty clayey sand, silty sand with varying amounts of gravel size constituents Native cohesive soils: sandy lean clay with varying proportion of gravel size constituents;	Granular: very loose to medium dense relative density Cohesive: medium stiff consistency
Native granular soils	Undetermined (Boring B-3 was terminated at a depth of about 30 feet bgs)	Native granular soils: poorly graded sand, with varying silt and gravel size constituents	Granular: medium dense relative density

PUBLIC VERSION

Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual.

3.3 Water Level Observations

The borings were observed groundwater while sampling. The subsurface water levels observed at these times are indicated on the boring logs in Appendix A and are summarized in the following table.

Boring Number	Observed Water Depth (feet bgs)
	While drilling
B-1	5.8
B-2	5.5
B-3	4.5
B-4	4.5
B-5	4.0
B-6	3.8

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Terracon evaluated the soil boring data and laboratory test results to develop recommendations for the site preparation, foundation design and construction for the proposed solar project.

The subsurface profile can be generalized as surficial soil (topsoil) underlain by predominately native granular soils with occasional layers of native cohesive soils to the depths explored (30 feet bgs). The native granular soils indicated a relative density of very loose to medium dense. The native cohesive soils indicated a consistency of medium stiff.

Based on the borings, steel piles can be used to support the proposed solar array panels. The steel piles should bear on a suitable soil below the existing ground surface. The design pile embedment depth, however, depends on several others factors (pile driving time, steel section, design structural loads and field pile load test results) that will need to be considered by the designer.

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Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



A “turned down” concrete slab-on-grade is recommended for lightly loaded equipment pads that can tolerate some movement due to seasonal variation in temperature (freeze thaw action). The perimeter of the slab-on-grade should be designed as a “footing” that extends to a depth of at least 42 inches below the final exterior grade for frost depth considerations. Native granular or new structural fill material is considered suitable for direct support of the equipment pads.

A mat foundation is recommended if the equipment pad is expected to carry heavy loads (area load in excess of 300 psf). Additional subgrade preparation will be required in that case.

Groundwater was encountered at depths ranging from about 3.8 to 5.8 feet bgs. Significant groundwater seepage is anticipated in shallow excavations for this project.

4.2 Foundations Design and Construction

Based on the provided information, the solar arrays for this project are anticipated to be supported by driven piles. The driven piles should be designed to resist design loads including compression, uplift, frost heave action and lateral forces. The soils on this site are frost susceptible. The typical frost depth for North Indiana for foundation design frost considerations is 42 inches (3.5 feet). Frost heave on pile foundations will be significant. If the anchorage of the foundations and the deadweight of the structure is not sufficient to resist these forces, it can cause uplift to structures. Based on our review of soil samples and published soil maps of the area, we recommend that an adfreeze (frost heave) of 1,000 psf acting along the pile perimeter to a depth of 3½ feet below the ground surface should be considered.

4.2.1 Driven Pile Foundation Design Recommendations

Driven piles should be designed to resist design loads including compression, uplift and lateral forces. Additionally, for slender piles, the potential for buckling should be evaluated. At a minimum, these driven piles should bear on a suitable soil below the existing ground surface. The minimum pile driven depth provided in this report is based on the subsurface conditions encountered during this field exploration. The minimum pile embedment depth however depends on several other factors (pile driving time, steel section, design structural loads and field pile load test results) to be evaluated by the designer.

In the following table, we have provided design parameters, allowable skin friction and allowable end bearing capacities for consideration by the designers to evaluate compression and uplift capacities of various types of driven steel piles considered for use for the project. These parameters were developed from information from the borings and laboratory testing performed for this project and empirical correlations of soil type, soil index properties and SPT N-values. The pile skin friction and capacities shown below assume the adjacent soil providing these will remain in place during the life of the project.

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Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



It is recommended that the drilled pier design should incorporate a factor of safety of 3.0 for end bearing and 2.5 for side resistance, respectively, when subjected to axial compression loading situation. A factor of safety of 3.0 is recommended for side resistance against uplift loading situation. Soil parameters for axial design of drilled pier are provided in section below.

The computations of ultimate skin friction, f_s , and ultimate end bearing pressure, q_{eb} , are dependent upon whether the soils are cohesion less as follows:

Cohesionless Soil $f_s = \sigma' K \tan \delta$,
 $q_{eb} = \sigma' N_q$

Where: σ' = effective vertical overburden pressure
K = coefficient of lateral earth pressure
 δ = soil to pier friction angle (equal to $\frac{3}{4} \phi$ soil angle of internal friction for concrete piers or piles)
 N_q = end bearing capacity factor for granular soils

The above equations will yield ultimate capacities. We recommend that an appropriate factor of safety be applied to the ultimate capacities.

Design Parameters for Driven Piles

Stratum Depth (feet bgs)	Soil Type	Consistency/ Relative Density	Total Unit Weight, γ_{wet} (pcf)	Cohesion, c (psf)	Friction Angle, ϕ (degrees)	Allowable Skin Friction at mid of the layer (ksf)	Allowable End Bearing at top of the layer (ksf)
0 to 3½ ⁽¹⁾ (2)	Sand	Loose	110	--	--	--	--
3½ to 12	Sand	Loose	115	--	30	0.06	--
12 to 30	Sand	Medium dense	120	--	32	0.20	8

Notes:

1. Ignore the parameters and resistance contribution for the uppermost 3½ feet bgs of the soil profile
2. This native cohesive soil layer was encountered in Boring B-6 only.

The calculated side resistance pertains to the mid of the soil layer in which it is referenced. The calculated allowable end bearing value pertains to the top of the soil layer in which it is referenced.

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Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



4.2.2 Construction Considerations

We recommend that piles be driven with equipment with the required driving energy in order to achieve the required minimum penetration depth.

Piles should be spaced no closer to each other than three times the pile diagonal dimension, center-to-center. This spacing is to eliminate axial compressive loading group effects. The pile spacing is a function of the bearing capacity of the supporting stratum.

Preconstruction pile load testing consisting of a “pullout” and lateral load test are recommended to validate the computed capacity of piles in tension (uplift) and lateral deflection. Terracon provides this services as a supplemental scope of work.

4.2.3 L-Pile Soil Parameters

We have developed soil parameters for the generalized soil profile encountered in the boring. The parameters provided below can be utilized in conjunction with the computer program “LPILE Version 7.0 for Windows” for lateral load analysis and for determining side resistance for piles in uplift. The effective weight of the steel pile can also be used to resist design uplift forces

Soil Parameters for LPILE Analyses

Stratum Depth (feet bgs)	L-Pile Model	Effective Unit Weight (pcf)	Internal Friction Angle, Φ (degrees)	Cohesion, C (psf)	Modulus of Subgrade Reaction, k (pci)	Strain @ 50% of Max. Stress, ϵ_{50}
0 to 3½	Sand	110	--	--	--	--
3½ to 12	Sand	53 ⁽¹⁾	30	--	50	--
12 to 30	Sand	58	32	--	75	--

Notes:

- 1 For this analyses groundwater depth is referenced at 3 feet below existing ground surface.

4.3 Equipment Slab

We suggest that a “turned down” concrete slab-on-grade type foundation system be considered for relatively lightly loaded equipment pads that can tolerate some movements due to frost heave action. Recommendations for “turned down” concrete slabs are presented in **Section 4.3.1** below. For heavy equipment loads or slabs that cannot tolerate movements, a reinforced concrete mat foundation should be considered. Recommendations for mat foundations are presented in **Section 4.3.3** below.

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Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



4.3.1 Equipment Slab Design Recommendations

Slab-on-grade construction should be suitable for the proposed equipment slab provided that the subgrade is prepared in accordance with the recommendations provided in the **Section 4.2** above.

For a turned-down concrete slab, we recommend that "footings" at the edges of the slab bear upon or within suitable native cohesive or granular soils or new structural fill extended to native soil. Footings bearing within these materials can be proportioned for an allowable bearing capacity of up to 1,500 psf and should be founded at a depth of at least 3.5 feet below exterior grade for frost depth considerations.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The footings could also bear on properly compacted backfill extending down to the suitable soils. Over-excavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with engineered fill placed in lifts of 9 inches or less in loose thickness and compacted to at least 98 percent of the material's maximum dry density (ASTM D 698).

The slab should be supported directly on new base course material consisting of free draining granular material. We recommend a minimum 6-inch thick free draining granular base, such as relatively clean, well-graded crushed limestone. This material will serve as a leveling course, a capillary moisture break, help provide load distribution, and expedite construction. Care will be necessary to avoid contaminating this layer with soil prior to slab placement.

During earthwork procedures, care should be taken to maintain the subgrade moisture content prior to construction of the slab. If the subgrade should become desiccated, the affected material should be removed or these materials should be scarified, moistened, and re-compacted prior to floor slab placement.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

For design under "point loading" conditions, a subgrade modulus of 110 pci is recommended.

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Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



4.3.2 Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the slab subgrade may not be suitable for placement of aggregate base course and concrete and corrective action will be required. We recommend the area underlying the slab be rough graded and then, where possible, thoroughly proof-rolled with a heavy vibratory compactor (granular soil subgrade) or a loaded tandem axle dump truck (should a cohesive soil subgrade be exposed) prior to final grading and placement of the aggregate base course. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the aggregate base course and concrete.

4.3.3 Mat Foundations

Mat foundations could be considered for supporting heavy equipment loads or structures that cannot tolerate movements. Subgrades for mat foundations should be prepared following the recommendation presented in **Section 4.2**. We recommend that mat foundations should be supported a minimum 12-inch thick free draining granular base, such as relatively clean, well-graded crushed limestone.

The mat foundation can be designed using a theoretical allowable soil bearing capacity of 1,500 psf. A modulus of subgrade reaction design value should be based on anticipated soil contact pressure and theoretical vertical displacements. In this case, based on an assumed 500 psf contact stress and anticipated settlement up to 1 inches, a value of 4 pci is computed as the average subgrade modulus.

If exposed to the exterior grade, the sides of the mat foundation should be backfilled with compacted soil and consideration should also be made with regard to frost protection. A minimum 3.5 feet foundation embedment should be used for frost protection.

If lateral load resistance is required, an allowable coefficient of friction between the bottom of the concrete mat and the underlying structural granular fill can be assumed to be 0.3. This value includes a theoretical safety factor of about 1.5 against sliding. It is recommended that passive pressure resistance along the sides of the foundation be neglected.

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Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

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APPENDIX A FIELD EXPLORATION

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PUBLIC VERSION



Project Manager: NP	Project No. N4175437	 <p>800 Morrison Road Columbus, Ohio 43230 PH: (614) 863-3113 FAX: (614) 863-0475</p>	SITE LOCATION PLAN	Exhibit
Drawn by: NP	Scale: N.T.S.		South Bend Solar Project	A-1
Checked by: KME	File Name: N4175437 SLP		Bittersweet Road	
Approved by: KME	Date: Dec. 2017		Granger, Indiana	

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Field Exploration Description

Subsurface soil and groundwater conditions were evaluated drilling and sampling six (6) test borings designated as B-1 through B-6 to an approximate depth ranging from about 15-30 feet below existing ground surface.

The boring locations were established in the field by Terracon exploration team using a survey grade GPS unit. The boring locations and elevations presented on the Boring Location Plan and Boring Logs should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were advanced with a track-mounted Mobil B-57 rotary drill rig owned and operated by Terracon using continuous-flight hollow-stem augers. Representative soil samples were obtained primarily with a 2-inch outside diameter split-barrel standard penetration test (SPT) sampling spoon. The soil samples were obtained by driving the SPT sampler 18 inches into the boring with a 140-pound C.M.E automatic hammer free falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The blow count "N-value" of the soil was calculated as the number of blows required for the final 12 inches of the typical 18-inch sampling interval.

The SPT resistance, or N-value, provides a measure of the relative density of granular soils and consistency of cohesive soils. The field recorded blow counts and N-values are shown on the boring logs at the respective sample depths. The blow counts reported on the boring logs are uncorrected field recorded blow counts and have not been adjusted/corrected for field procedures, hammer efficiency, etc.

The collected soil samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Upon completion, the borings were backfilled with cement-bentonite grout.

Our exploration team prepared a field log of each boring. These logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples. Observations of groundwater conditions were made during drilling included on the boring logs represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site.

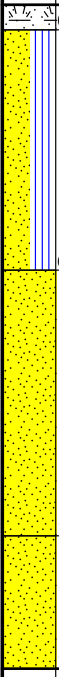
PUBLIC VERSION
BORING LOG NO. B-1

Page 1 of 1

PROJECT: South Bend Solar Project

CLIENT: American Electric Power
Columbus, Ohio

SITE: Bittersweet Road
Granger, Indiana

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 41.7311° Longitude: -86.1083°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS
	DEPTH	ELEVATION (Ft.)							LL-PL-PI
	0.6	768.5+/-				14	2-2-3 N=5		
						14	1-1-2 N=3		
						18	2-3-3 N=6		NP
			5			18	2-2-2 N=4		
	6.0	763+/-				18	2-3-3 N=6		
						18	2-2-3 N=5		NP
			10			18	1-2-3 N=5		
	12.0	757+/-							
	15.0	754+/-	15			18	2-4-6 N=10		
Boring Terminated at 15 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic 140#/30inch

Advancement Method:
3.25" Hollow Stem Augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Boring backfilled with cement-bentonite grout

WATER LEVEL OBSERVATIONS
 Water encountered @ 5.8 feet while drilling

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 11-28-2017

Boring Completed: 11-28-2017

Drill Rig: Mobile B-57

Driller: Moore-Lansing, Matt

Project No.: N4175437

Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL N4175437 SOUTH BEND SOLAR.GPJ TERRACON.DATATEMPLATE.GDT 12/21/17



PUBLIC VERSION
BORING LOG NO. B-2

Page 1 of 1

PROJECT: South Bend Solar Project

CLIENT: American Electric Power
Columbus, Ohio

SITE: Bittersweet Road
Granger, Indiana

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 41.7307° Longitude: -86.1041°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS
	DEPTH	ELEVATION (Ft.)							LL-PL-PI
	0.6	769.5+/-				14	2-3-4 N=7	11	NP
	1.5	768.5+/-				18	2-2-4 N=6		
						18	2-2-3 N=5		NP
			5			18	2-2-4 N=6		
						18	1-1-3 N=4		
						18	3-3-5 N=8		
			10			18	2-3-4 N=7		NP
	12.0	758+/-							
	15.0	755+/-	15			18	3-5-5 N=10		
Boring Terminated at 15 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic 140#/30inch

Advancement Method:
3.25" Hollow Stem Augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Boring backfilled with cement-bentonite grout

WATER LEVEL OBSERVATIONS

 Water encountered @ 5.5 feet while drilling

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 11-28-2017

Boring Completed: 11-28-2017

Drill Rig: Mobile B-57

Driller: Moore-Lansing, Matt

Project No.: N4175437

Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL N4175437 SOUTH BEND SOLAR.GPJ TERRACON.DATATEMPLATE.GDT 12/21/17



PUBLIC VERSION
BORING LOG NO. B-3

Page 1 of 2

PROJECT: South Bend Solar Project

**CLIENT: American Electric Power
Columbus, Ohio**

**SITE: Bittersweet Road
Granger, Indiana**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 41.7301° Longitude: -86.1° Approximate Surface Elev: 768 (Ft.) +/-		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
	DEPTH	ELEVATION (Ft.)							
	0.6	767.5+/-			X	18	2-2-2 N=4		
					X	18	1-3-2 N=5		
					X	18	1-3-1 N=4		NP
	4.5	763.5+/-	5		X	18	1-1-1 N=2		
					X	18	1-1-2 N=3		
					X	18	2-3-5 N=8		NP
	9.0	759+/-	10		X	18	3-5-7 N=12		
					X	10	8-9-8 N=17		NP
	23.5	744.5+/-	20		X	18	4-6-8 N=14		
			25		X	18	5-7-8 N=15		

Stratification lines are approximate. In-situ, the transition may be gradual.
Started running driller mud @ 13.5'

Hammer Type: Automatic 140#/30inch


Advancement Method:
3.25" Hollow Stem Augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Boring backfilled with cement-bentonite grout

WATER LEVEL OBSERVATIONS

 Water encountered @ 4.5 feet while drilling

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 11-29-2017

Boring Completed: 11-29-2017

Drill Rig: Mobile B-57

Driller: Moore-Lansing, Matt

Project No.: N4175437

Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT: GEO SMART LOG-NO WELL N4175437 SOUTH BEND SOLAR.GPJ TERRACON.DATATEMPLATE.GDT 12/21/17


PUBLIC VERSION
BORING LOG NO. B-3

Page 2 of 2

PROJECT: South Bend Solar Project

CLIENT: American Electric Power
Columbus, Ohio

SITE: Bittersweet Road
Granger, Indiana

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 41.7301° Longitude: -86.1° Approximate Surface Elev: 768 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS
								LL-PL-PI
	POORLY GRADED SAND WITH GRAVEL (SP) , brown, wet, medium dense (<i>continued</i>)	30		X	18	5-7-11 N=18		
	Boring Terminated at 30 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Started running driller mud @ 13.5'

Hammer Type: Automatic 140#/30inch


Advancement Method:
3.25" Hollow Stem Augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Boring backfilled with cement-bentonite grout

WATER LEVEL OBSERVATIONS

 Water encountered @ 4.5 feet while drilling

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 11-29-2017

Boring Completed: 11-29-2017

Drill Rig: Mobile B-57

Driller: Moore-Lansing, Matt

Project No.: N4175437

Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT: GEO SMART LOG-NO WELL N4175437 SOUTH BEND SOLAR.GPJ TERRACON_DATATEMPLATE.GDT 12/21/17


PUBLIC VERSION
BORING LOG NO. B-4

Page 1 of 1

PROJECT: South Bend Solar Project

CLIENT: American Electric Power
Columbus, Ohio

SITE: Bittersweet Road
Granger, Indiana

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 41.7297° Longitude: -86.0964° Approximate Surface Elev: 769 (Ft.) +/-		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS
	DEPTH	ELEVATION (Ft.)							LL-PL-PI
	0.6	768.5+/-				18	2-3-4 N=7	15	
						18	1-2-2 N=4	15	NP
	3.0	766+/-				14	1-2-1 N=3		
			5			18	1-2-2 N=4		
						18	1-2-2 N=4		NP
						10	1-2-2 N=4		
	9.0	760+/-				18	3-5-5 N=10		
			10						
						18	2-4-6 N=10		
	15.0	754+/-	15						
Boring Terminated at 15 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic 140#/30inch

Advancement Method:
3.25" Hollow Stem Augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Boring backfilled with cement-bentonite grout

WATER LEVEL OBSERVATIONS
 Water encountered @ 4.5 feet while drilling

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 11-28-2017

Boring Completed: 11-28-2017

Drill Rig: Mobile B-57

Driller: Moore-Lansing, Matt

Project No.: N4175437

Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL N4175437 SOUTH BEND SOLAR.GPJ TERRACON.DATATEMPLATE.GDT 12/21/17


PUBLIC VERSION
BORING LOG NO. B-5

Page 1 of 1

PROJECT: South Bend Solar Project

CLIENT: American Electric Power
Columbus, Ohio

SITE: Bittersweet Road
Granger, Indiana

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 41.7296° Longitude: -86.0931°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS
	DEPTH	ELEVATION (Ft.)							LL-PL-PI
	0.6	768.5+/-				18	1-2-3 N=5		
	TOP SOIL (7")					14	3-2-1 N=3		
	POORLY GRADED SAND WITH SILT (SP-SM) , brown, wet, very loose to loose					18	1-2-1 N=3		
			5			18	1-2-2 N=4		NP
						18	1-1-1 N=2		
	7.5	761.5+/-				18	2-2-5 N=7		
	POORLY GRADED SAND (SP) , brown, wet, loose					18	3-4-5 N=9		
			10						
	12.0	757+/-							
	POORLY GRADED SAND (SP) , brown, wet, medium dense					18	3-5-6 N=11		
	15.0	754+/-	15						
Boring Terminated at 15 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic 140#/30inch


Advancement Method:
3.25" Hollow Stem Augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Boring backfilled with cement-bentonite grout

WATER LEVEL OBSERVATIONS

 Water encountered @ 4.0 feet while drilling

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 11-29-2017

Boring Completed: 11-29-2017

Drill Rig: Mobile B-57

Driller: Moore-Lansing, Matt

Project No.: N4175437

Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL N4175437 SOUTH BEND SOLAR .GPJ TERRACON .DATATEMPLATE GDT 12/21/17

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APPENDIX B

LABORATORY TESTING

PUBLIC VERSION

Geotechnical Engineering Report

AEP South Bend Solar Project ■ Granger, Indiana
December 27, 2017 ■ Terracon Project No. N4175437



Laboratory Testing

As a part of the laboratory testing program, the soil samples were classified in the laboratory based on visual observation, and texture. The soil descriptions presented on the boring logs for native soils are in accordance with our enclosed General Notes and Unified Soil Classification System (USCS). A brief description of the Unified System is included in this report. Classification was predominantly by visual manual procedures. Atterberg Limits test, hand penetrometer test, Moisture content test, gradation analyses, pH, Sulfate, Chlorides, Red-Ox and Resistivity test were performed on selected soil samples. The data from this laboratory testing is presented in on the boring logs included in Appendix A. Laboratory test results are presented in Appendix B.

PUBLIC VERSION
ASTM D4318



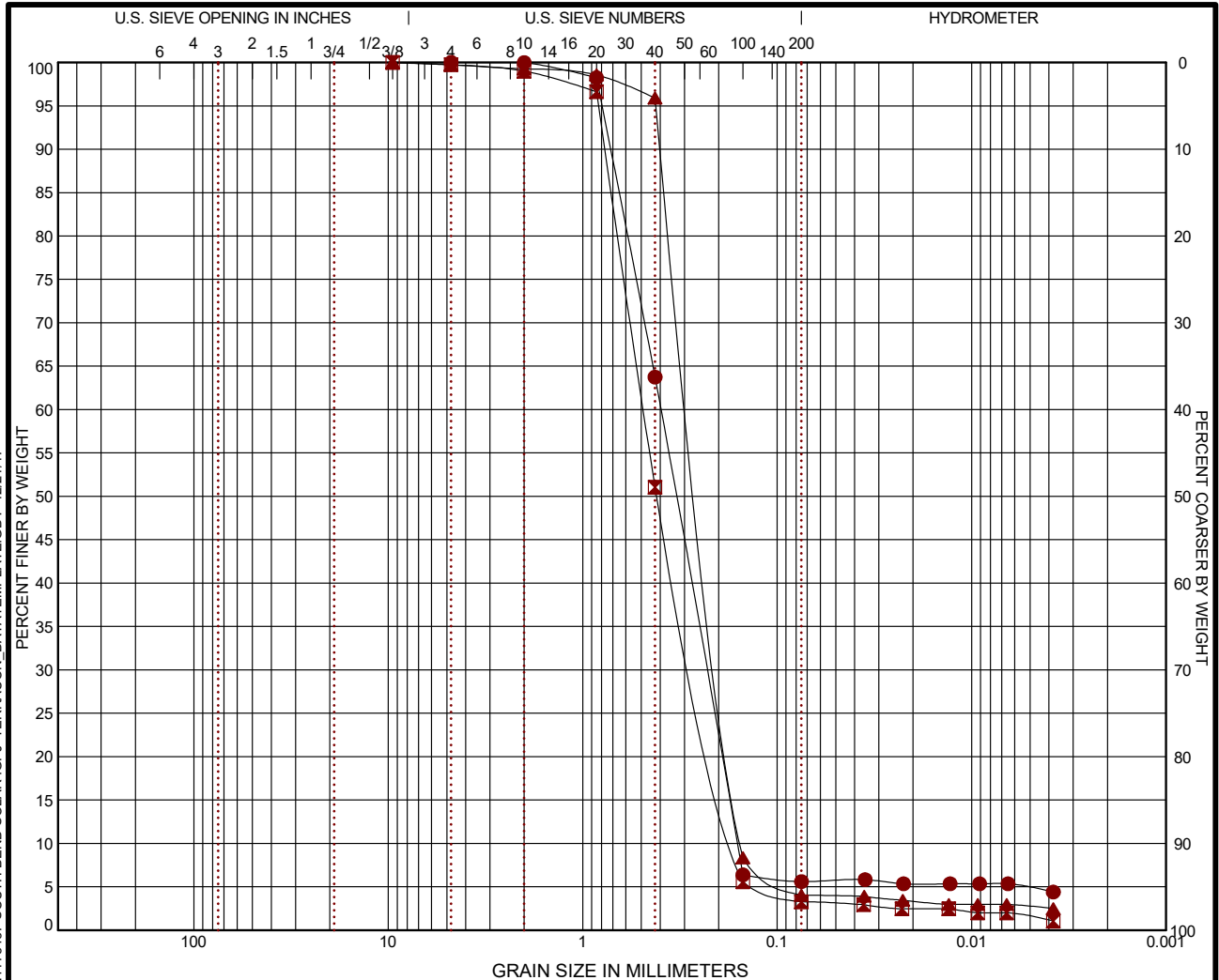
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS N4175437 SOUTH BEND SOLAR.GPJ TERRACON_DATATEMPLATE.GDT 12/21/17

EXHIBIT: B-2

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GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-1	3 - 4.5	0.0	0.0	94.4	0.7		4.9	SP-SM
☒	B-1	7.5 - 9	0.0	0.3	96.5	1.7		1.5	SP
▲	B-2	3 - 4.5	0.0	0.3	95.7	1.3		2.7	SP

	GRAIN SIZE		
	●	☒	▲
D ₆₀	0.397	0.487	0.277
D ₃₀	0.23	0.262	0.194
D ₁₀	0.16	0.166	0.153
COEFFICIENTS			
C _c	0.83	0.85	0.89
C _u	2.48	2.93	1.81

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	100.0	3/8"	100.0	3/8"	100.0
#10	99.98	#4	99.73	#4	99.74
#20	98.24	#10	99.0	#10	99.27
#40	63.74	#20	96.63	#20	98.56
#100	6.38	#40	51.04	#40	95.9
#200	5.6	#100	5.59	#100	8.35
		#200	3.28	#200	4.04

SOIL DESCRIPTION	
●	POORLY GRADED SAND with SILT (SP-SM)
☒	POORLY GRADED SAND (SP)
▲	POORLY GRADED SAND (SP)
REMARKS	
●	
☒	
▲	

PROJECT: South Bend Solar Project

SITE: Bittersweet Road
Granger, Indiana

Terracon
800 Morrison Rd
Gahanna, OH

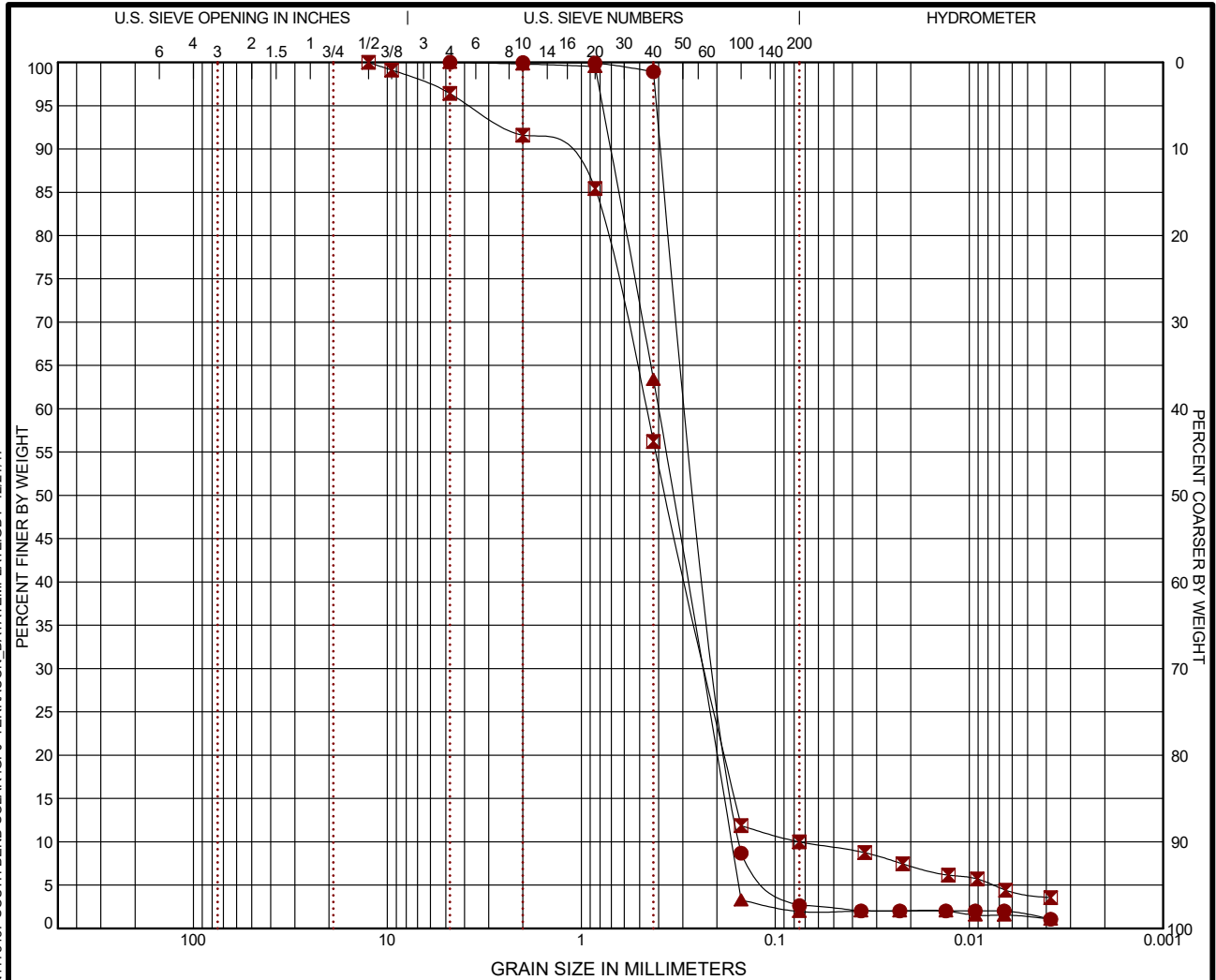
PROJECT NUMBER: N4175437

CLIENT: American Electric Power
Columbus, Ohio

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 N4175437 SOUTH BEND SOLAR.GPJ TERRACON.DATATEMPLATE.GDT 12/21/17

GRAIN SIZE DISTRIBUTION
PUBLIC VERSION
ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-2	9 - 10.5	0.0	0.0	97.4	1.1		1.5	SP
☒	B-3	3 - 4.5	0.0	3.6	86.4	6.0		4.0	SW-SM
▲	B-3	7.5 - 9	0.0	0.0	98.1	0.6		1.3	SP

	GRAIN SIZE		
	●	☒	▲
D ₆₀	0.271	0.465	0.401
D ₃₀	0.192	0.23	0.238
D ₁₀	0.152	0.075	0.168
	COEFFICIENTS		
	C _c	1.51	0.84
C _u	1.78	6.17	2.38

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	100.0	1/2"	100.0	#4	100.0
#10	99.96	3/8"	99.1	#10	99.82
#20	99.91	#4	96.41	#20	99.52
#40	98.91	#10	91.6	#40	63.4
#100	8.69	#20	85.44	#100	3.31
#200	2.63	#40	56.21	#200	1.95
		#100	11.86		
		#200	9.99		

SOIL DESCRIPTION	
●	POORLY GRADED SAND (SP)
☒	WELL-GRADED SAND with SILT (SW-SM)
▲	POORLY GRADED SAND (SP)
REMARKS	
●	
☒	
▲	

PROJECT: South Bend Solar Project

SITE: Bittersweet Road
Granger, Indiana

Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4175437

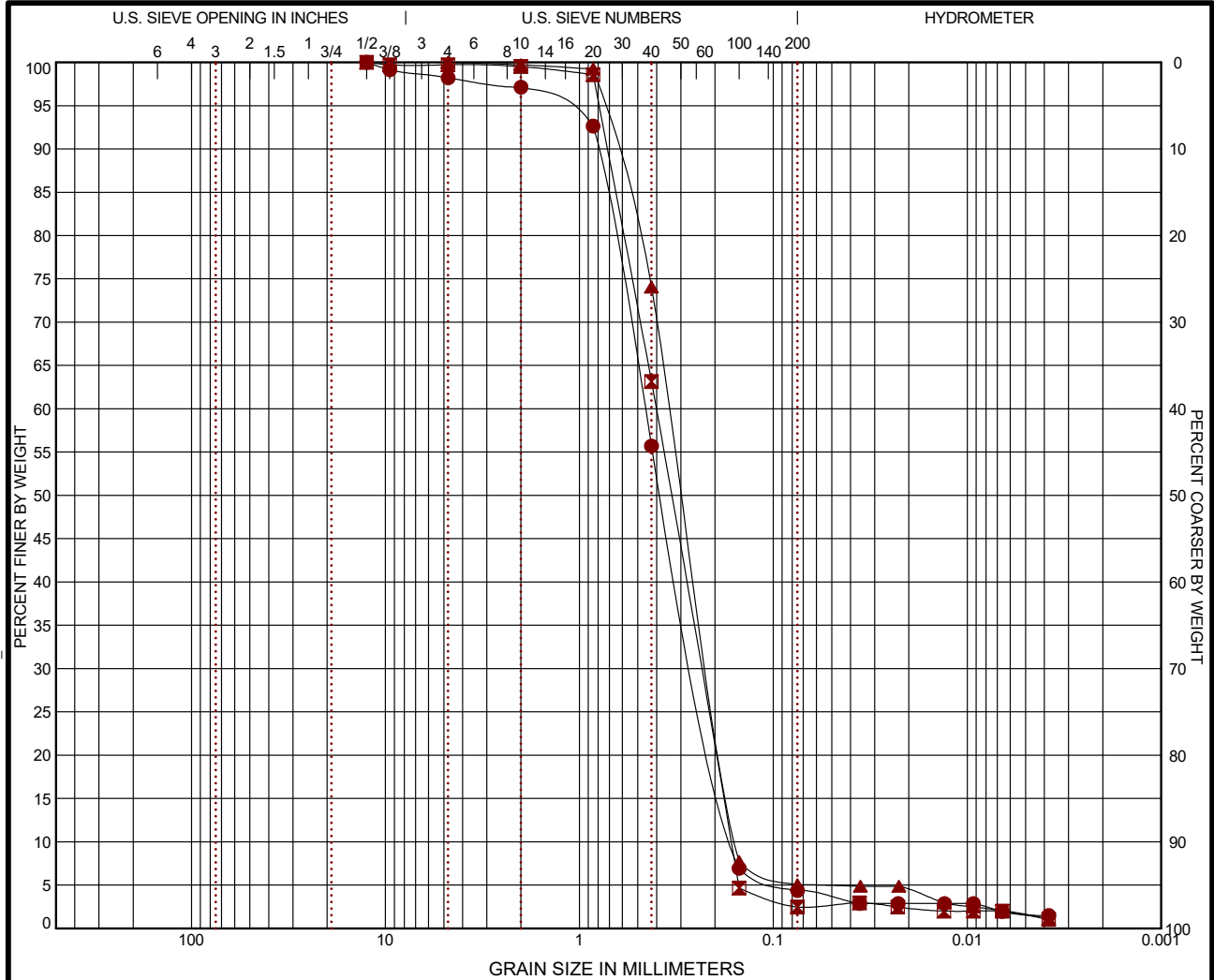
CLIENT: American Electric Power
Columbus, Ohio

EXHIBIT: B-4

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GRAIN SIZE DISTRIBUTION

PUBLIC VERSION
ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY		
	coarse	fine	coarse	medium	fine			

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-3	13.5 - 15	0.0	1.8	93.8	2.7		1.7	SP
⊠	B-4	6 - 7.5	0.0	0.3	97.2	0.9		1.5	SP
▲	B-5	4.5 - 6	0.0	0.0	95.0	3.5		1.5	SP-SM

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.461	0.402	0.341
D ₃₀	0.245	0.236	0.213
D ₁₀	0.16	0.165	0.155
COEFFICIENTS			
C _c	0.82	0.84	0.85
C _u	2.88	2.44	2.19

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1/2"	100.0	1/2"	100.0	#4	100.0
3/8"	99.15	3/8"	99.73	#10	99.72
#4	98.2	#4	99.73	#20	99.23
#10	97.13	#10	99.51	#40	74.05
#20	92.64	#20	98.59	#100	7.71
#40	55.7	#40	63.14	#200	5.05
#100	6.93	#100	4.66		
#200	4.38	#200	2.48		

SOIL DESCRIPTION	
●	POORLY GRADED SAND (SP)
⊠	POORLY GRADED SAND (SP)
▲	POORLY GRADED SAND with SILT (SP-SM)
REMARKS	
●	
⊠	
▲	

PROJECT: South Bend Solar Project

SITE: Bittersweet Road
Granger, Indiana

Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4175437

CLIENT: American Electric Power
Columbus, Ohio

EXHIBIT: B-5

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 N4175437 SOUTH BEND SOLAR.GPJ TERRACON.DATATEMPLATE.GDT 12/21/17

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CHEMICAL LABORATORY TEST REPORT PUBLIC VERSION

Project Number: N4175437

Service Date: 12/13/17

Report Date: 12/18/17

Task:

Terracon

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

American Electric Power
Columbus, Ohio

Project

South Bend Solar Project

Sample Submitted By: Terracon (N4)

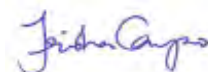
Date Received: 12/8/2017

Lab No: 17-1256

Results of Corrosion Analysis

<i>Sample Number</i>			
<i>Sample Location</i>	B-1	B-5	B-6
<i>Sample Depth (ft.)</i>	1.0-3.5	1.0-3.5	1.0-3.5
pH Analysis, AWWA 4500 H	8.70	8.51	8.33
Water Soluble Sulfate (SO ₄), ASTM D 516 (mg/kg)	94	52	91
Chlorides, ASTM D 512 (mg/kg)	80	35	73
Red-Ox, AWWA 2580 (mV)	+656	+653	+666
Resistivity, ASTM G 57 (ohm-cm)	3686	3977	2862

Analyzed By:



Trisha Campo
Chemist

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.










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PUBLIC VERSION

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING			
	Auger	Shelby Tube	Split Spoon
			
WATER LEVEL			
	Water Initially Encountered	Water Level After a Specified Period of Time	Water Level After a Specified Period of Time
	Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.		
FIELD TESTS	(HP)	Hand Penetrometer	
	(T)	Torvane	
	(b/f)	Standard Penetration Test (blows per foot)	
FIELD TESTS	N	N value	
	(PID)	Photo-Ionization Detector	
	(OVA)	Organic Vapor Analyzer	

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS	RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
	Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, tsf	Standard Penetration or N-Value Blows/Ft.
	Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1
	Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4
	Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8
	Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15
	Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30
				Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

PUBLIC VERSION
UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E		GW	Well-graded gravel ^F
			Cu < 4 and/or 1 > Cc > 3 ^E		GP	Poorly graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}
			Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E		SW	Well-graded sand ^I
			Cu < 6 and/or 1 > Cc > 3 ^E		SP	Poorly graded sand ^I
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}
			Fines classify as CL or CH		SC	Clayey sand ^{G,H,I}
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots on or above “A” line ^J		CL	Lean clay ^{K,L,M}
			PI < 4 or plots below “A” line ^J		ML	Silt ^{K,L,M}
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried			Organic silt ^{K,L,M,O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line		CH	Fat clay ^{K,L,M}
			PI plots below “A” line		MH	Elastic Silt ^{K,L,M}
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried			Organic silt ^{K,L,M,Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

^A Based on the material passing the 3-inch (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

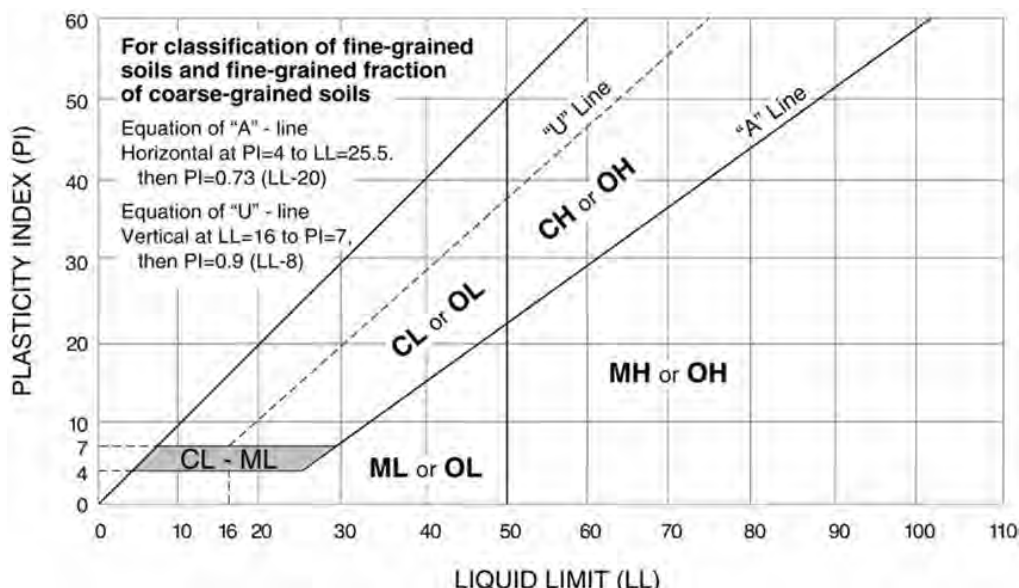
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

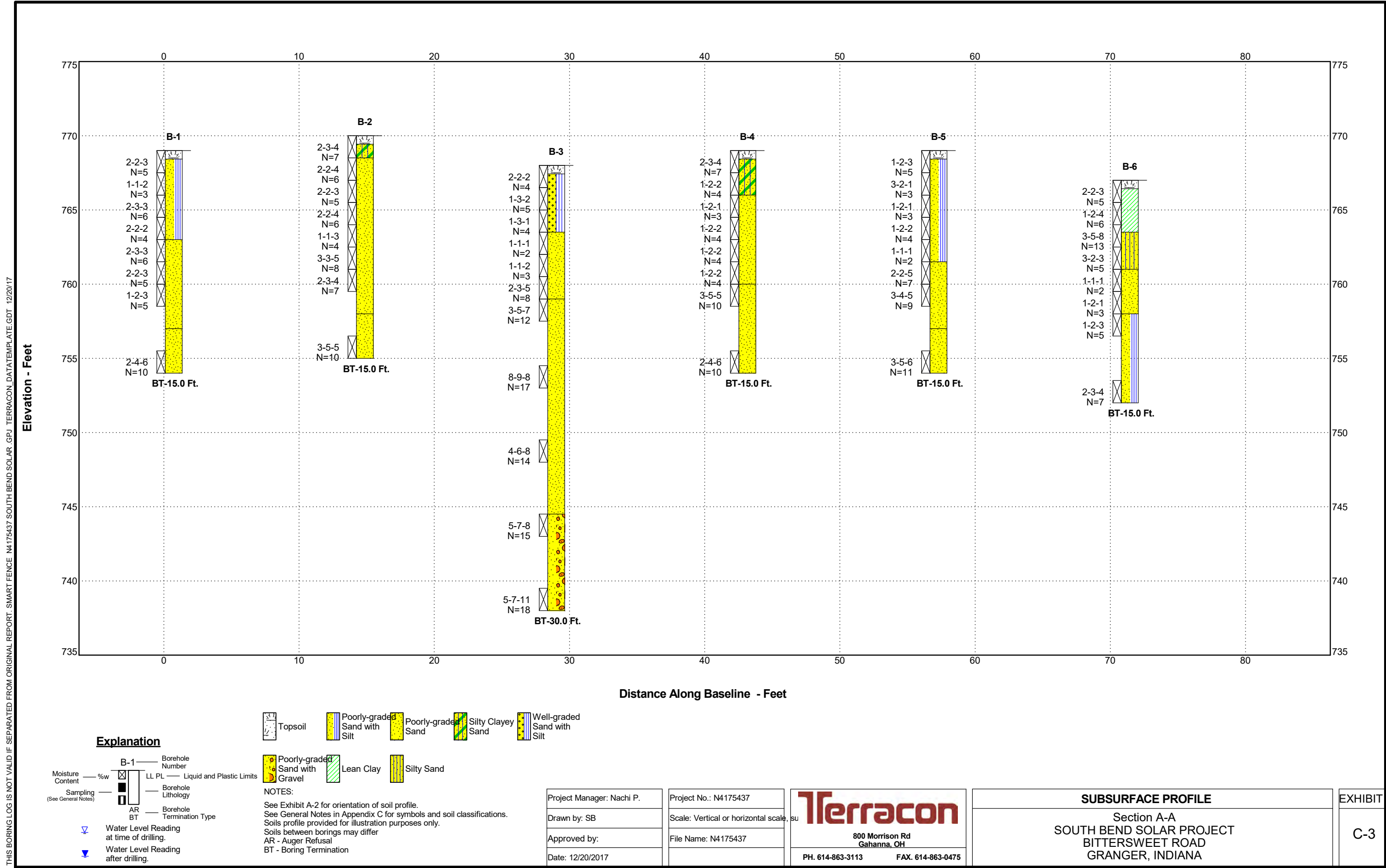
^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



PUBLIC VERSION



PUBLIC VERSION



**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

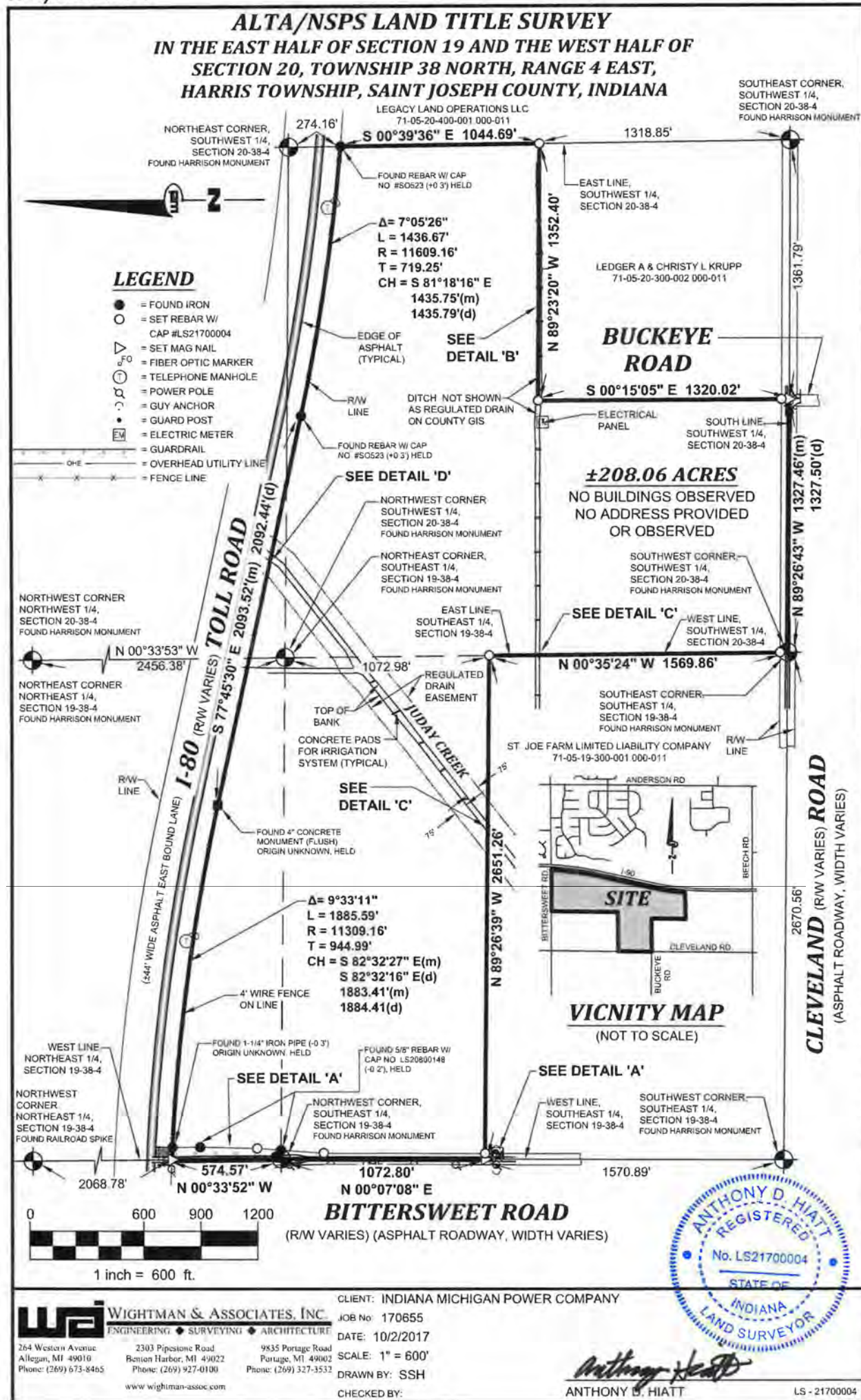
**APPENDIX 8
SOUTH BEND SOLAR FARM ALTA SURVEY**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

E 1/2 19-38-4
W 1/2 20-38-4

SHEET 1 OF 5



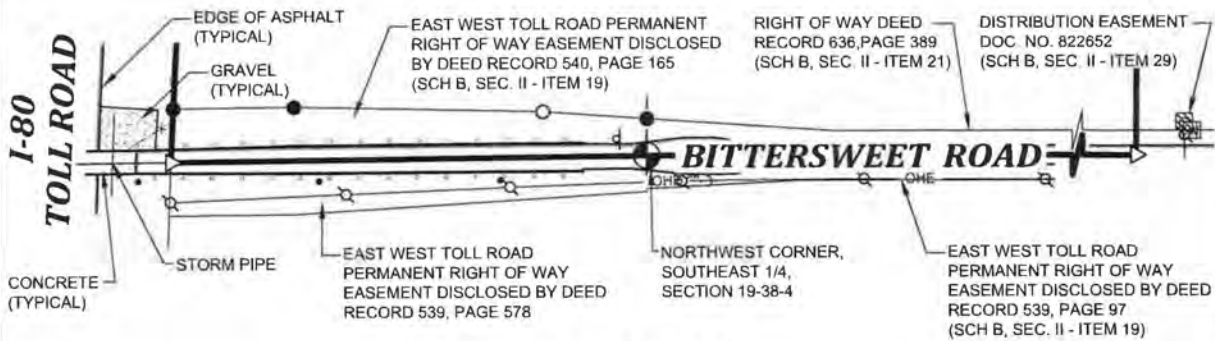
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HARRIS TOWNSHIP, SAINT JOSEPH COUNTY, INDIANA

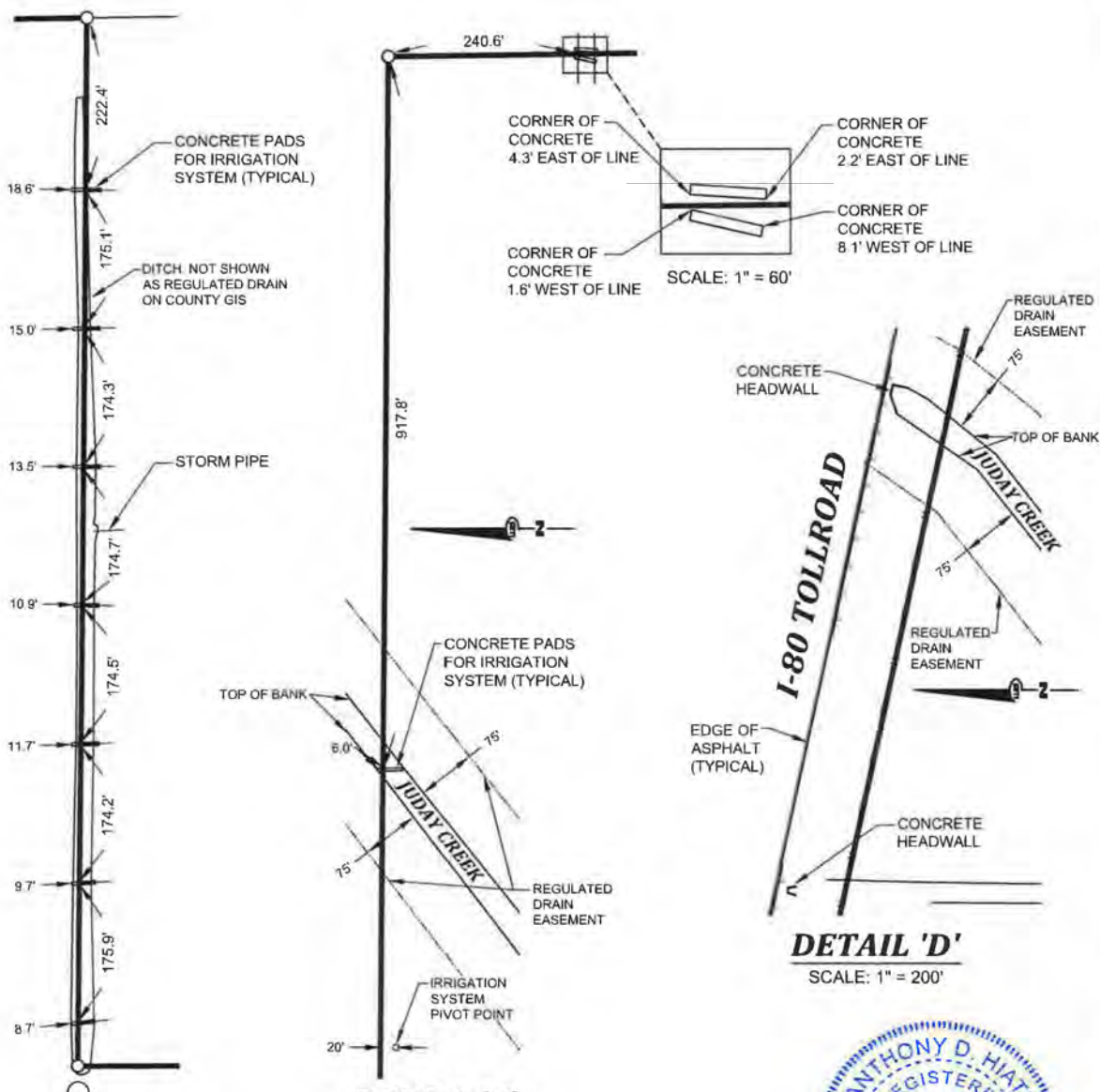
SECTION 19&20, T 38 N, R 4 E

A-170655

Indiana Michigan Power Company
Cause No. 45245
Attachment DAL-2R
Page 312 of 554



DETAIL 'A'
SCALE: 1" = 200'



DETAIL 'B'
SCALE: 1" = 200'

DETAIL 'C'
SCALE: 1" = 200'

DETAIL 'D'
SCALE: 1" = 200'



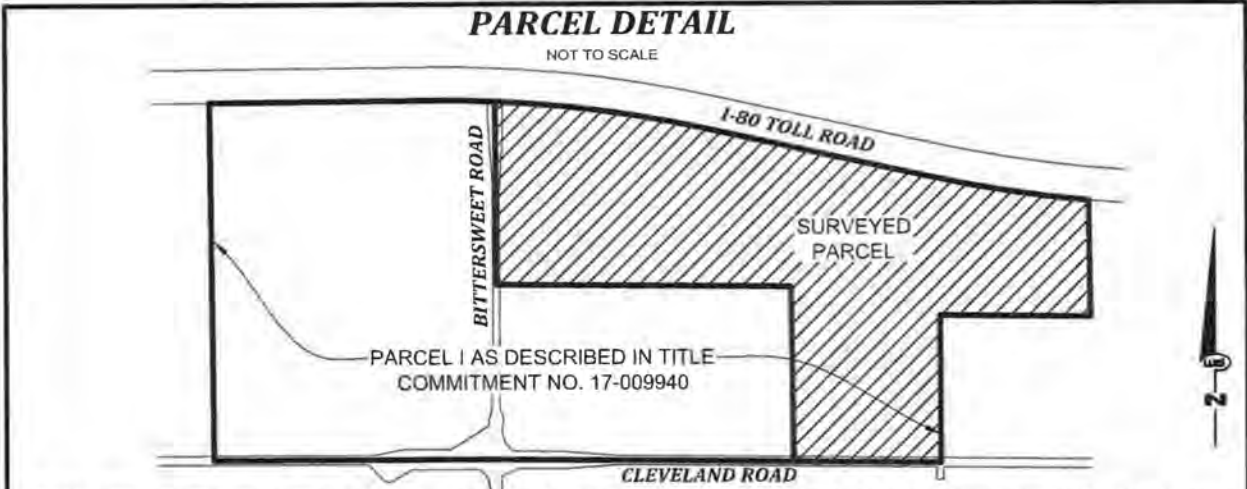
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CLIENT: INDIANA MICHIGAN POWER COMPANY
JOB No: 170655
DATE: 10/2/2017
SCALE: AS NOTED
DRAWN BY: SSH
CHECKED BY:

Anthony D. Hiatt
ANTHONY D. HIATT

LS - 21700004

HARRIS TOWNSHIP, SAINT JOSEPH COUNTY, INDIANA
SECTION 19&20, T 38 N, R 4 E
A-170655



LEGAL DESCRIPTION PER COMMITMENT FOR TITLE INSURANCE ISSUED BY FIDELITY NATIONAL TITLE INSURANCE COMPANY, COMMITMENT NO. 17-009940, EFFECTIVE DATE: SEPTEMBER 14, 2017.

PARCEL I:
A PARCEL OF LAND BEING A PART OF THE EAST HALF OF SECTION 24, TOWNSHIP 38 NORTH, RANGE 3 EAST, AND A PART OF SECTION 19 AND SECTION 20, BOTH IN TOWNSHIP 38 NORTH, RANGE 4 EAST, ALL IN HARRIS TOWNSHIP, ST. JOSEPH COUNTY, INDIANA, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTH QUARTER CORNER OF SAID SECTION 24; THENCE NORTH 00°14'26" WEST ALONG THE NORTH-SOUTH CENTERLINE OF SAID SECTION 24, A DISTANCE OF 2641.06 FEET TO THE CENTER OF SAID SECTION 24; THENCE NORTH 00°14'12" WEST ALONG SAID NORTH-SOUTH CENTERLINE, A DISTANCE OF 576.70 FEET TO SAID LINE'S INTERSECTION WITH THE SOUTH RIGHT-OF-WAY LINE OF THE INDIANA EAST-WEST TOLL ROAD; THENCE FOR THE NEXT FIVE COURSES ALONG SAID SOUTH RIGHT-OF-WAY LINE, THE FIRST COURSE BEING NORTH 89°32'10" EAST, A DISTANCE OF 4567.86 FEET; THENCE ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 11309.16 FEET, A CENTRAL ANGLE OF 03°08'46" AND LIMITED IN LENGTH BY A CHORD WHICH BEARS SOUTH 88°53'24" EAST, A DISTANCE OF 620.92 FEET TO SAID SOUTH RIGHT-OF-WAY LINE'S INTERSECTION WITH THE NORTH-SOUTH CENTERLINE OF SAID SECTION 19; THENCE CONTINUING ALONG SAID CURVE TO THE RIGHT HAVING A RADIUS OF 11309.16 FEET, A CENTRAL ANGLE OF 09°33'29", AND LIMITED IN LENGTH BY A CHORD WHICH BEARS SOUTH 82°32'16" EAST, A DISTANCE OF 1884.41 FEET; THENCE SOUTH 77°45'30" EAST, A DISTANCE OF 2092.44 FEET; THENCE ALONG A CURVE TO THE LEFT HAVING A RADIUS OF 11609.16 FEET, A CENTRAL ANGLE OF 07°05'27" AND LIMITED IN LENGTH BY A CHORD WHICH BEARS SOUTH 81°18'16" EAST, A DISTANCE OF 1435.79 FEET TO SAID RIGHT-OF-WAY LINE'S INTERSECTION WITH THE NORTH-SOUTH LINE OF SAID SECTION 20; THENCE SOUTH 00°39'36" EAST ALONG SAID LINE, A DISTANCE OF 1044.69 FEET; THENCE NORTH 89°23'20" WEST, A DISTANCE OF 1352.40 FEET; THENCE SOUTH 00°15'05" EAST, A DISTANCE OF 1320.02 FEET TO A POINT ON THE SOUTH LINE OF SAID SECTION 20; THENCE NORTH 89°26'43" WEST ALONG SAID LINE, A DISTANCE OF 1327.50 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 19; THENCE NORTH 89°28'23" WEST ALONG THE SOUTH LINE OF SAID SECTION 19, A DISTANCE OF 2670.76 FEET TO THE SOUTH QUARTER CORNER OF SAID SECTION 19; THENCE SOUTH 89°52'29" WEST ALONG SAID SOUTH LINE, A DISTANCE OF 2540.96 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 24; THENCE SOUTH 89°35'22" WEST ALONG THE SOUTH LINE OF SAID SECTION 24, A DISTANCE OF 2635.43 FEET TO THE POINT OF BEGINNING, CONTAINING 687.64 ACRES, MORE OR LESS.

EXCEPT THEREFROM ANY PART THEREOF LYING WITHIN SECTION 24, TOWNSHIP 38 NORTH, RANGE 3 EAST

LEGAL DESCRIPTION AS SURVEYED

THAT PART OF THE EAST HALF OF SECTION 19 AND THE WEST HALF OF SECTION 20, TOWNSHIP 38 NORTH, RANGE 4 EAST, HARRIS TOWNSHIP, SAINT JOSEPH COUNTY, INDIANA, DESCRIBED AS: BEGINNING AT A HARRISON MONUMENT AT THE SOUTHEAST CORNER OF THE SOUTHEAST QUARTER OF SAID SECTION 19, SAID POINT ALSO BEING THE SOUTHWEST CORNER OF THE SOUTHWEST QUARTER OF SAID SECTION 20; THENCE NORTH 00° 35' 24" WEST ON THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 19 A DISTANCE OF 1569.86 FEET TO A SET 5/8" REBAR WITH CAP #LS21700004; THENCE NORTH 89° 26' 39" WEST PARALLEL WITH THE NORTH LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 19 A DISTANCE OF 2651.26 FEET TO A SET PK NAIL ON THE WEST LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 19; THENCE NORTH 00° 07' 08" EAST ON SAID WEST LINE 1072.80 FEET TO A HARRISON MONUMENT AT THE NORTHWEST CORNER OF THE SOUTHEAST QUARTER OF SAID SECTION 19; THENCE NORTH 00° 33' 52" WEST ON THE WEST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 19 A DISTANCE OF 574.57 FEET TO A SET PK NAIL ON THE SOUTHERLY RIGHT OF WAY LINE OF THE INTERSTATE 80 TOLL ROAD; THENCE EASTERLY 1885.59 FEET ON SAID SOUTHERLY RIGHT OF WAY LINE AND ON A 11309.16 FOOT RADIUS CURVE TO THE RIGHT WHOSE CHORD BEARS SOUTH 82° 32' 27" EAST 1883.41 FEET (DEEDED SOUTH 82° 32' 16" EAST 1884.41 FEET) TO A FOUND CONCRETE MONUMENT; THENCE SOUTH 77° 45' 30" EAST ON SAID SOUTHERLY RIGHT OF WAY LINE 2093.52 FEET (DEEDED 2092.44 FEET) TO A FOUND REBAR WITH CAP NO. S0523; THENCE EASTERLY 1436.67 FEET ON SAID SOUTHERLY RIGHT OF WAY LINE AND ON A 11609.16 FOOT RADIUS CURVE TO THE LEFT WHOSE CHORD BEARS SOUTH 81° 18' 16" EAST 1435.75 FEET (DEEDED 1435.79 FEET) TO A FOUND REBAR WITH CAP NO. S0523 ON THE EAST LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20; THENCE SOUTH 00° 39' 36" EAST ON SAID EAST LINE 1044.69 FEET TO A SET 5/8" REBAR WITH CAP NO. LS21700004; THENCE NORTH 89° 23' 20" WEST 1352.40 FEET TO A SET 5/8" REBAR WITH CAP NO. LS21700004; THENCE SOUTH 00° 15' 05" EAST 1320.02 FEET TO A SET PK NAIL ON THE SOUTH LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20; THENCE NORTH 89° 26' 43" WEST ON SAID SOUTH LINE 1327.46 FEET (DEEDED 1327.50 FEET) TO THE POINT OF BEGINNING. CONTAINING 208.06 ACRES MORE OR LESS.

SUBJECT TO THE RIGHTS OF THE PUBLIC AND OF ANY GOVERNMENTAL UNIT IN ANY PART THEREOF TAKEN, USED, OR DEEDED FOR STREET, ROAD, OR HIGHWAY PURPOSES.

BEARINGS ARE RELATED TO THE INDIANA STATE PLANE COORDINATE SYSTEM, EAST ZONE (U.S. SURVEY FEET).



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CLIENT: INDIANA MICHIGAN POWER COMPANY
JOB No: 170655
DATE: 10/2/2017
SCALE:
DRAWN BY: SSH
CHECKED BY:

Anthony D. Hiatt
ANTHONY D. HIATT

LS - 21700004

HARRIS TOWNSHIP, SAINT JOSEPH COUNTY, INDIANA

SECTION 19&20, T 38 N, R 4 E

A-170655

ITEMS PER SCHEDULE B, SECTION 2, SPECIAL EXCEPTIONS

TERMS AND PROVISIONS OF THE EAST-WEST TOLL ROAD PERMANENT RIGHT OF WAY EASEMENT GRANTED TO THE STATE OF INDIANA BY INSTRUMENTS DATED JULY 14, 1954 AND RECORDED MARCH 18, 1955 IN BOOK 539, PAGE 97 AND DATED JULY 12, 1954 AND RECORDED APRIL 20, 1955 IN BOOK 540 PAGE 165. (SECTION 19) AFFECTS PARCEL AS SHOWN (ITEM 19).

EASEMENT FOR LINES, POLES AND WIRES FOR TRANSMITTING ELECTRIC, POWER, TELEPHONE OR TELEGRAPH GRANTED TO INDIANA & MICHIGAN ELECTRIC COMPANY DATED OCTOBER 24, 1958 AND RECORDED DECEMBER 12, 1958 IN BOOK 584 PAGE 514. (SECTIONS 30 & 19) DOES NOT AFFECT PARCEL (ITEM 20)

RIGHT OF WAY GRANTED TO ST. JOSEPH COUNTY BY INSTRUMENT DATED MAY 11, 1961, AND RECORDED MARCH 26, 1963, IN BOOK 636, PAGE 389. (SE QUARTER SECTION 19) AFFECTS PARCEL AS SHOWN (ITEM 21).

RIGHT OF WAY GRANTED TO ST. JOSEPH COUNTY BY INSTRUMENT DATED MAY 11, 1961, AND RECORDED MARCH 26, 1963, IN BOOK 636, PAGE 390. (NW QUARTER SECTION 30) DOES NOT AFFECT PARCEL (ITEM 22).

RIGHT OF WAY GRANTED TO ST. JOSEPH COUNTY BY INSTRUMENT DATED MAY 11, 1961, AND RECORDED MARCH 26, 1963, IN BOOK 636, PAGE 391. (SE OF SW QUARTER SECTION 19) DOES NOT AFFECT PARCEL (ITEM 23).

RIGHT OF WAY GRANTED TO ST. JOSEPH COUNTY BY INSTRUMENT DATED MAY 11, 1961, AND RECORDED MARCH 26, 1963, IN BOOK 636, PAGE 392. (NE OF SW QUARTER SECTION 19) DOES NOT AFFECT PARCEL (ITEM 24).

RIGHT OF WAY GRANTED TO ST. JOSEPH COUNTY BY INSTRUMENT DATED MAY 11, 1961, AND RECORDED MARCH 26, 1963, IN BOOK 636, PAGE 393. (SW OF NE QUARTER SECTION 19) DOES NOT AFFECT PARCEL (ITEM 25).

RIGHT OF WAY GRANTED TO ST. JOSEPH COUNTY BY INSTRUMENT DATED MAY 11, 1961, AND RECORDED MARCH 26, 1963, IN BOOK 636, PAGE 394. (NE QUARTER SECTION 30) DOES NOT AFFECT PARCEL (ITEM 26).

EASEMENT FOR GAS MAIN GRANTED TO NORTHERN INDIANA PUBLIC SERVICE COMPANY, AN INDIANA CORPORATION DATED AUGUST 31, 2006 AND RECORDED SEPTEMBER 22, 2006 AS INSTRUMENT NO. 0641298. (SECTION 30) DOES NOT AFFECT PARCEL (ITEM 27).

DISTRIBUTION EASEMENT BY HEARTLAND FARMS, LLC TO INDIANA MICHIGAN POWER COMPANY DATED MAY 13, 2008 AND RECORDED JULY 8, 2008 AS INSTRUMENT NO. 0822651. (SECTION 19) DOES NOT AFFECT PARCEL (ITEM 28).

DISTRIBUTION EASEMENT BY HEARTLAND FARMS, LLC TO INDIANA MICHIGAN POWER COMPANY DATED MAY 13, 2008 AND RECORDED JULY 8, 2008 AS INSTRUMENT NO. 0822652. (SECTION 19) AFFECTS PARCEL AS SHOWN (ITEM 29).

TEMPORARY HIGHWAY EASEMENT GRANT TO THE BOARD OF COUNTY COMMISSIONERS OF ST. JOSEPH COUNTY, STATE OF INDIANA DATED DECEMBER 3, 2008 AND RECORDED JANUARY 16, 2009 AS INSTRUMENT NO. 0901398. (SW QUARTER SECTION 19) DOES NOT AFFECT PARCEL (ITEM 30).

SURVEY NOTES

A NEW LEGAL DESCRIPTION WAS DRAFTED TO DESCRIBE ONLY THAT PORTION OF PARCEL I AS DESCRIBED IN COMMITMENT FOR TITLE INSURANCE ISSUED BY FIDELITY NATIONAL TITLE INSURANCE COMPANY, COMMITMENT NO. 17-009940, EFFECTIVE DATE SEPTEMBER 14, 2017, SURVEYED AS SHOWN.

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION. THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN-SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES ARE IN THE EXACT LOCATION INDICATED ALTHOUGH THE SURVEYOR DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM THE INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

AREAS OF THE SURVEYED PARCEL ARE LOCATED WITHIN ZONE X, (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN), ZONE X, (AREAS SUBJECT TO THE 0.2% ANNUAL CHANCE FLOODPLAIN) AND ZONE AE (AREA SUBJECT TO 1% ANNUAL CHANCE 100 YEAR FLOOD) PER FEMA FLOOD INSURANCE RATE MAPS NUMBER 18141C0226D EFFECTIVE DATE JANUARY 6, 2011 AND 18141C0227D EFFECTIVE DATE JANUARY 6, 2011.

THERE ARE NO PROPOSED CHANGES IN STREET RIGHT OF WAY LINES PER INFORMATION OBTAINED FROM THE INDIANA DEPARTMENT OF TRANSPORTATION ON 10/11/2017. NO EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION OR REPAIRS WAS OBSERVED IN THE PROCESS OF CONDUCTING THE FIELDWORK. (TABLE A, ITEM 17)

SURVEYOR'S REPORT

IN ACCORDANCE WITH TITLE 865, ARTICLE 1, CHAPTER 12, SECTION 1 THROUGH 29 OF THE INDIANA ADMINISTRATIVE CODE, THIS RETRACEMENT SURVEY WAS PERFORMED BY OR UNDER THE DIRECTION OF THE REGISTERED LAND SURVEYOR STATED HEREON AND TO THE BEST OF SURVEYOR'S BELIEF WAS EXECUTED ACCORDING TO THE SURVEY REQUIREMENTS OF THIS RULE. FURTHERMORE, THE FOLLOWING OBSERVATIONS AND OPINIONS ARE SUBMITTED REGARDING THE VARIOUS UNCERTAINTIES IN THE LOCATIONS OF THE LINES AND CORNERS ESTABLISHED ON THIS SURVEY AS A RESULT OF:

- A) AVAILABILITY AND CONDITION OF REFERENCE MONUMENTS;
- B) OCCUPATION OR POSSESSION LINES
- C) CLARITY OR AMBIGUITY OF THE RECORD DESCRIPTION USED AND OF ADJOINERS' DESCRIPTIONS AND THE RELATIONSHIP WITH ADJOINER'S LINES.
- D) THE RELATIVE POSITIONAL ACCURACY OF THE MEASUREMENTS

THIS SURVEY HAS BEEN PERFORMED UNDER CLASSIFICATION OF A RURAL SURVEY. THE RELATIVE POSITIONAL ACCURACY OF THE MEASUREMENTS AND CORNERS OF THE SUBJECT TRACT ESTABLISHED IN THIS SURVEY ARE WITHIN SPECIFICATIONS FOR A RURAL SURVEY (0.26 FEET PLUS 200 PARTS PER MILLION).



W**A****I****G****H****T****M****A****N****&****A****S****S****O****C****I****A****T****E****S****, I****N****C.**
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LS - 21700004

HARRIS TOWNSHIP, SAINT JOSEPH COUNTY, INDIANA

SECTION 19&20, T 38 N, R 4 E

A-170655

THEORY OF LOCATION:

THE PURPOSE OF THIS SURVEY IS TO PREPARE AN ALTA/NSPS LAND TITLE SURVEY OF A PORTION OF PARCEL 1 AS DESCRIBED IN COMMITMENT FOR TITLE INSURANCE PREPARED BY FIDELITY NATIONAL TITLE INSURANCE COMPANY COMMITMENT NUMBER 17-009940 EFFECTIVE DATE SEPTEMBER 14, 2017, SAID PARCEL ALSO DESCRIBED IN WARRANTY DEED RECORDED AS DOCUMENT NO. 1128527 IN THE OFFICE OF THE RECORDER OF ST. JOSEPH COUNTY, INDIANA.

THE BASIS OF BEARING FOR THIS SURVEY IS BASED ON THE INDIANA STATE PLANE COORDINATE SYSTEM, EAST ZONE.

THE FOLLOWING DEEDS AND PLATS WERE REFERENCED FOR THIS SURVEY:

- COMMITMENT FOR TITLE INSURANCE ISSUED BY FIDELITY NATIONAL TITLE INSURANCE COMPANY, COMMITMENT NO. 17-009940, EFFECTIVE DATE SEPTEMBER 14, 2017.
- WARRANTY DEED RECORDED AS DOCUMENT NO. 1128527 IN THE OFFICE OF THE RECORDER OF ST. JOSEPH COUNTY, INDIANA.
- WARRANTY DEED RECORDED AS DOCUMENT NO. 9511686 IN THE OFFICE OF THE RECORDER OF ST. JOSEPH COUNTY, INDIANA.
- CORPORATE WARRANTY DEED RECORDED AS DOCUMENT NO. 0811752 IN THE OFFICE OF THE RECORDER OF ST. JOSEPH COUNTY, INDIANA.
- RIGHT OF WAY PLANS FOR INTERSTATE 80 TOLL ROAD DESIGN SECTION D6, CONTRACT NO. C-31 (1953, LAST REVISED 1959).

COMMENTS / SUMMARY:

THE EAST LINE OF THE SOUTHEAST QUARTER OF SECTION 19-38-4, SAID LINE ALSO BEING THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 20-38-4, WAS ESTABLISHED BY HOLDING HARRISON MONUMENTS FOUND AT THE SOUTHEAST AND NORTHEAST CORNERS THEREOF. THE LINE BEARING NORTH 89° 26' 39" WEST 2651.26 FEET ACROSS THE SOUTHEAST QUARTER OF SAID SECTION 19 WAS ESTABLISHED 20 FEET NORTH OF THE PIVOT POINT OF A CENTER PIVOT IRRIGATION SYSTEM AND PARALLEL WITH THE NORTH LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 19 AS INSTRUCTED BY THE CLIENT. THE WEST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 19 WAS ESTABLISHED BY HOLDING HARRISON MONUMENTS FOUND AT THE SOUTHWEST AND NORTHWEST CORNERS THEREOF. THE WEST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 19 WAS ESTABLISHED BY HOLDING A HARRISON MONUMENT FOUND AT THE SOUTHWEST CORNER AND A RAILROAD SPIKE FOUND AT THE NORTHWEST CORNER. THE SOUTHERLY RIGHT OF WAY LINE OF THE I-80 TOLL ROAD WAS ESTABLISHED BY RIGHT OF WAY PLANS AND FOUND MONUMENTATION. THE EAST LINE OF THE SOUTHWEST QUARTER OF SECTION 20-38-4 WAS ESTABLISHED BY HOLDING A HARRISON MONUMENTS FOUND AT THE SOUTHEAST AND NORTHEAST CORNER THEREOF. THE LINES RUNNING WESTERLY AND SOUTHERLY BETWEEN THE EAST LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20 AND THE SOUTH LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20 WERE ESTABLISHED BY HOLDING DEEDED BEARINGS AND DISTANCES. THE SOUTH LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20 WAS ESTABLISHED BY HOLDING HARRISON MONUMENTS FOUND AT THE SOUTHEAST AND SOUTHWEST CORNER THEREOF.

AS A RESULT OF THE ABOVE OBSERVATIONS, IT IS MY OPINION THAT THE UNCERTAINTIES IN THE LOCATIONS OF THE LINES AND CORNERS ON THIS SURVEY ARE AS FOLLOWS:

- DUE TO VARIANCES IN THE AVAILABILITY AND CONDITION OF REFERENCE MONUMENTS: NONE.
- DUE TO INCONSISTENCIES IN THE LINES OF OCCUPATION OR POSSESSION: CONCRETE PADS FOR IRRIGATION SYSTEM UP TO 18.6 FEET OVER LINE.
- DUE TO DISCREPANCIES OR AMBIGUITY IN THE RECORD OR ADJOINING DESCRIPTIONS: DIFFERENCE BETWEEN DEEDED AND MEASURED DIMENSIONS UP TO 1.08 FEET

I AFFIRM, UNDER THE PENALTIES FOR PERJURY, THAT I HAVE TAKEN REASONABLE CARE TO REDACT EACH SOCIAL SECURITY NUMBER IN THIS DOCUMENT, UNLESS REQUIRED BY LAW.

SURVEYOR'S CERTIFICATE

TO: INDIANA MICHIGAN POWER COMPANY, AN INDIANA CORPORATION AND FIDELITY NATIONAL TITLE INSURANCE COMPANY:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 3, 4, 7(A), 8, AND 17 OF TABLE A THEREOF. THE FIELDWORK WAS COMPLETED ON OCTOBER 12, 2017.

Anthony D. Hiatt
ANTHONY D. HIATT LS - 21700004
THIATT@WIGHTMAN-ASSOC.COM



HARRIS TOWNSHIP, SAINT JOSEPH COUNTY, INDIANA

SECTION 19&20, T 38 N, R 4 E

A-170655

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9835 Portage Road Portage, MI 49002 Phone: (269) 527-3532
www.wightman-assoc.com

CLIENT: INDIANA MICHIGAN POWER COMPANY
JOB No: 170655
DATE: 10/2/2017
SCALE:
DRAWN BY: SSH
CHECKED BY:

PUBLIC VERSION



Indiana Michigan (I&M) Power Company South Bend Solar Project

APPENDIX 9 PERMIT SUMMARY REPORT FORM

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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PROJECT NAME
PERMIT SUMMARY REPORT

Issue Date: **XX/XX/XX**
Schedule Reference: **XX/XX/XX**

(LATEST REVISIONS SHOWN IN RED)

A: Actual Date	NR: Not Required
C: Completed	UD: Under Determination
D: Duration (Working Days)	
S: Scheduled Date	

NO ISSUES		CONCERNS	
LATE &/OR RESTRAINT		UPDATE SCHEDULE	

PERMIT NAME	GOVERNING AGENCY	PERMIT REQUIRED FOR	RESPONSIBLE GROUP/ ENGINEER(S)	SUBMITTAL DATE S/A	PERMIT RECEIPT DATE S/A	COMMENTS	STATUS
NON-ENVIRONMENTAL PERMITS							
PERMIT NAME	AGENCY NAME	REASON FOR PERMIT	APPLICATION D: XX DESIGN Design Firm	XXXXXXX S XXXXXXX A Agency Review D:XX	XXXXXXX S XXXXXXX A		

Permitting departments will coordinate compliance with individual terms and conditions associated with issuance of the permits as listed for all permits obtained. Initiation of actual follow-up of the permits' individual terms and conditions is the responsibility of the **RESPONSIBLE GROUP/ENGINEER(S)** listed in the current Permitting Summary Report.

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**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

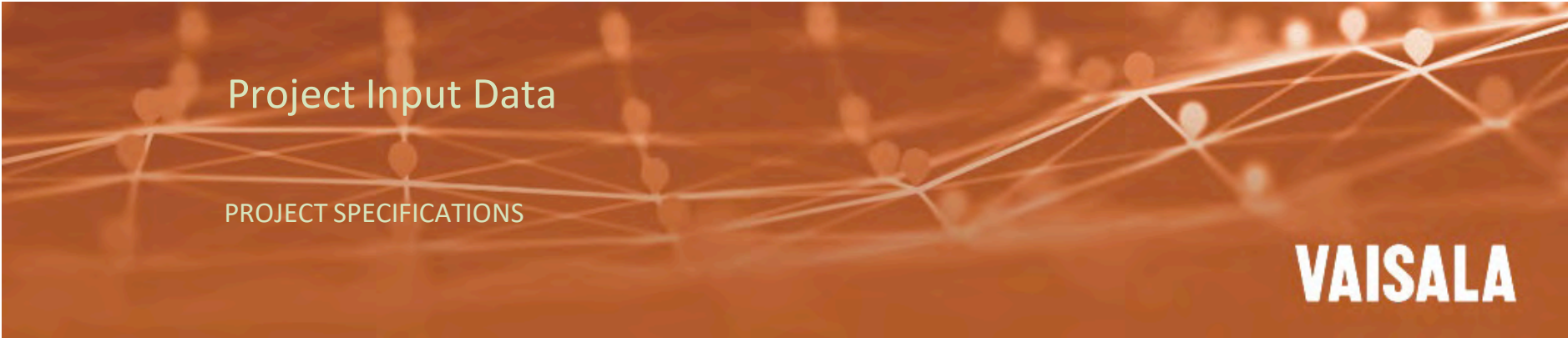
**APPENDIX 10
VAISALA SOLAR CLIENT DATA REVIEW FORM**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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Client name	
Project name	
Date at which project started operation (if applicable)	
Latitude	
Longitude	
Elevation	
AC Capacity [MW]	
DC Capacity [MW]	
Total number of modules	
Total number of inverters	
Modules per string	
Module Manufacturer and Model	
Inverter Manufacturer and Model	
Mounting Type Select From Drop-Down	
Tilt angle	
Azimuth	
Pitch (m) (see picture 1)	
Width of sensitive area (m) (see picture 1)	
Distance from lower edge of array to ground (m)	
Module orientation (landscape or portrait)	
Table or Racking configuration (see picture 2)	
(If trackers used) Backtracking?	
(If trackers used) Tracker range (min/max rotation)	
Auxiliary loads to subtract from production if any (W/kW)	<input type="checkbox"/>
Cleaning frequency	
Is output curtailed? If so, please provide details.	
Number of transformer stages between inverters and energy meter	
For each transformer stage, please indicate the following	Transformer stage 1Transformer stage 2 (if any)Transformer stage 3 (if any)
Rating (MVA)	
Voltage (kV)	
No-load loss (%)	
Load loss at peak power (%)	
Is night disconnect used?	
If transmission line losses are significant, please specify for each line	Line 1 (if any)Line 2 (if any)Line 3 (if any)
Loss (%)	
Line length (km)	
Resistance per unit length (Ω/m)	
Conductors per phase	
Please specify power factor, if not equal to 1	

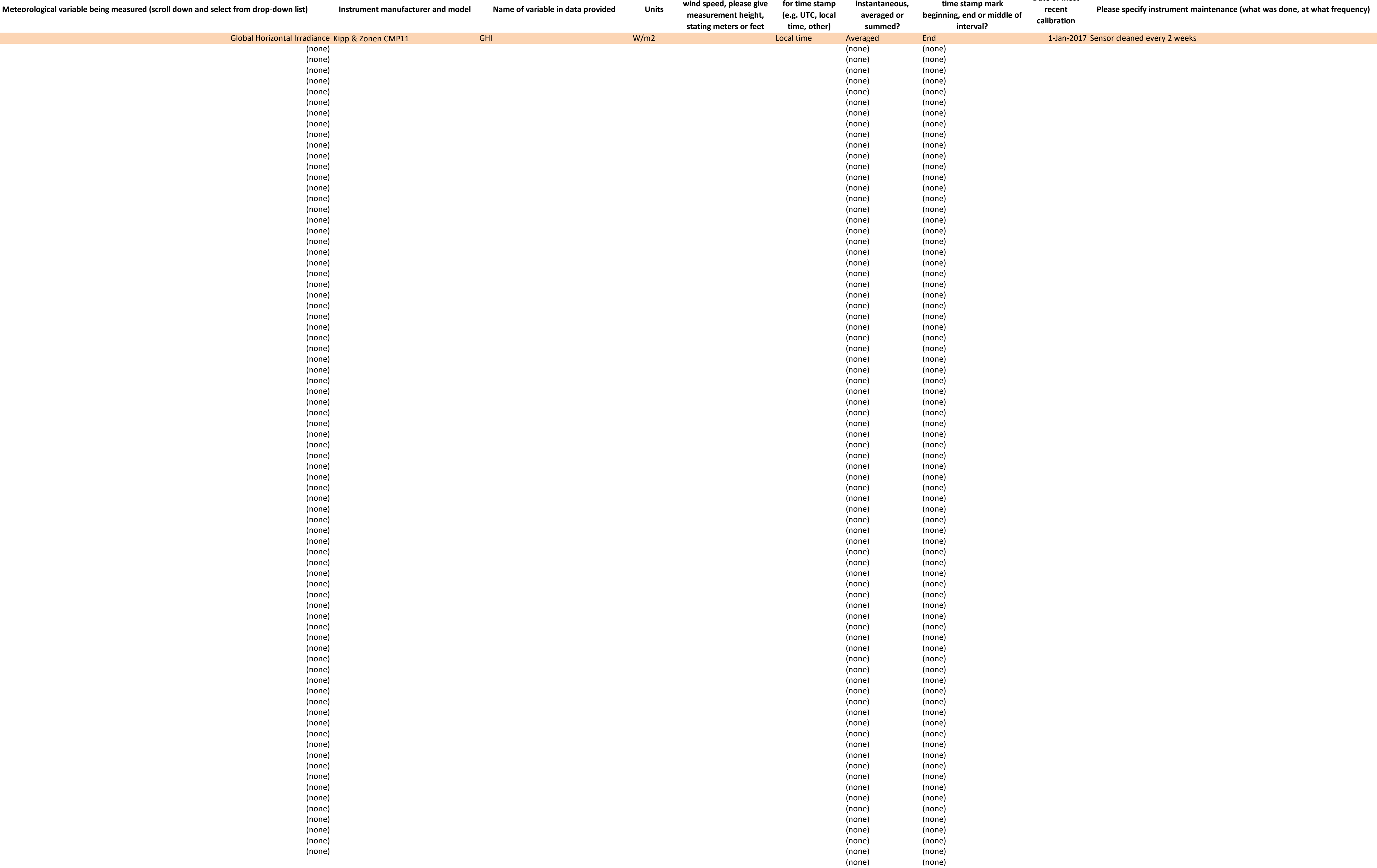


Picture 1



Picture 2

Please provide separately any system-specific loss calculations that have been performed (e.g. AC and DC wiring, auxiliary losses, transmission line losses, soiling)
Please provide separately any information relevant for shading analysis
Please provide separately any other relevant documentation for energy modeling (e.g. single-line diagrams)



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APPENDIX 11

POWER OUTPUT AND ENERGY PERFORMANCE TESTING REQUIREMENTS

PUBLIC VERSION

EXHIBIT G-1 – POWER OUTPUT TEST

1.0 DEFINITIONS

- 1.1 “Block”** means each AC Block (Array) at the Facility as set forth in Attachment A to Exhibit G-2.
- 1.2 “Capacity Liquidated Damages”** has the meaning set forth in Section 2.5 below.
- 1.3 “Facility Met Data”** means, for each hour of the day during the Energy Performance Test, the irradiance, relative humidity and ambient temperature actually recorded for the applicable time period by all meteorological stations at the Facility. When multiple meteorological stations are located on a Facility site, the data will be averaged together.
- 1.4 “Facility Meter”** means the permanent ANSI C-12 power meter located at the Facility’s point of interconnection.
- 1.5 “Combining Switchgear”** means the switchgear which collects generated power from the inverters.
- 1.6 “Minimum Power Output Guarantee”** means 95.0% of the Power Output Guarantee.
- 1.7 “Power Output Guarantee”** means the capacity of the Facility as measured by the Facility Meter that is the expected result of the Power Output Test, corrected to Standard Test Conditions.
- 1.8 “Power Output Test”** means a test carried out in accordance with steps, procedures and conditions specified in this Exhibit G-1, to demonstrate achievement of the Power Output Guarantee and the Minimum Power Output Guarantee shown in the table below:

Power Output Test	Power Output Guarantee (in MW AC)	Minimum Power Output Guarantee (in MW AC)
South Bend	20	19

PUBLIC VERSION

- 1.9 “Primary Measurement Device”** means an instrument that provides a measurement or reading that is used in calculating power output pursuant to this Exhibit G-1.
- 1.10 “Secondary Measurement Device”** means an instrument that is not used in calculating the output power or energy but is used as a check on primary measurements.
- 1.11 “Standard Test Conditions (STC)”** means the following, with respect to each Block in the Facility: (i) irradiance in the plane of the array (module tilt angle and orientation) of 1,000 W/m²; (ii) 25°C module cell operating temperature as measured at the back surface or cell of the module (reference module temperatures shall not be used for temperature correction); and (iii) Air Mass (AM) of 1.5.
- 1.12 “Temperature Corrected Output”** means the solution of the linear regression equation for the Power Output Test, where x is equal to 1,000 W/m².

2.0 POWER OUTPUT TEST

The objective of the Power Output Test is for Contractor to demonstrate to Owner that the Facility shall achieve (i) the Minimum Power Output Guarantee as a condition to achievement of Substantial Completion, and (ii) the Power Output Guarantee, in each case when the results are corrected from the test conditions to STC.

2.1 Outline of Steps for POWER OUTPUT TEST

2.1.1 Conduct field tests: Contractor shall measure and record AC power output (P_m) at the Facility Meter, Module temperature(s) from representative Modules in the Blocks, and irradiance levels using laboratory certified reference modules identical to those mounted in the field. Record this data over a duration and frequency to achieve a sufficient data population and minimize random error.

2.1.1.1 Module temperature shall be measured by use of Resistance Temperature Detectors (RTD) attached to the back side of representative Modules in the solar field, or embedded into the Module cells. If attached to the back side of the Module, the RTD shall be attached in a manner which will not allow any air gaps between sensor and surface, will not come loose, and will not create any hot spots. A minimum of 4 Modules will be instrumented for temperature readings. These RTDs shall be distributed throughout the solar field with 20% on the north-south perimeter rows and the third module in from edge of east-west rows.

2.1.1.2 Laboratory certified reference modules or cells shall be (to be provided by Module Supplier):

(1) Calibrated by National Renewable Energy Laboratory or

PUBLIC VERSION

approved equal with appropriate supporting documentation.

- (2) Of the same type (identical optical and electrical properties) and rated power (reference module power rating shall be equal to the rated power of the Modules to within +/- 1%) as those in the solar field.
 - a. Mounted in the same plane (same tilt angle and orientation) and elevation as field solar arrays.
 - b. Labeled with permanent weatherproof label as certified calibrated reference module.
 - c. Provided in quantities as specified in Table 2-1.

2.1.2 Compile and reduce test data set: For each Power Output Test, raw test data shall be analyzed by Contractor and reduced to eliminate data points that clearly exhibit a high degree of random error or are not indicative of actual typical operating conditions, such as shading, clipping, or disturbances or unstable weather that were not indicative of the test. Contractor shall document all data that are eliminated and review with Owner for acceptance. Details shall be included in the agreed upon Power Output Test Procedures.

2.1.3 Apply temperature correction factors: Contractor shall correct each power measurement to 25 °C (STC temperature) using the module temperature coefficient of power to yield the corrected output power, P_{stc} . To ensure a mean representative solar module temperature is used in this correction calculation, the module temperature transmitters shall be placed as described in 2.1.1.2 and in quantities as specified in Table 2-1.

2.1.4 Ancillary Load Considerations: The test shall account for ancillary loads up to the Facility Meter which deduct energy from the net AC output. These are loads which are used for the running of the Facility but which reduce the net delivered power of the Facility. An example of this would be HVAC/lighting loads for the buildings (if used) which house the inverters, back feed power to transformers, etc. If such loads exist, they must be running during the test.

2.1.5 Plot data set using computational software: Contractor shall plot temperature-corrected power measurement versus measured solar irradiance as a scatter graph (y axis = power, x axis = plane of array irradiance).

2.1.6 Generate curve fit: Contractor shall, using computational software, generate a linear regression curve fit through the data and obtain the curve equation.

2.1.7 Solve for standard insolation, 1000 W/m²: Contractor shall solve the equation using a value of 1000 watts/m² for the irradiance to calculate what the value would be at STC.

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2.1.8 Determine pass/fail: Contractor shall compare the Temperature Corrected Output resulting from the Power Output Test to the Power Output Guarantee per 2.5.

2.2 Pre-Test Activities

2.2.1 Contractor/Owner Representatives: Owner and Contractor shall define lead representatives for the power output testing. Lead test representative for Contractor shall be termed the Test Manager.

2.2.2 Power Output Test Procedures: Thirty (30) days prior to commencement of the Power Output Test, Contractor shall submit to Owner for review and approval the Power Output Test Procedures which shall detail all Power Output Test activities including:

2.2.2.1 Specification “cut-sheets” for all Primary Measurement Devices. Also provide drawing showing location of all measurements for field verification.

2.2.2.2 Field testing procedures (to meet minimum test duration and frequency requirement as specified in Table 2-2).

2.2.2.3 List of Secondary Measurement Devices and locations.

2.2.2.4 Applicable Equipment factory test certificates.

2.2.2.5 Calculations, methodologies, equations and procedures.

2.2.3 Power Output Test Scheduling: Contractor shall notify Owner in writing of proposed test date not less than 5 days prior to the proposed date for the Power Output Test.

2.2.4 Pre-test Conditions: Tests may be performed only when the following conditions are met:

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2.2.4.1 The Completion Tests have been Successfully Run, and system is in automatic operation.

2.2.4.2 Weather conditions are as required to complete the Power Output Test, as addressed in this exhibit and in the approved Power Output Test Procedures.

2.2.4.3 Utility grid voltage is stable and within +/- 5% of design voltage.

2.2.4.4 There is grid connectivity at each inverter such that the Power Output Test can be accomplished under load.

2.2.5 Pre-Test Meeting: Prior to each test, a pre-test meeting shall be conducted and recorded. The meeting shall review the applicable approved Power Output Test Procedures, instrumentation locations, calibration sheets and other relevant topics including safety requirements. Minutes of this meeting shall be recorded by Contractor and approved by both Parties. Immediately after the meeting, a system walk-through shall be conducted to verify calibration certificates match field instrumentation and to verify instrumentation is correctly installed and located.

2.2.6 Pre-Test Runs: Contractor shall perform preliminary test runs prior to the official test in order to validate instrument readings, data acquisition operation and stable system operation. Owner shall be notified one day in advance of preliminary test runs and shall be allowed to observe testing.

2.3 Test Measurements

All test measurement devices used shall be fully documented in terms of their make/model, accuracy, calibration and location. The following tables summarize these measurements:

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TABLE 2-1: POWER OUTPUT TEST Measurements (Minimum)

Measurement	Quantity	Type	Instrument Type	Range	Minimum Accuracy
Solar Irradiance	1 per Facility	Primary for Power Output Test	NREL calibrated Reference module	0 to 1600 W/m ²	+/- 5.0%
	1 per Facility	Primary for Energy Test	Pyranometer (Global Horizontal Irradiance)	0 to 1600 W/m ² 285 to 2800 nm	+/- 2.0% daily
	1 per Facility	Secondary for Power Output Test	Pyranometer (Plane of Array Irradiance)		
Ambient Air Temperature	1 per Facility	Primary for Energy Test	Temperature Probe	-52°C to +60°C	+/- 0.3°C @ 20°C
Wind Speed	1 per Facility	Primary for Energy Test	Sonic Wind Sensor	0 – 60 m/s	±3% at 10m/s
Rain Fall	1 per Facility	Primary for Energy Test	Raincap Sensor	None specified	+/- 5.0%
Relative Humidity	1 per Facility	Primary for Energy Test	Temperature/ Humidity Sensor	0% to 100%	±3%RH at 0 to 90%RH and ±5% at >90 to 100%RH
Net Power Output Power (kW), Power Factor (PF), Current (A), Voltage (V)	1 per Facility	Primary for Power Output Test	ANSI C-12 power meters installed by CONTRACTOR at the COMBINING SWITCHGEAR with calibrated CTs and PTs.	0 to PV Power Plant size +20%	+/- 0.2%
Module cell temperature	4 per Facility	Primary for Power Output Test	Platinum RTD (resistance temperature detector) transmitter (.00385 TCR DIN B), on back surface or cell of module	-50°C to 85°C	.08% drift”<0.1°C per year
AC/DC power, volts and amperage	1 per Inverter	Secondary	From inverter via SCADA	N/A	determined from inverter data sheet
Soiling ¹	1 per Facility	Primary for Adjusted Energy Performance Test	Soiling Monitoring Station	0 to 100%	+/- 0.2%

¹ When a Soiling Monitoring Station is utilized, the uncleaned portion of the system will be considered a Reference Module.

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2.3.1 Instrument Calibration: All instruments shall have current NIST or equivalent calibration certificates. All calibration certificates shall be submitted to Owner for review prior to commencement of the applicable Power Output Test.

2.3.2 Test Duration and Data Frequency: Testing duration and frequency shall be as follows:

TABLE 2-2: POWER OUTPUT TEST

Test Duration	The test period shall consist of at least 5 valid days. A day is considered valid if a wide distribution of data is collected over the range of insolation values from 200 W/m ² to 1,000 W/m ² . Each day shall have an adequate quantity (minimum of 150 data point sets per day) of valid data points in the morning (sunrise to solar noon) and in the afternoon (solar noon to sunset).
Data Frequency	1 minute instantaneous
Minimum Number of Data Points	750

2.3.3 Data Collection: Data shall be recorded by the SCADA. The use of alternative means for data acquisition shall be reviewed for acceptance by Owner.

2.3.4 Adjustments: Any adjustments made during the test to any portion of the Facility or test measurement devices shall be reviewed for acceptance by Owner prior to execution. Any revisions shall be fully documented.

2.3.5 Cancellation of a Power Output Test: Either Party has the right to cancel a test with written justification if it can be shown that test conditions or other reasons are causing erroneous data. Any test cancelled by either party shall not be deemed to be successfully run.

2.3.6 Test Data and Acceptance/Rejection of Test Data: At the conclusion of each day's data collection, Contractor shall provide Owner the electronic file of the data set from the SCADA. If either party reasonably demonstrates that the data are inaccurate, the data shall be rejected and the applicable Power Output Test must be re-run.

2.4 Test Calculations

2.4.1 Temperature Correction of Power Measurements: Each power measurement will be corrected to 25 °C (STC temperature) using the Module temperature coefficient of power. This temperature coefficient shall accurately model the Module's performance in a grid connected Block at the Facility location. This

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value and the basis for its validity shall be submitted during the bid process and as an attachment to the Power Output Test Procedures.

The correction is determined by the following equation:

$$P_{stc} = \frac{P_m}{1 + C_t(T_m - 25^{\circ}\text{C})}$$

Where,

P_{STC} = AC power corrected to STC temperature (25°C)

P_m = measured AC power output (kW) at the POI

C_t = module temperature coefficient of power per manufacturer's spec sheet.

T_m = averaged measured module cell operating temperature in degrees Celsius.

$$T_m = \Sigma T_f / \#T_f$$

Where,

T_f = measured field module temperature (distributed as described above)

$\#T_f$ = number of module temperature sensors.

2.4.2 Generation of Performance Curve and Determination of Temperature

Corrected Output: The temperature-corrected power measurement as calculated above is then plotted as a scatter graph of temperature corrected power output (y axis) versus solar irradiance (x axis). Using the graphical data in the scatter graph, a linear regression curve is generated along with its equation, in the form of,

$$y = mx + b$$

Where,

y = power (corrected)

m = slope

x = irradiance (W/m^2)

b = y intercept

The resulting equation is solved for Irradiance of $1000 \text{ W}/\text{m}^2$ to calculate the Temperature Corrected Output (MW).

The Coefficient of Determination (R-squared) shall be 0.95 or higher (for the complete data set of the test) to validate a statistically acceptable fit.

PUBLIC VERSION

2.4.3 Combine Results: Combine the Temperature Corrected Output results for each day to determine final results. The 5-day cumulative data shall be plotted together to determine the final Power Output Test result. Each day's results, however, must first be reviewed and approved by Owner. If one day, for example, is unacceptable, then an additional test day shall be required if still below the five day minimum. The minimum R^2 value for each day is 0.90. The minimum R^2 value for the overall test (5 day cumulative) is 0.95.

2.5 Pass / Failure of a Power Output Test

If the Temperature Corrected Output is equal to or greater than the Power Output Guarantee, then Contractor has successfully achieved the objective of the Power Output Test.

If the Temperature Corrected Output is equal to or greater than the Minimum Power Output Guarantee, then Contractor will have successfully achieved the objective of the Power Output Test, but, as described in the Agreement, Contractor may elect to remediate and retest within the Cure Period, or pay Capacity Liquidated Damages in accordance with **Section 13.4.1 of the Agreement**. If the Temperature Corrected Output is less than the Power Output Guarantee, "**Capacity Liquidated Damages**" shall be calculated as follows:

One minus (a) the Temperature Corrected Output divided by the Power Output Guarantee (rounded to the nearest thousandth (ex. 1.2519% rounded to 1.252%)), multiplied by (b) the Contract Price (CP).

$$\text{Capacity Liquidated Damages} = \left(1 - \frac{\text{Temperature Corrected Output}}{\text{Power Output Guarantee}}\right) * CP$$

Final acceptance of the Power Output Test will be given once the test report is submitted by Contractor and approved by Owner.

If the result of the calculation above is a negative number, then no Capacity Liquidated Damages shall be due.

2.6 Test Reporting

Contractor shall submit a detailed test report within 5 business days of completion of successful Power Output Test to Owner, after which Owner will have 15 business days to review and either accept or reject. The test report shall consist of the following at a minimum:

2.6.1 Power Output Test Procedures (as executed).

2.6.2 Instrument calibration sheets/certificates.

2.6.3 Test data (manual and data acquisition).

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2.6.4 Field observations and notes.

2.6.5 Calculations and results.

2.6.6 Conclusions.

PUBLIC VERSION

EXHIBIT G-2 – ENERGY PERFORMANCE TEST

1.0 DEFINITIONS

- 1.1 “AC Losses”** means all transformation and line losses between the point of power conversion within each inverter as measured on the AC side and the Facility Meter.
- 1.2 “Actual Energy Performance”** means the actual energy produced by the Facility during the Energy Performance Test as measured at the Facility Meter (measured in MWh). The result is an 8760 hour Actual Energy Performance data file.
- 1.3 “Adjusted Expected Energy Performance”** means the Expected Energy Performance Data File adjusted to account for Block Degradation, Effective Availability, AC Losses and power limitations imposed at the point of interconnect (expressed in MWh) for the Facility.
- 1.4 “Ancillary Services Losses”** means reactive power and voltage control losses, plant ramp rate restrictions or other power limiting restrictions as defined by the grid operator necessary to maintain reliable operations between interconnected transmission systems and within controlled areas.
- 1.5 “Auxiliary Load Adjustment”** means to correct the Expected Energy Performance for any auxiliary loads present during the data collection which were not accounted for in Attachment A to this Exhibit G-2 input assumptions, as necessary.
- 1.6 “Average Solar Irradiance”** means the average of plane of array (“POA”) irradiance measurements in W/m² from all operational weather stations in the Facility.
- 1.7 “Block”** means each AC Block (Array) at the Facility as set forth in Attachment A to this Exhibit G-2.
- 1.8 “Block Degradation”** means a degradation amount of five-tenths of a percent (0.5%) per annum applied to each of the PV modules comprising a Block, beginning 366 days following the Commencement Date.
- 1.9 “Facility Met Data”** means, for each hour of the day during the Energy Performance Test, the Average Solar Irradiance, relative humidity and ambient temperature actually recorded for the applicable time period by all meteorological stations at the Facility, including the irradiance measurements by all pyranometers. When multiple meteorological stations are located on the Facility site, the data will be averaged together.
- 1.10 “Facility Meter”** means the permanent ANSI C-12 power meter located at the Facility’s point of interconnection.

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- 1.11 “Commencement Date”** means the date which is the first Business Day following the conclusion of the Cure Period.
- 1.12 “Effective Availability”** means the actual Effective Availability calculated pursuant to Attachment B to this Exhibit G-2.
- 1.13 “Energy Model”** means the PVsyst version 6.22 and post-processing software, using input assumptions set forth in Attachment A to this Exhibit G-2.
- 1.14 “Energy Performance Guarantee”** means 97% of the Adjusted Expected Energy Performance.
- 1.15 “Expected Energy Performance”** means the Energy Model predicted energy performance using actual Facility Met Data and corrected for soiling losses experienced during the Energy Performance Test for the Facility.
- 1.16 “Expected Energy Performance Data File”** means the 8760 hour output file produced by the Energy Model’s calculation of the Expected Energy Performance.
- 1.17 “Interruptions”** means any Force Majeure Events, Owner’s regularly scheduled maintenance outages, or outages due to curtailment of the Facility by the grid operator, which for clarity does not include forced outages or unplanned maintenance outages unless as the result of Force Majeure Events or grid curtailments.
- 1.18 “MWh”** means the megawatt-hours measured on an Alternating Current (“AC”) basis.
- 1.19 “Primary Measurement Device”** means an instrument that provides a measurement or reading that is used in calculating annual energy production pursuant to this Exhibit G-2.
- 1.20 “Reference Period”** means a 1 year (365 day) duration for the Energy Performance Test beginning on the Commencement Date. The Reference Period shall in no event be extended unless the Parties agree in writing to extend such period.
- 1.21 “Secondary Measurement Device”** means an instrument that is not used in calculating the output power or energy but is used as a check on primary measurements.
- 1.22 “Soiling Losses”** means actual soiling losses calculated using the methods described in Attachment C to this Exhibit G-2 and measured by a Soiling Monitoring Station (SMS) consisting of calibrated reference modules mounted in the same location and orientation. One half of the SMS reference modules will be cleaned at regular intervals.

PUBLIC VERSION

2.0 PRETEST ACTIVITIES

2.1 Procedures and Conditions: The following procedures to be performed by Contractor and conditions are applicable to the Energy Performance Test.

2.1.1 Contractor/Owner Representatives: Five (5) days prior to the start of testing activities, Contractor shall provide notice to Owner of testing and Owner and Contractor shall each identify lead representatives for the Energy Performance Test.

2.1.2 Test Procedures: Thirty (30) days prior to the start of testing activities, Contractor shall provide the Energy Performance Test Procedure to Owner for review and mutual agreement, as further described in Section 6.3.2 of the Scope of Work. The Energy Performance Test Procedure shall include:

2.1.2.1 Purpose, inputs, methodology, calculations, results and conclusion

2.1.2.2 Approval, review and submittal requirements

2.1.2.3 List and location of all Primary Measurement Devices and Secondary Measurement Devices for field verification

2.1.2.4 Applicable equipment factory test certificates

2.1.2.5 Soiling Losses and Effective Availability calculations, as applicable.

PUBLIC VERSION

ENERGY PERFORMANCE TEST

2.2 Energy Performance Test: Beginning on the Commencement Date, Contractor shall conduct the Energy Performance Test for the Reference Period separately measuring the Actual Energy Performance of the Facility compared to its Energy Performance Guarantee. Contractor shall perform the Energy Performance Test in accordance with the procedures, conditions and requirements contained in this Exhibit G-2 and the Energy Performance Test Procedures to be approved by Owner.

2.2.1 Data Collection: Facility test related parameters are collected on an instantaneous one (1) minute interval for the Reference Period. The data shall consist of the actual Facility Met Data and the Actual Energy Performance of the Facility during Energy Performance Test.

2.2.2 Compile Test Data Set: The instantaneous one (1) minute interval test data is summed into hourly values and averaged across the number of same measurement instruments to produce average per hour result.

2.2.3 Reduce Test Data Set: The hourly data shall be filtered so that the data set is free of nuisance data points and bad data that exhibit a high degree of error (such as errors caused by faulty instrumentation). Contractor shall document data that is eliminated.

2.2.3.1 Data Filtering – The following criteria shall be used to filter the data used for this test:

(i) **Snow or frost** – Any measurement intervals with snow or frost accumulation on the modules will be excluded.

(ii) **Ancillary Services Losses** – Any measurement intervals where Ancillary Services Losses beyond design conditions are reducing AC power output will be excluded (example design for inverters is for a power factor of +/-0.95 and actual power factor is -0.90).

(iii) **Interruptions** – Time periods of Interruptions that reduce the power output of the Facility shall be excluded.

(iv) **Nuisance or bad data** – Any nuisance data points or bad data that clearly exhibit a high degree of error including required meteorological measurement equipment that is identified as being out of calibration or requiring adjustment.

(v) **The Facility Meter reads “importing” power** – These data points will not be included.

2.2.4 Determine the Expected Energy Performance: PVsyst and post-processing software are used to calculate the Expected Energy Performance using actual Facility Met Data and corrected for soiling.

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2.2.5 Determine the Adjusted Expected Energy Performance: The Expected Energy Performance (EEP) is adjusted to account for Auxiliary Loads (AUX), Block Degradation (BD), Effective Availability (EA), AC Losses (AC) and power limitations (PL) imposed at the point of interconnect. **AEEP = (EEP * (1-AUX) * (1-BD) * (EA) * (1-AC)) - PL**

2.2.6 Determine the Actual Energy Performance: Collect the metered energy output of the Facility over the testing period.

2.2.7 Acceptable Test Results: The Actual Energy Performance (AEP) meets or exceeds the Energy Performance Guarantee (EP_G).

$$AEP \geq EP_G \quad \text{Where: } EP_G = 97\% * AEEP$$

2.2.8 Reporting: Contractor shall submit to Owner a detailed report of the Energy Performance Test for the Facility within five (5) days after completion of the Energy Performance Test. Owner shall have fifteen (15) Business Days after receipt to review and comment to the report. The report shall contain the following:

2.2.8.1 Metered Facility Met Data

2.2.8.2 8760 hour Expected Energy Performance data

2.2.8.3 8760 hour Actual Energy Performance data from SCADA

2.2.8.4 Filtered or excluded data

2.2.8.5 Adjusted Expected Energy Performance

2.2.8.6 Comparison of the Actual Energy Performance to the Energy Performance Guarantee

2.2.8.7 Comments, field notes and annotations

2.2.8.8 Results and conclusions

2.2.9 Determine the Test Factor: “**Test Factor**” is used by the Limited Warranty Agreement, Exhibit N, and means the lesser of (i) one (1.0) and (ii) the ratio of (A) Actual Energy Performance divided by (B) Adjusted Expected Energy Performance, in each case, as determined by the Energy Performance Test.

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3.0 ENERGY PERFORMANCE LIQUIDATED DAMAGES

3.1 ENERGY PERFORMANCE LIQUIDATED DAMAGES

3.1.1 Energy Performance Liquidated Damages: After the Energy Performance Test, if the Actual Energy Performance is less than the Energy Performance Guarantee, “**Energy Performance Liquidated Damages**” shall be calculated as follows:

3.1.1.1 (A) (1) (i) [REDACTED] *minus* (ii) Actual Energy Performance (AEP) *divided* by the Energy Performance Guarantee (EP_G) (and multiplied by [REDACTED] so as to be expressed as a percentage, and rounded to the nearest one hundredth of a percent (ex. [REDACTED] rounded to [REDACTED])) *multiplied* by (2) the Contract Price (CP) *minus* (B) any Capacity Liquidated Damages paid by Contractor.

Energy Performance LDs = [([REDACTED] - ((AEP/ EP_G)*[REDACTED])) x CP] – Capacity LDs]

3.1.1.2 If the amount resulting from the calculation of the formula in Section 3.1.1.1 is greater than zero (0), then such amount shall be payable by Contractor to Owner as Energy Performance Liquidated Damages.

3.1.1.3 If the amount resulting from the calculation of the formula in Section 3.1.1.1 is less than zero (0), then the absolute value of such amount shall be payable by Owner to Contractor, in an amount not to exceed the total Capacity Liquidated Damages paid by Contractor, as a reimbursement of such Capacity Liquidated Damages paid by Contractor.

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Attachment A

Energy Model Input Assumptions – TBD Based on Final Facility Design

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[End of Attachment A]

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Attachment B

Effective Availability Calculation

A. Purpose

The Effective Availability calculation determines the overall availability of the Facility performed on an inverter basis.

B. Definitions

1. **“Clipping”** means that an inverter limits the AC output power or current it produces to its maximum nameplate AC power or current rating. The input DC power and current would otherwise enable a greater output AC power or current to be produced.
2. **“Effective Availability”** means, for each Reference Period, the calculation resulting from the following formula:

$$\text{Effective Availability} = \frac{\text{MWh Produced}}{\text{MWh Produced} + \text{MWh Lost}}$$

3. **“Facility Off-Line Period”** means any period of time during which all Facility inverters are Off-Line Inverters.
4. **“Inverter Meter”** means a meter measuring an inverter’s AC power output.
5. **“MWh Lost”** means the total MWh lost at the Facility during the Reference Period caused by any Interruptions, calculated as the sum of lost energy due to Off-line Inverters and Facility Off-Line Periods.
6. **“MWh Produced”** means the total MWh produced by the Facility during the Reference Period as measured by the Facility Meter(s).
7. **“Off-Line Inverter”** means any inverter that is not producing power measured at the Inverter Meter when the Average Solar Irradiance is greater than 85 W/m².
8. **“On-Line Inverter”** means any inverter that is producing power measured at the Inverter Meter when the Average Solar Irradiance is greater than 85 W/m².
9. **“Reference Period”** means a period of time for which the Effective Availability is calculated.

C. Data Collection

1. Over the Reference Period, log the Interruptions.
2. Collect and Log the instantaneous samples at one minute intervals for:
 - a. Inverter kW output
 - b. Average Solar Irradiance W/m²
 - c. Facility Meter kW and MWh output.

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D. **Normalization of Inverter Data**

The collected inverter kW output data is revised for balance of system losses between the inverter kW output and the Facility Meter (Revenue Energy Meter) kW output, then normalized on a Facility basis to account for differences in inverter DC sizes.

1. **Inverter kW Contribution of the Revenue Energy Meter (REM):**

$$\text{Inverter REM kW} = \frac{\text{Inverter AC kW}}{\text{SUM Inverter AC kW}} \times \text{Facility REM kW}$$

Where:

- a. **Inverter AC kW** = AC kW value produced by the inverter at that minute as measured at the inverter.
- b. **SUM Inverter AC kW** = sum of all inverters' AC kW value at that minute.
- c. **Facility REM kW** = AC kW value at the Facility Meter at that minute.

2. **Normalized Inverter kW**

$$\text{Normalized Inverter kW} = \text{Inverter REM kW} \times \frac{\text{Average of all Inverters' Nameplate Capacity}}{\text{Inverter's Nameplate Capacity}}$$

Where:

- a. **Inverter's Nameplate Capacity**
 - i. When the inverter is Clipping: AC nameplate capacity of the inverter.
 - ii. When the inverter is not Clipping: the DC capacity feeding the inverter.
- b. **Average of all Inverters' Nameplate Capacity**
 - i. When the inverter is Clipping: the average of the inverter AC nameplate capacity of all inverters in the Facility.
 - ii. When the inverter is not Clipping: the average of the DC capacity feeding all inverters in the Facility.

3. **Calculation of the Average Inverter Normalized Value**

- a. Inverters are ranked by Normalized Inverter kW values from highest to lowest excluding any off-line inverters.
- b. The highest 40% of Normalized Inverter kW values are then averaged together to achieve the **Average Inverter Normalized Value**.
- c. Off-Line Inverters are excluded from the calculation.

4. **Calculation of Inverter Denormalized kW**

- a. Inverter Denormalized kW for each inverter Off-Line the following formula is used:

$$\text{Inverter Denormalized kW} = \text{Avg Inverter Normalized Value} \times \frac{\text{Inverter's Nameplate Capacity}}{\text{Average of all Inverters' Nameplate Capacity}}$$

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- b. For the avoidance of doubt, Inverter Denormalized kW is limited to the AC nameplate capacity of each inverter.

E. **Calculation of MWh Lost**

The MWh Lost is the sum of the components listed in the equation below:

$$MWh\ Lost = OffLine\ Inverter\ MWh + Facility\ OffLine\ MWh$$

1. **Off-Line Inverter MWh**

The Off-Line Inverter MWh is equal to the sum of the Inverter Denormalized kW values for the off-line period converted from kW-minutes to MWh (60 kW-minutes per kWh, 1000 kWh per MWh). The Off-Line Inverter lost MWh are calculated as follows:

$$Offline\ Inverter\ MWh = \frac{\sum (Inverter\ Denormalized\ kW)}{60 \times 1000}$$

2. **Facility Off-Line MWh**

For any Facility Off-Line Period, the total amount of energy lost, which shall be the Adjusted Expected Energy Performance in MWh projected to have been generated by the Energy Model, in each case for the period commencing at the time all such inverters are so removed from service and ending at the time that the first inverter is considered an On-Line Inverter (such period, a “Facility Off-Line Period”).

3. **For all purposes of this Exhibit, any calculation of MWh Lost shall be made in accordance with the following:**

- a. MWh Lost shall exclude any (or any portion of any) MWh lost due to an Interruption.
- b. MWh Lost will only be calculated when the Average Solar Irradiance is greater than 85 W/m².
- c. Because the Facility controller directs On-Line Inverters to compensate for Off-Line Inverters, only Off-Line Inverters that aren’t compensated will be included in the Effective Availability calculations. In other words, Lost MWh will be limited for each minute to the difference between the Facility controller commanded MW output and measured MW output.

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F. Determining MWh Produced

Record the Facility Meter MWh value over the Reference Period.

G. Effective Availability Calculation

Insert the MWh Produced and MWh Lost values over the Reference Period into the equation below and calculate the Effective Availability:

$$\text{Effective Availability} = \frac{\text{MWh Produced}}{\text{MWh Produced} + \text{MWh Lost}}$$

[End of Attachment B]

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Attachment C

Soiling Losses Calculation

1 Introduction

Quantifying the long term soiling loss factor can be achieved by comparing the output of one or more pairs of reference modules. In each pair, one module is regularly cleaned as a control while the other is left to accumulate dust from weather events. This document outlines the methodology for determining the soiling level using a Soiling Monitoring System (SMS). For information on the installation, commissioning, and operation of the SMS, reference the manufacturer's documentation for further details.

2 Instrumentation

The photovoltaic array is instrumented with one pair of reference modules per weather station installed at the site. These modules shall be verified to have identical tilt and azimuth. The modules' short-circuit currents are outdoor-calibrated by an independent laboratory, or field calibrated by qualified technicians. These non-power generating modules operate in short-circuit bias with the current measured by the power plant's data acquisition system. All reference modules shall be recalibrated or replaced annually.

The control reference module(s) are cleaned at regular intervals by automatic cleaning systems, or by hand, at least once per week. The test module(s) are representative of the condition of typical power plant modules and are therefore left to accumulate dust naturally. They are also subject to natural cleaning events such as rain or snow.

In the case of automatic washing, self-cleaning systems shall be installed on the reference module(s) designated as controls. These devices periodically dispense a spray of water to remove dust. They are configured to clean the control modules at a daily frequency during non-power-generating hours.

3 Soiling Measurement Algorithm

The soiling accumulation is measured by calculating the percentage difference between the short-circuit currents of control and test module pairs. The absolute soiling level over an interval of time is determined by calculating the percentage difference between the cumulative measured current of the test module and that of the control module. Measured parameters required for this analysis include:

- Test and Control Module short circuit current, ISC (A)
- Module cleaning times (if not continuously washed by an automatic cleaning system)
- Automatic wash cycle status (Boolean, historized in SCADA)

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- Daily rainfall accumulation (mm), as measured by each Met Station

To correct any Module calibration differences, the Baseline Offset shall be applied to the ratio of Test to Control Module currents for all Reference Periods. Prior to or during the soiling measurement period, the reference Modules in the SMSs (including Control and Test Modules) shall be washed uniformly and daily for a period of at least one (1) week (the “Baseline Period”). The “Baseline Offset” shall equal the coefficient which, if multiplied by the ratio of the Test Module current to the Control Module current during the Baseline Period, results in a product of 1.0. The Baseline Offset shall be calculated as follows:

- 1) Omit both Test and Control Modules’ short circuit current values, (the “BTMSC” and “BCMISC” respectively), in cases with instrumentation error (such as missing data from one SMS Module);
- 2) Aggregate the BCMISC for the Baseline Period (which shall only include values of BCMISC > 0.6 Amps) (the “AGG BCMISC”);

$$AGG\ BCMISC = \sum_{i=1}^n BCMISC_i; \text{ For } BCMISC > 0.6 \text{ Amps}$$

- 3) Aggregate the BTMSC for the Baseline Period (which shall only include values of BTMSC when the corresponding BCMISC > 0.6 Amps) (the “AGG BTMSC”);

$$AGG\ BTMSC = \sum_{i=1}^n BTMSC_i; \text{ For } BCMISC > 0.6 \text{ Amps}$$

- 4) Divide the AGG BTMSC by AGG BCMISC, subtract 1 and convert to a percentage (the “BLOS%”);

$$BLOS\% = \left(\frac{AGG\ BTMSC}{AGG\ BCMISC} - 1 \right) * 100$$

When deemed necessary, a new baseline scale factor may be established using data gathered during the three days immediately following rain events of at least four millimeters.

In the event that no rain occurs in the immediate weeks following commissioning, the following procedure may be used to quantify soiling losses on the array until the next rain event:

- Clean one module from each pair and measure the results for at least one clear sky day. The delta observed will correspond with the plant’s current soiling level.
- Once this has been observed, clean both modules in each pair. This will quantify the baseline offset in each pair.

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- After these two points have been established, continue with the normal control cleaning procedure. The delta observed in the first measurement, corrected with the baseline offset, can be used as an adder to the measured soiling until a rain event occurs.

This procedure requires the soiling stations be installed at roughly the same time as the surrounding array so that they may be subjected to the same soil accumulation through commissioning.

3.1 Procedure

- 1) Omit both Test and Control Modules' current values, (the "TMSC" and "CMSC" respectively), in cases with instrumentation error (such as missing data from one SMS Module);
- 2) For each SMS, aggregate the CMSC for each month of the Reference Period (which shall only include values of CMSC > 0.6 Amps) (the "AGG CMSC");

$$AGG\ CMSC = \sum_{i=1}^n CMSC_i ; \text{ For } CMSC > 0.6\ Amps$$

- 3) For each SMS, aggregate the TMSC for each month of the Reference Period (which shall only include values of TMSC when the corresponding CMSC > 0.6 Amps) (the "AGG TMSC");

$$AGG\ TMSC = \sum_{i=1}^n TMSC_i ; \text{ For } CMSC > 0.6\ Amps$$

- 4) Divide the AGG TMSC by AGG CMSC, subtract 1 and convert to a percentage (the "RAW SOIL%");

$$RAW\ SOIL\% = \left(\frac{AGG\ TMSC}{AGG\ CMSC} - 1 \right) * 100$$

- 5) Subtract the BLOS% from the RAW SOIL% to determine the SOIL%;

$$SOIL\% = RAW\ SOIL\% - BLOS\%$$

- 6) If the SOIL% is positive, the SOIL% shall equal 0 for that month (the "ABS SOIL%"); in no instance of this daily calculation can the result be positive;

$$ABS\ SOIL\% = \max_{-100 \leq SOIL\% \leq 0} (SOIL\%)$$

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3.2 Example Soiling Calculation

An example soiling calculation, for illustrative purposes only is shown in **Table 1**.

Table 1

Baseline Offset	BTMSC	BCMSC
Day 1	897.0955508	895.6993791
Day 2	925.0377031	922.6451839
AGGREGATE	1822.133254	1818.344563
BLOS%		0.21%

Soiling Adjustment	TMSC	CMSC
Day 1	923.9695411	928.2912125
Day 2	936.7651188	941.9753581
Day 3	925.5108449	927.1688807
AGGREGATE	2786.245505	2797.435451
RAW SOIL%		-0.40%
SOIL%		-0.61%
ABS SOIL%		-0.61%

In this illustration, the soiling reduction is -0.61% and represents the energy lost due to soiling for the test period, and is computed by taking the average of all soiling for the reference period.

[End of Attachment C]

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**Indiana Michigan (I&M) Power Company
South Bend Solar Project**

**APPENDIX 12
FORM OF LIMITED NOTICE TO PROCEED
AND FORM OF NOTICE TO PROCEED**

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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APPENDIX 12

Form of Limited Notice To Proceed



LIMITED NOTICE TO PROCEED

Date: [INSERT]

Via Email and Fax To

White Construction, LLC
Attention: David Berthelsen, President
3900 E. White Avenue
P.O. Box 249
Clinton, IN 47842
Email: david.berthelsen@iea.net
Fax No.: (765) 832-2075

Infrastructure and Energy Alternatives, Inc.
Attention: Gil Melman, General Counsel
6325 Digital Way, Suite 460
Indianapolis, IN 46278
Email: gil.melman@iea.net
Fax No.: (888) 730-1216

Re: Limited Notice to Proceed in accordance with that certain Contract No. [xxx] between American Electric Power, as an agent for Indiana Michigan Power Company, and Indiana corporation ("**Owner**") and White Construction, LLC, an Indiana corporation ("**Contractor**"), dated as of May [X], 2019 (the "**Contract**")

In accordance with §5.1.1 of the Scope of Work pursuant to the Contract, Owner hereby gives Contractor Limited Notice to Proceed and authorizes Contractor to immediately proceed with the "**Preliminary Work**" as defined therein for the South Bend Solar Project (RFP No. AEP-LC-2672) upon receipt of this letter in accordance with the terms and conditions of the Contract. Owner does not authorize Contractor to perform any other services anticipated under the Contract, except at its sole risk.

For and on behalf of

American Electric Power, as an agent for **Indiana Michigan Power Company**

By: _____
Name: _____
Title: _____

cc: [INSERT ADDITIONAL EMAIL ADDRESSES AS APPLICABLE]

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Form of Notice To Proceed



NOTICE TO PROCEED

Date: [INSERT]

Via Email and Fax

White Construction, LLC
Attention: David Berthelsen, President
3900 E. White Avenue
P.O. Box 249
Clinton, IN 47842
Email: david.berthelsen@iea.net
Fax No.: (765) 832-2075

Infrastructure and Energy Alternatives, Inc.
Attention: Gil Melman, General Counsel
6325 Digital Way, Suite 460
Indianapolis, IN 46278
Email: gil.melman@iea.net
Fax No.: (888) 730-1216

Re: Notice to Proceed in accordance with that certain Contract No. [xxx] between American Electric Power, as an agent for Indiana Michigan Power Company, and Indiana corporation ("**Owner**") and White Construction, LLC, an Indiana corporation ("**Contractor**"), dated as of May [X], 2019 (the "**Contract**")

In accordance with §5.1.2 of the Scope of Work pursuant to the Contract, Owner hereby gives Contractor Notice to Proceed and authorizes Contractor to immediately proceed with the "**Work**" as defined therein for the South Bend Solar Project (RFP No. AEP-LC-2672) upon receipt of this letter in accordance with the terms and conditions of the Contract.

For and on behalf of

American Electric Power, as an agent for
Indiana Michigan Power Company

By: _____
Name: _____
Title: _____

cc: [INSERT ADDITIONAL EMAIL ADDRESSES AS APPLICABLE]

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Indiana Michigan (I&M) Power Company South Bend Solar Project

APPENDIX 13 OWNER CHECKLIST FOR CTO WALK DOWN

**South Bend Solar RFP
RFP No. AEP-LC-2672**

REVISION 0, NOVEMBER 5, 2018

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OWNER CHECKLIST FOR CTO WALK DOWN

Documentation / Information	Yes	No
Start Up and Commissioning of Facility	<input type="checkbox"/>	<input type="checkbox"/>
Completion of SCADA	<input type="checkbox"/>	<input type="checkbox"/>
Successfully Run Performance Acceptance Tests	<input type="checkbox"/>	<input type="checkbox"/>
Intellectual Property Rights	<input type="checkbox"/>	<input type="checkbox"/>
Warranties or Guarantees	<input type="checkbox"/>	<input type="checkbox"/>
Provide Interim As-Built Drawings and all other Contractor Deliverables for the Facility	<input type="checkbox"/>	<input type="checkbox"/>
Completed participation in required orientations – Owner and Contractor onsite meeting unless otherwise agreed upon	<input type="checkbox"/>	<input type="checkbox"/>
Delay Liquidated Damages (this is to allow for punch list items to be corrected by Contractor)	<input type="checkbox"/>	<input type="checkbox"/>
Delivered a Conditional Waiver and Release Upon Progress Payment	<input type="checkbox"/>	<input type="checkbox"/>
Contractor Acquired Permits	<input type="checkbox"/>	<input type="checkbox"/>
Contractor and Owner shall have agreed on the Punch List (including Commissioning data)	<input type="checkbox"/>	<input type="checkbox"/>
List of major equipment	<input type="checkbox"/>	<input type="checkbox"/>
DC portion of project meets required size	<input type="checkbox"/>	<input type="checkbox"/>
Certificates provided to Owner	<input type="checkbox"/>	<input type="checkbox"/>
Commercial Operation as defined in Contract	<input type="checkbox"/>	<input type="checkbox"/>
Owner has received all Operating Manuals for equipment to include but not limited to:	<input type="checkbox"/>	<input type="checkbox"/>
• Main GSU (30/40/50 MVA 48/27.7 – 34.5/19.9)	<input type="checkbox"/>	<input type="checkbox"/>
• Power circuit breaker (38 kV class)	<input type="checkbox"/>	<input type="checkbox"/>
• Power circuit breaker (69 kV class)	<input type="checkbox"/>	<input type="checkbox"/>
• Capacitor switcher	<input type="checkbox"/>	<input type="checkbox"/>
• Capacitor bank	<input type="checkbox"/>	<input type="checkbox"/>
• Battery charge controller	<input type="checkbox"/>	<input type="checkbox"/>
• Protection Relays	<input type="checkbox"/>	<input type="checkbox"/>
• Pad mount transformers	<input type="checkbox"/>	<input type="checkbox"/>
• Inverters	<input type="checkbox"/>	<input type="checkbox"/>
• Trackers	<input type="checkbox"/>	<input type="checkbox"/>
• Weather Station	<input type="checkbox"/>	<input type="checkbox"/>
• Anemometers	<input type="checkbox"/>	<input type="checkbox"/>
• Pyranometers	<input type="checkbox"/>	<input type="checkbox"/>
• Module temperature sensors	<input type="checkbox"/>	<input type="checkbox"/>
• Programmable automation controller	<input type="checkbox"/>	<input type="checkbox"/>

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EXHIBIT B

CONTRACT 03065263X132

**AMERICAN ELECTRIC POWER SERVICE CORPORATION
INDIANA MICHIGAN POWER COMPANY
SOUTH BEND SOLAR PROJECT
ENGINEERING PROCUREMENT AND CONSTRUCTION SERVICES
SPECIFICATION AEP-LC-2672**



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3900 E. White Ave
Clinton, IN 47842
Tel: (765) 832-8526
www.iaa.net

Ms. Lisabeth Warncke
Contract Analyst Sr – Generation Procurement
1 Riverside Plaza, 22nd Floor
Columbus, OH 43215

12/14/2018

Dear Ms. Warncke:

Subject **Indiana Michigan (I&M) Power Company
South Bend Solar RFP
Granger, IN
RFP # AEP-LC-2672
Specification GEN4550 Rev. 3**

In response to your request for bids dated November 5, 2018, contained in the Request for Proposal terms and conditions, and other such requirements, including specification GEN4550 Rev.3 as amended, as well as all conditions pertaining thereto; I, the undersigned, submit the attached proposal, to execute the Work, as specified on this project.

I hereby certify that, to the best of knowledge and belief after reasonable inquiry:

- Neither the undersigned nor any of its directors, officers, employees, agents, consultants or affiliated companies engaged in any unethical bidding practices or anti-competitive activity of any kind, including but not limited to price-fixing, bribery, or providing or offering to provide any money, fee, commission, credit, gift, gratuity, thing of value or compensation of any kind, directly or indirectly, for the purpose of improperly obtaining or rewarding favorable treatment in connection with the RFP;
- All statements contained in the attached proposal in response to the RFP are true and accurate; and
- All confidential information contained in the RFP has been used solely for the purpose of preparing the attached proposal in response to the RFP.

By signing below, I certify that the above statements are accurate. ***(NOTE: If you are unable to provide all of the above certifications, you will need to provide additional information as to the reasons therefore.)**

Legal Company Name:	White Construction, Inc
Company Address:	3900 E White Ave. Clinton, In 47842
Signature:	
Name and Title:	Mick McDaniel, VP Solar Business Development
Indicate whether Owner, Partnership or Corporation:	Corporation
If Corporation, incorporated in which	Indiana

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Infrastructure & Energy Alternatives, Inc.

6325 Digital Way
Suite 460
Indianapolis, IN 46278
Tel (800) 688 3775
Tel (317) 210 9550
www.iea.net

December 14, 2018

Ms. Lisabeth Warncke
Contract Analyst Sr – Generation Procurement
1 Riverside Plaza, 22nd Floor
Columbus, OH 43215

RE: IEA Proposal Summary for RFP #AEP-LC-2672

Infrastructure and Energy Alternatives, Inc. (IEA), is pleased to submit this proposal in response to the above-referenced Request for Proposal (RFP) for the South Bend Solar Project located near Mishawaka, Indiana.

IEA has successfully demonstrated that it is a trusted and reliable partner in the energy construction business. We are tremendously proud of the impacts that we have made in helping our renewable energy clients by providing over 15,000 MW's of *best-in-class* EPC and BOP solutions. From the earliest planning stages through final project turnover, IEA commits the necessary resources to achieve safe, cost-effective and efficient results.

IEA's approach in this proposal was to provide a variety of system designs so that AEP could select the one that best fits its objectives. These system designs consist of four (4) different system types along with two different schedules. These system designs will be identified throughout this proposal with the following "Option" numbers. Please see the chart below for a high-level summary. A short, system description narrative follows the chart.

Option #	Schedule Timing	Module Type	Mounting Type	Inverter
1	2019	Jinko Solar mono PERC modules	Fixed Tilt Racking by Gamechange	TMEIC (Toshiba Mitsubishi)
2	2019	Jinko Solar mono PERC modules	Single Axis Tracker by ATI	TMEIC (Toshiba Mitsubishi)
3	2020	First Solar CadTel thin film modules	Fixed Tilt Racking by Gamechange	TMEIC (Toshiba Mitsubishi)
4	2020	First Solar CadTel thin film modules	Single Axis Tracker by ATI	TMEIC (Toshiba Mitsubishi)

Options 1 & 2: 2019 COD with Industry-Standard Components

IEA wanted to provide AEP both a fixed-tilt and single axis tracker solution with a 2019 COD. This "early COD" date can be made possible with an April 2019 FNTF. The technologies utilized in these designs are industry-standard Tier 1 monocrystalline PERC modules from Jinko Solar. Jinko is a *Tier 1* Chinese module company and is currently the largest in the world by shipment volume. IEA has a strong relationship with Jinko and has attained a commitment to procure some of their highest wattage modules (395 watts) for these designs. IEA has also selected Gamechange Solar fixed tilt racks and Array Technologies single axis trackers along with

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TMEIC inverters to round out the equipment selections. All of these companies have strong reputations as leaders in the U.S. solar industry.

Options 3 & 4: 2020 COD with “Buy American” Technology

For the 2020 Options, IEA thought it might be beneficial to AEP if we could offer a “Buy American” system. To achieve this goal, we selected the following components:

- First Solar Series 6 Modules: Manufactured in Perrysburg, OH
- Toshiba/Mitsubishi Inverters (TMEIC): Manufactured in Houston, TX
- Array Technologies Trackers: Manufactured in Albuquerque, NM

This biggest challenge in putting together a “Buy American” solar equipment scope is typically the PV modules, because few modules are manufactured in the U.S. But we reached out to First Solar, the leader in this category, and they have agreed to partner with IEA on this project. First Solar was excited at the prospect of supplying modules to an AEP project and they have committed to us that they can furnish the majority of the modules for this project out of their Perrysburg factory—a mere 145 miles directly east of the project site on Interstate 80. In addition, their Series 6 Module is expected to become one of the more desirable modules when it starts shipping early next year.

Please feel free to contact me directly to discuss any questions pertaining to this submission.

On behalf of IEA, I would like to thank you for the opportunity to respond to this RFP and I look forward to earning your business.

Regards,



Mick McDaniel
V.P. Solar Business Development
Mick.McDaniel@iea.net
Office: 765-820-0096

PUBLIC VERSION

Executive Summary

Who is White Construction?

White Construction, Inc. (WCI) is a market leader in *engineering, procurement and construction* (EPC) services. Since 1947, WCI has established a successful history of heavy highway, road building, heavy rigging/lifting, and renewable power construction. WCI has established a reputation for building quality projects on schedule and within budget, which has led to many satisfied customers and repeat business.

In 2011, WCI became a wholly-owned corporation of Infrastructure & Energy Alternatives, LLC, and became part of a family of companies (including IEA Constructors and H.B. White Canada Corporation) whose focus is to provide full service solutions to the expanding Renewable Energy Infrastructure. And in 2018, IEA, Inc. (IEA) become a publicly traded entity on the NASDAQ (ticker symbol: IEA) and continues to grow by adding more services and diversification to our family of companies.

IEA, Inc. delivers comprehensive infrastructure construction services across the country through a portfolio of union and non-union entities. White Construction, Inc. serves the union labor needs for our clients. IEA Constructors, Inc serves markets with non-union needs. White Electrical Constructors, Inc specializes in high voltage transmission services. And H.B. White Canada is set up to service the Canadian market.

Why Partner with IEA?

At IEA, we believe there are fundamental qualities necessary in an engineering, procurement, and construction (EPC) company for it to be successful in this very fast-paced and demanding renewable energy business. These qualities are: **safety, experience, integrity, and financial strength**. In addition, a successful EPC must have a qualified and engaged senior management team with a keen focus on operational excellence. Without these qualities, an EPC cannot be a strong partner to its clients in this challenging industry.

Project Safety

By far the most important and critical aspect a company can offer, WCI stresses the absolute necessity for safety to be at the core of all projects. In addition to instilling safe work practices in all employees, WCI has also invested much in developing a standard Health & Safety Manual, which is the foundation for each Site-Specific Safety Manual that is developed on-site. Not only does safety protect each individual on site, but it also creates a high level of effectiveness, by lowering the potential for injury, and standardizing most labor activities.



Safety Culture

One of the most important elements of IEA's company culture that carries over into our solar practice is an unwavering focus on safety and risk management. IEA places a strong emphasis on its people and as a result, safety is a very important component of the company culture. Our safety staff ensures that our procedures and site programs are continuously updated and integrated into our daily processes. IEA ranks annually near the top of the industry in safety as evidenced by our safety performance.



PUBLIC VERSION

Quality

A quality product is of the utmost importance within today's market. Power plant longevity is crucial in meeting guaranteed power output over the life of the plant which means the plant must stay fully operational with minimal operating issues. WCI's quality management program ensures that a project will be designed and built at or above the standards necessary for a facility that will operate at peak performance for the expected lifecycle. WCI utilizes ISO:9001 quality standards as a baseline for project quality management.



Project Schedule

WCI utilizes any and all target dates and milestones given by the Owner in order to develop a comprehensive schedule for the project. By utilizing CPM software such as Primavera P6 software, WCI can represent a clear critical path for the project and identify risk factors associated with the schedule in order to develop an execution plan that will best mitigate those potential issues.

Project Management & Staffing

The primary challenge of project management is to achieve all of the project goals and objectives while considering project constraints. The WCI Construction Management staff incorporates many years of combined relevant experience into any given project. Their synergistic efforts bring considerable value to every project; all members of a project staff are chosen based on how well their skill sets will serve the project. As a union contractor, WCI has the added capability to bring in experienced craft up to the Foremen level, that have guaranteed working knowledge of the scope of work to be performed. In addition to the Project Management staff and labor craft, WCI promotes a stringent Subcontractor hiring standard. WCI has very high standards for Safety, Quality and Customer Satisfaction; these standards are also required to be met by every Subcontractor chosen for a project. Through a stringent screening and prequalification process, WCI will utilize Subcontractors that have exceptional safety records, and are experientially and financially sound.

Financial Strengths

For over 70 years, WCI has proven to be a formidable strength within the Construction Industry. Now, as a wholly owned corporation of IEA, Inc, WCI continues to have the capabilities to respond to the growing demands of larger scale renewable energy projects. IEA's senior leadership places an unwavering emphasis on financial strength—as we firmly believe that it allows us to be a better partner to our customers and also to provide better career opportunities for our own employees. IEA's cash position is strong with multiple zero-balance credit facilities totaling over \$100 million. IEA also has a bonding capacity that exceeds \$350 million with leading underwriters.

PUBLIC VERSION

Strengths in Utility Solar

IEA has been actively designing and building utility solar and wind projects since 2004 and has installed over 14,500 MW's of wind and 600 MW's of solar since that time.

These energy and power projects are typically very complex with tight schedules and firm completion dates. IEA's seasoned operations team—including engineering, pre-construction planning, procurement, logistics, and project management—has proven time and time again that they can succeed in this environment. In addition to the operations groups, IEA's construction support services group—which includes safety, quality, and cost controls—also plays a significant role in both the planning, scheduling, and execution of the projects. And our executive management team is involved in every project—from the very beginning all the way through final completion.



IEA will provide a complete EPC “turnkey” solution for these solar projects by managing all phases of the project—including the engineering, design, permitting, procurement, project management, project delivery, logistics, installation, and commissioning. IEA has dedicated engineering management in-house to support the PV optimization cycle on the front of all solar projects.

Then, when it comes time to put engineering “lines on paper,” IEA leverages partnerships with several large national engineering firms for layouts and designs for the civil, structural, electrical, high voltage, and mechanical engineering scopes.

IEA's solar systems are designed with quality, bankable components and equipment from established manufacturers with long-term and creditable warranties. The helps us ensure the highest energy production, highest reliability, and best value for our clients. We also have strong and established relationships with leading solar vendors which enables us to procure effectively and leverage our buying power across multiple projects. Our long-term relationships with our vendors are invaluable in this business.

IEA will self-perform a majority of the construction work on a solar project—as well as utilize strong subcontractor partners where it makes the most sense for a given project. We believe our knowledge and understanding of the labor landscape will allow us to effectively put together an execution plan that will be acceptable to all.

Finally, the IEA solar management team has been augmented over the past year with more industry talent and experience. This is in addition to the fifty-plus field management and supervisory personnel already on staff who have solar experience with IEA. Please see our solar team bios in a following section.

PUBLIC VERSION

LUMP SUM, TURNKEY CONTRACT PRICE

Preliminary Milestones

1. Notice to Proceed: 4-1-20
2. Site Mobilization: 4-10-20
3. Substantial Completion date: 12-15-20

Price Breakdown:

Rev. 2/13/19

Item	OPTION #3 - 2020 Fixed Tilt System Price (\$)	OPTION #4 - 2020 Single Axis Tracking System Price (\$)
<u>ITC Eligible</u>		25.3564 MWdc
Solar Inverters		
Modules		
Site Preparations		
Racking		
Transformers		
Cabling to Transformers (<u>AC Collection</u>)		
Metering		
Switchgear on or before transformer		Included in inverter
System monitoring equipment		
Conduit Protection (<u>Combiner Boxes</u>)		
Foundations		
Engineering		
DC Conduit/wire/miscellaneous		
Labor		
Commissioning		
<u>ITC Ineligible</u>		
Lines from transformer to vault		
Lines from vault to pole		
Switchgear in vault		
Switchgear at load		
Line from inverter to load		
Permitting		
Fencing		
Roads (<i>pulled out of Site Preparations line</i>)		
Security		
Bonding (<u>Performance & Payment Bond</u>)		
Interconnection Costs		
Regional Transmission Operator fees		
Labor		
Financing Costs		
TOTAL		
Total Price in \$/W_{DC}		
25' Pile Contingency Add		

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PUBLIC VERSION



Infrastructure & Energy Alternatives, Inc.

6325 Digital Way
Suite 460
Indianapolis, IN 46278
Tel (800) 688 3775
Tel (317) 210 9550
www.iea.net

Date: 3/15/19

Pricing Clarification for Lump Sum Turnkey Contract Price Forms

Forms submitted on 2/1/2019 & 2/14/19

During a technical bid review phone call that took place on 1/25/19, AEP requested IEA to revise its offering to reflect a 30-year design life. IEA proceeded to meet this request and resubmitted the revised Lump Sum Turnkey Contract Price Form on 2/1/19. The changes included an increase to the items "Racking" and "Foundations." The total amount of the increase was [REDACTED]. The actual costs included were:

- Additional foundations to improve the structural integrity of the tracker arrays
- All foundation pile lengths were increased from 18' in length to 20' in length
- The array foundation pile design was improved by adding W6x12 piles to the exterior rows (in lieu of the W6x10.5 piles)
- Additional installation time was added for the handling and installation of the larger and heavier piles as well as attachment to the tracker assembly

IEA also offered a contingency adder at the bottom of this submission for a 25' pile length.

IEA would revise the price form one more time in response to an additional AEP request to split the road costs out of the civil Site Preparations item. IEA resubmitted this Lump Sum Turnkey Price Form on 2/14/19. There was no increase in the overall cost on this form.

Submitted by: Mick McDaniel, VP Solar Business Development

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PUBLIC VERSION
FORM A
(Electrical Work)

Page 1 of 13

THIS FORM A IS APPLICABLE TO ELECTRICAL CONSTRUCTION WORK AUTHORIZED UNDER A COST PLUS CONTRACT, AN EXTRA WORK ORDER OR CONTRACT AMENDMENT FOR COST PLUS OR EXTRA WORK

Owner's Facility the Below Rates are Applicable to: *South Bend Solar*

Markup Percentages for Cost Plus Work As a Percentage of Base Wage Rates plus Taxable Fringe Benefits
(Refer to Notes A and B on Page 5)
STATUTORY RATES

ITEM #	CLASSIFICATION	STRAIGHT TIME % (Refer to Note D)	PREMIUM TIME % (Refer to Note E)
1	Social Security Tax (FICA)	7.65%	7.65%
2	Federal Unemployment Insurance	0.60%	0.60%
3	State Unemployment Insurance	8.15%	8.15%
4	Workers' Compensation (Refer to Note F on Page 5)		
5	General Liability & Property Damage Insurance (Refer to Note P on Page 6)		
6	Overhead (Refer to Note C on Page 5)		
7	Profit		
8	Total Markup on Base Wage (Sum Items 1 - 7)		

Contractor : IEA

Specification: South Bend Solar Spec
Initial: _____
Date: 12/14/2018
Page _____ of _____

FORM A PUBLIC VERSION
(Electrical Work)

THIS FORM A IS APPLICABLE TO ELECTRICAL CONSTRUCTION WORK AUTHORIZED UNDER A COST PLUS CONTRACT, AN EXTRA WORK ORDER OR CONTRACT AMENDMENT FOR COST PLUS OR EXTRA WORK

Owner's Facility the Below Rates are Applicable to:

South Bend Solar

All-inclusive Hourly Billable Rates and Per-Diem Living Allowance for Supervision and Field Office Personnel.
(Refer to Notes G, H, I, J & K on page 5)

ITEM #	CLASSIFICATION (Refer to Pages 3 & 4)	1st Shift ST	1st Shift 1.5 Time	1st Shift 2.0 Time	2nd Shift ST	2nd Shift 1.5 Time	2nd Shift 2.0 Time	Per-Diem
9	Project Manager	\$	\$	\$				
10	Superintendent	\$	\$	\$				
11	Craft Supervisor	\$	\$	\$				
12	Office Manager (field accountant)	\$	\$	\$	N/A	N/A	N/A	
13	Timekeeper	\$	\$	\$	N/A	N/A	N/A	
14	Safety & Health Coordinator	\$	\$	\$				
15	Planner/Scheduler	\$	\$	\$				
16								
17								

ITEM #	Other Rates and Mark-Up Percentages	\$ or %
18	Unit price adder per ST/OT billable craft workhour (General Foreman and below) for Small Tools, Consumables & Personal Protective Equipment for electrical work. (Refer to Notes L, M, N & O on Pages 5 & 6 and Pages 7 through 12 for additional clarifications on this item). This unit price shall as a minimum include all consumables and personal protective equipment listed on Pages 7 & 8 and all small tools listed on Pages 9 & 10 regardless if their cost currently or at some future date exceeds \$1,500 in value. In addition, items that are not currently listed as a small tool but are currently under \$1,500 in value will be considered to be covered by this small tool adder unless already identified as a rental item on Page 12. If at some future date tooling that is not currently listed on Page 12 exceeds \$1,500 in value, it will be considered to be a rental item. A listing (not all inclusive) of reimbursable rental items is listed on Page 11.	
19	% Mark-Up of Materials, third party rentals or subcontractors at Actual Invoice Cost. Not including Consumables, tools or equipment included in Item 18 above. (Refer to Notes 1 & 2 on Page 6)	
20	Unit price adder per manhour worked for personnel required to wear personal protective equipment due to arsenic, lead, hexavalent chromium, cutting and welding fumes. (Refer to Page 13)	

Contractor : IEA

Specification: South Bend Solar Spec
Initial: _____
Date: 12/14/2018
Page _____ of _____

FORM A PUBLIC VERSION
(Electrical Work)

Page 2 ITEM #	Supervision and Field Office Personnel Classification Notes																						
9	The Project Manager has all the responsibilities of the Superintendent but has multiple Superintendents on site that report to them such as during multi-shift work or major projects with multiple work areas and crafts. The necessity of and employment of a Project Manager shall be agreed to by Owner and Contractor before bringing them on Owner's site.																						
10	The Superintendent's responsibilities include but are not limited to the following: <table border="1"> <tr><td>1</td><td>Functions as the primary liaison with Owner to define the work scope and objectives of the project.</td></tr> <tr><td>2</td><td>Performing constructability reviews to support Contractor's Engineering and Estimating activities needed to support the project.</td></tr> <tr><td>3</td><td>Assisting its Planner/Scheduler and Owner in developing work plans.</td></tr> <tr><td>4</td><td>Determining staffing levels for both field office and craft labor for each phase of the project.</td></tr> <tr><td>5</td><td>Recruiting and assigning of project personnel including assigning all duties and responsibilities of their subordinates.</td></tr> <tr><td>6</td><td>Providing direction to Craft employees to meet Safety Goals, Quality Requirements, Cost, Schedule and Design requirements.</td></tr> <tr><td>7</td><td>Ensure strict adherence to all safety procedures and manage any infractions.</td></tr> <tr><td>8</td><td>Monitoring scope, scope changes, budgets, and schedules and directs and coordinates all activities of its site personnel including any sub contractors it hires to ensure that the project remains on schedule and within budget.</td></tr> <tr><td>9</td><td>Supporting all its field personnel to ensure they have the proper number and pieces of equipment and materials required to perform the work.</td></tr> <tr><td>10</td><td>Obtaining and providing technical advice and resolving problems related to the work.</td></tr> <tr><td>11</td><td>Performing first line inspection of removal and installation activities including the successful implementation of Contractor's Project Quality Assurance/Control Program.</td></tr> </table>	1	Functions as the primary liaison with Owner to define the work scope and objectives of the project.	2	Performing constructability reviews to support Contractor's Engineering and Estimating activities needed to support the project.	3	Assisting its Planner/Scheduler and Owner in developing work plans.	4	Determining staffing levels for both field office and craft labor for each phase of the project.	5	Recruiting and assigning of project personnel including assigning all duties and responsibilities of their subordinates.	6	Providing direction to Craft employees to meet Safety Goals, Quality Requirements, Cost, Schedule and Design requirements.	7	Ensure strict adherence to all safety procedures and manage any infractions.	8	Monitoring scope, scope changes, budgets, and schedules and directs and coordinates all activities of its site personnel including any sub contractors it hires to ensure that the project remains on schedule and within budget.	9	Supporting all its field personnel to ensure they have the proper number and pieces of equipment and materials required to perform the work.	10	Obtaining and providing technical advice and resolving problems related to the work.	11	Performing first line inspection of removal and installation activities including the successful implementation of Contractor's Project Quality Assurance/Control Program.
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11	Craft Supervisor directly supervises General Foreman, Foreman and Craft labor of a particular union craft such as boilermakers, ironworkers, pipe fitters, etc. and is considered to be highly knowledgeable and skilled in that particular craft. Must have prior Supervisory or General Foreman / Foreman experience. The Craft Supervisor's responsibilities include but are not limited to the following: <table border="1"> <tr><td>1</td><td>Assist in the development of work packages, schedule and cost updating, and recovery plans if required.</td></tr> <tr><td>2</td><td>Provide direction and mentoring to the Craft General Foreman / Foreman.</td></tr> <tr><td>3</td><td>Develop expectations in safety culture, quality standards, budget and schedule adherence, and design requirements.</td></tr> <tr><td>4</td><td>Manage the work in accordance with the project schedule and plan.</td></tr> <tr><td>5</td><td>Assures the work crews have the proper tools, equipment, and materials are available to support the work activities. The necessity of and employment of a Craft Supervisor shall be agreed to by Owner before bringing them on Owner's site.</td></tr> </table>	1	Assist in the development of work packages, schedule and cost updating, and recovery plans if required.	2	Provide direction and mentoring to the Craft General Foreman / Foreman.	3	Develop expectations in safety culture, quality standards, budget and schedule adherence, and design requirements.	4	Manage the work in accordance with the project schedule and plan.	5	Assures the work crews have the proper tools, equipment, and materials are available to support the work activities. The necessity of and employment of a Craft Supervisor shall be agreed to by Owner before bringing them on Owner's site.												
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12	The Office Manager may act and have all the responsibilities of a timekeeper. In addition, responsibilities of the Office Manager may include but are not limited to the following: <table border="1"> <tr><td>1</td><td>Is proficient with computers and knowledge in Microsoft word, Excel and Contractor's accounting system.</td></tr> <tr><td>2</td><td>Supervision of timekeeper(s).</td></tr> <tr><td>3</td><td>Preparation of daily/weekly (manpower and cost) reports.</td></tr> <tr><td>4</td><td>Maintaining and updating applicable union wage and fringe benefit rates.</td></tr> <tr><td>5</td><td>Preparation of Weekly invoicing for submittal to Owner.</td></tr> </table>	1	Is proficient with computers and knowledge in Microsoft word, Excel and Contractor's accounting system.	2	Supervision of timekeeper(s).	3	Preparation of daily/weekly (manpower and cost) reports.	4	Maintaining and updating applicable union wage and fringe benefit rates.	5	Preparation of Weekly invoicing for submittal to Owner.												
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FORM A PUBLIC VERSION
(Electrical Work)

Page 2 ITEM #	Supervision and Field Office Personnel Classification Notes
13	<p>The Timekeeper's responsibilities include but are not limited to the following:</p> <ol style="list-style-type: none"> 1 Creating and maintain time sheets. 2 Tracking and reporting all time associated with Contractor's work daily and weekly by cost codes, work orders and releases provided by Owner to Contractor. 3 Track and report daily and weekly all material, equipment and subcontractor costs.
14	<p>The Safety and Health Coordinator's responsibilities and qualifications include but are not limited to the following:</p> <ol style="list-style-type: none"> 1 Qualification for these individuals shall include satisfactory work experience and completion of the OSHA 500 or 510 training and satisfactory work experience as determined by Owner. 2 Is responsible for assisting Contractor's supervision in carrying out its responsibilities for job site safety and health and other loss prevention programs associated with the Work. <p>Prior to bringing Safety and Health Coordinator(s) on Owner's work site, Contractor shall provide Owner with their resumes and documentation of their training which will be reviewed and must be approved by Owner.</p>
15	<p>The Planner/Scheduler's responsibilities and qualifications include but are not limited to the following:</p> <ol style="list-style-type: none"> 1 Is proficient in Primavera Enterprise Version 6.2 or newer (P3e) and capable of providing Level 4 detail. 2 Is able to provide Owner with a work schedule showing the sequence of activities required to complete all of the work assigned to Contractor and its subcontractors by Owner. 3 Will be responsible for assisting Contractor and Owner's designated Project Manager or designee in evaluating contract performance relative to Owner's integrated schedule. 4 Will provide Owner with Daily/Weekly and Monthly progress reports. 5 Will be responsible for assisting Contractor and Owner's designated Project Manager or designee in adjusting the schedules due to proposed schedule and or scope modifications.

PAGE ____ OF ____

FORM A PUBLIC VERSION
(Electrical Work)

ITEM #	Pages 1 & 2 Notes
A	Base wages are the taxable wage and taxable fringe benefit amount paid according to union agreement. Base Wages shall include craft levels up to and including General Foreman.
B	Fringe benefits are the nontaxable amount paid to trust funds in accordance with union agreements. Fringe benefits shall be billed at cost without additional markup. Owner will not reimburse any Industry Advancement Fund as a direct labor cost.
C	Unless otherwise specified, the Contractor's overhead markup shall include all home office expenses and all field office equipment costs and other field office misc. expenses, including but not limited to: office furniture, telephone & fax machines and services, computers and internet services, copying machines, paper, postage, water, ice, etc.
D	Straight Time (ST): Hours actually worked; also, paid holidays and show up time. The straight time markup shall be applied only to Base Wages.
E	Premium Time (PT): Hours for which wages are paid, but not worked, over and above ST. (The premium portion of overtime paid at time-and-one-half is the one-half hour paid, but not worked.). The total PT markup shall be applied only to Premium Time Wages.
F	Contractor's Worker's Compensation markup shall not include any costs associated with claims as set forth in Article 16.6 of Owner's "General Terms and Conditions for Labor and Services" . The percentage markup on premium time for workers' compensation shall be applicable for cost-plus work performed in Ohio only.
G	Supervision and field office personnel billing rates shall be quoted fully loaded, including insurance, taxes, overhead and profit.
H	The per diem living allowance shall be all inclusive with no additional markup. Items to be included in the per-diem cost are all hotel/motel expenses, meals, tips, laundry services, parking expenses, personal phone calls, taxes, overhead and profit. The per-diem living allowance shall be billable for days worked only for Supervision and Field Office Personnel that have a permanent legal residence 50 miles or more from the job site. For example, Contractor employees arrive on a Sunday to begin work on a Monday. No per diem would be paid for Sunday. Work is completed on a Friday, Contractor could bill the per-diem for that Friday even though its employees went home. Contractor shall provide proof of residency prior to submittal of an invoice for the per diem along with a document such as from Mapquest that provides the mileage from the employees home address to the physical work plant site.
I	Travel time for Supervision and Field Office Personnel that have a permanent legal residence 50 miles or more from the job site shall be billable for one time to the Site and one time from the Site, at the applicable straight-time rate, not to exceed eight hours total in either instance.
J	Holiday pay for the Supervision and Field Office Personnel shall be billable at the straight-time rate, not to exceed eight hours pay each, if said holiday occurs during an ongoing project. The exception is if the Contractor is working a 4-10 schedule. In that case if the holiday occurs on a day they would have worked, then they are paid ten hours at the straight-time rate. If Contractor is working a 5-10 schedule than the Contractor would only be entitled to 8 hours pay at the straight time rate for a holiday. If the Contractor works the holiday they are entitled to double time for all hours worked on the Holiday. Holidays are considered to be those that apply to the craft workers on site and will not be paid for Holidays that apply to Owner's personnel only. Owner will only pay Holiday pay if Contractor's Supervision and Field Office Personnel worked the day before and or the day after the holiday occurred.
K	Supervision and field office personnel shall be paid at the rates of time and one-half and double time on the same basis as craft labor at the Site.

FORM A
(Electrical Work)

Item #	Pages 1 & 2 Notes (Continued)
L	Small tools are defined as construction equipment that have a current market value or new replacement cost, whichever is less, of \$1,500 and would normally be utilized by Contractor in the performance of electrical work. This value is based on the cost of the tool when new and includes all parts, pieces & accessories associated with the tooling such as saw blades, tool stands, dies, mandrels, drill bits, cutoff wheels etc. Owner will reimbursing Contractor for the use of this equipment based on the Owner approved rental rates submitted on Form B or actual invoice cost plus markup. The exception to the \$1,500 market value or replacement cost for small tools are listed on Page 12 .
M	Consumables are defined as those items which do not become a permanent part of a piece of equipment or structure. This includes miscellaneous parts and pieces associated with tools and equipment such as drill bits, cut off wheels, grinding wheels, saw blades, ect. Only those items listed on the "Non-Inclusive Consumables List" (Page 13) used in the performance of cost-plus work are not covered by the dollar per man-hour rate for small tools, consumables and personal protective equipment. When requested by Owner, Contractor shall supply specific items listed on the "Non-Inclusive Consumables List" . Contractor will be reimbursed for these items based on their actual invoice cost plus Contractors approved applicable markup (Item 19, Page 2).
N	Personal protective equipment is defined as all equipment Contractor needs to provide its employees in order to perform the specific assigned task, that will protect the employee from bodily injury or potential future health problems, including but not limited to hands, feet, limbs, head, eyes, torso, skin and lungs. Not included but covered under a separate dollar per hour adder are safety items required for working in areas with potential exposure to an arsenic, lead or hexavalent chromium.
O	Contractor is not required to supply small tools for use by others under the dollar per manhour small tool adder. Contractor is only required to supply small tools for Work Contractor is performing. For example, if Owner wants light stringers installed for its own use, then Contractor must install/remove the light stringers as well as provide the labor to replace broken light bulbs.
P	Contractor's General Liability & Property Damage Insurance markup shall only include costs associated with maintaining minimum insurance requirements set forth in Article 16.0 of Owner's "General Terms and Conditions for Labor and Services" . Any cost associated with additional insurance that the contractor chooses to carry shall be included in Contractor's Overhead Markup.
Other Rates and Mark-Up Percentages Notes:	
1	Contractor may invoice Owner for any of the items on the Exemption List Refer to Page 8) not covered by the Small Tool Adder nor included in the items covered in Notes 1 above, Material, Construction Equipment Fuel (Unless specifically included in the equipment rental rate), Permits, Freight, Subcontractors and Third Party Rentals at the Invoice Cost to the Contractor Plus the stated % markup of the invoice. Contractor shall not purchase any materials unless specifically directed to do so by Owner.
2	Should Contractor utilize an affiliated company to perform any portion of the Work, Owner shall be billed for performance of this Work at invoice cost, with no additional markup.

Page _____ of _____

PUBLIC VERSION
FORM A
(Electrical Work)

REFER TO PAGE 2, ITEM 18: TYPICAL SMALL TOOL OVERHEADS, CONSUMABLES AND PERSONAL PROTECTIVE EQUIPMENT INCLUDED IN DOLLAR PER HOUR ADDER FOR ALL TYPES OF WORK

THE FOLLOWING ITEMS ARE CONSIDERED AS TYPICAL OVERHEADS THAT ARE TO BE INCLUDED IN THE DOLLAR PER CRAFT MANHOUR WORKED FOR SMALL TOOLS, CONSUMABLES AND PERSONAL PROTECTIVE EQUIPMENT:

ID	Description
1	Administrative cost associated with purchasing the tool.
2	Cost of space to store the tools at Contractor's facilities.
3	Cost of a storeroom attendant (at Contractor's home office).
4	Cost of labor to load and unload tools at Contractor's facility.
5	Cost of inspecting and cleaning tooling after each project.
6	Cost of labor and materials to repair tooling.
7	Cost of insurance on the tools.
8	Cost of replacing stolen or damaged tools.
9	Contractor's cost of money to own the tools.
10	Depreciation cost on the tools.
11	Depending on state law, there may be taxes on ownership of the tools (personal property tax).

THE FOLLOWING IS A PARTIAL LISTING OF ITEMS THAT WOULD NORMALLY BE CONSIDERED AS A CONSUMABLE OR PERSONAL PROTECTIVE EQUIPMENT COVERED UNDER THE SMALL TOOL, CONSUMABLES & PERSONAL PROTECTIVE EQUIPMENT ADDER ON FORM A (SEE PAGES 5 & 6 FOR NOTES REFERENCED BELOW)

A. Consumables - General (Refer to Note M on Page 6)

ID	Description	ID	Description
1	Abrasives (cloth/paper/powder)	18	Flints
2	Antifreeze	19	Fuses
3	Baricade Tape	20	Glue
4	Bottles Water	21	Grease
5	Bags (all types)	22	Grinding burrs
6	Batteries (all types)	23	Heating Fuel(Kerosene) and Gases(Propane) for office, change, shower and break areas.
7	Cable ties, nylon, all sizes	24	Hinges
8	Chalk, marking	25	Ice
9	Cloth, emery	26	Light Bulbs (florescent, halogen, Incandescent LCD, AC/DC)
10	Compounds, cleaning	27	Lubricants (thread/dope)
11	Connectors, hose/cable	28	Markers (ink/paint)
12	Cork(s)	29	Nails
13	Crayons	30	Oils - air tool, cutting, lubricating
14	Cups, drinking	31	Paint, spray cans
15	Deicing salts for walkway areas around Contractor's Office and Change Trailers.	32	Paint Remover, Thinners.
16	Filters, respirator (disposable)	33	Paper (toilet/wrapping)
17	Flux, soldering / brazing	34	Pens and Pencils

PUBLIC VERSION
FORM A
(Electrical Work)

A. Consumables - General (Cont'd. - Refer to Note M on Page 6)			
ID	Description	ID	Description
35	Putty	47	Stakes (wood)
36	Rags & shop cloths	48	Steel wool
37	Reciprocating saw blades	49	Stencils (steel/paper)
38	Repair kits, air/torch hose & weld leads	50	Stones, rubbing, honing & sharpening
39	Saw blades & cutoff wheels, all types for wood & s	51	Tape, electrical / masking / teflon/duct
40	Signs & Labels (Warning, Hazardous Materials, Key information, etc.)	52	Temp sticks
41	Sandpaper	53	Tips, cutting/welding & cleaners
42	Screws	54	Towels, hand/paper, antiseptic wipes
43	Soaps	55	Wheels, abrasive flapper/grinding/brush
44	Soapstone	56	Wire, No. 9 / tie or smaller
45	Solder	57	Wire rope, 3/4" diameter & smaller
46	Spill Kit/s (large enough to handle the biggest spill, but multiple kits for the Work may be required for remote equipment)		
B. Personal Protective Equipment & Supplies - General (Refer to Note N on Page 6)			
ID	Description	ID	Description
1	Boots, (rubber/paper)	16	Hardhat, ears/suspensions/hatband
2	Confined Space retrieval protection system	17	Hood repair kits
3	Coveralls, disposable	18	Hoods, disposable
4	Disinfectants	19	Jackets, welding flame resistant cloth
5	Dust masks (paper type) with or without valve	20	Keys
6	Ear Plugs, ear muffs	21	Knee Pads
7	Eye wash stations	22	Lenses, welder/helmets
8	Eyewash solution	23	Life vest
9	Face Shields	24	Rainsuits
10	Fire extinguishers	25	Retractable life line, stainless steel, 30' or 50'
11	Flashlights	26	Safety belts lanyards & accessories
12	First aid kit	27	Salt tablets and dispensers
13	Glasses & goggles, safety/flash	28	Saw Guards
14	Gloves - all types (welding/rubber/jersey)	29	Visor refills
15	Hand Cleaner	30	Welding sleeves & jackets

PUBLIC VERSION
FORM A
(Electrical Work)

TYPICAL LIST OF SMALL TOOLS THAT IS TO BE INCLUDED IN THE SMALL TOOL ADDER FOR ELECTRICAL CONSTRUCTION WORK (Refer to Item 18 on Page 2)

General Notes:

- | | |
|----------|--|
| 1 | The following listing is intended as clarification of Small Tools that are addressed by the Form A dollar per manhour adder applied per ST/OT billable craft workhour (General Foreman & Below) for use of small tools, consumables and expendables. |
| 2 | Reference the Exemption List on Pages 11 & 12 of for listing of items that are considered to be Rentals & are not included in the small tool adder. |

THE FOLLOWING IS A LISTING OF TYPICAL ITEMS THAT WOULD NORMALLY BE CONSIDERED AS A SMALL TOOL UNDER THE DOLLAR PER MANHOUR ADDER ON FORM A FOR ELECTRICAL WORK. ADDITIONAL ITEMS NOT LISTED MAY BE CONSIDERED A SMALL TOOL, IF THEY ARE UNDER \$1,500 IN VALUE. LIST CONTINUED ON PAGE 10.

ID	Description	ID	Description
1	Air mover & fan 110volt	28	Clamp Meters-voltage and amperage
2	Air hose (2" & smaller)	29	Come-A-Long \leq 10T
3	Barrels (trash or storage)	30	Conduit Benders-hand
4	Bits, drill	31	Conduit Benders 1 1/4"- 1 1/2"-Mechanical (Greenlee 1800, 1801 & 1801 G1 or equiv).
5	Bolt Cutters	32	Confined Space retrieval protection system
6	Bottle nut wrenches	33	Crowbar
7	Brass board & brass	34	Crimping tools-manual, electric and hydraulic including dies
8	Brooms and handles	35	Dies, bolt and pipe
9	Brushes (dope/wire)	36	Distribution Panels (Power)
10	Buckets (all types)	37	Dolly 4-wheel
11	Bulbs, lighting (AC & DC)	38	Drill 1/2" electric (bench & portable) including hammer drills
12	Buried line locator (Greenlee BLL-200 or equivalent)	39	Extension cords, 110V
13	Burning torch complete	40	Fault line locator (Greenlee PE 2003 or equivalent).
14	Cable Cutters-Hand, Ratcheting and Hydraulic	41	Files, and hasp
15	Cable Benders-ratchet type	42	Fish Tape, sticks and poles
16	Cable Benders- Hydraulic with foot pump & hose (Greenlee 800 & 800F 1725 or equiv).	43	Funnels
17	Cable tie guns-heavy duty	44	Gas can-safety
18	Carbon air arc - torch	45	Gas Pump 4"
19	Chain & wire rope to \leq 10T	46	Generator 4,000 watt or less
20	Chisels, all types & sizes	47	Grinder, pencil, deburr (all types)
21	Chokers to \leq 10T (wire rope slings)	48	Grinders, air/electric (all types)
22	Chop Saw	49	Hacksaw & blades
23	Circular saw 7"	50	Hammer, ramming/roto
24	Circuit Tracer	51	Hammer & handles
25	Clamp "C" - brass pin 6" & smaller	52	Hand pallet jack truck (all types)
26	Clamps, cable (7/8" & under)	53	Heliarc torch (complete)
27	Clamps, beam	54	Hydraulic punch set 1/2" through 2"

PUBLIC VERSION
FORM A
(Electrical Work)

THE FOLLOWING IS A LISTING OF TYPICAL ITEMS THAT WOULD NORMALLY BE CONSIDERED AS A SMALL TOOL UNDER THE DOLLAR PER MANHOURLY ADDER ON FORM A FOR ELECTRICAL WORK. ADDITIONAL ITEMS NOT LISTED MAY BE CONSIDERED A SMALL TOOL, IF THEY ARE UNDER \$1,500 IN VALUE. CONTINUED FROM PAGE 9.			
ID	Description	ID	Description
55	Insulated nutdrivers and screwdrivers	84	PVC electric heater benders-1/2"-6" (Greenlee 849 & 851-4 or equiv).
56	Kerosene Can	85	Radios, two-way w/holster & charger
57	Knives-utility	86	Roller stands
58	Knock out punches & dies	87	Rope, safety/manila/nylon $\leq 3/4$ "
59	Ladder (all types)	88	Ruler, folding/straight edge/retractable
60	Level, Magnetic 6' and under	89	Screwdrivers
61	Light stringers, electric	90	Shackles from 1/2" to ≤ 1 "
62	Lighters & flints (torch ignition)	91	Sidecutters
63	Line, chalk	92	Socket set with ratchets & extensions, 3/8", 1/2" & 3/4"
64	Mig welders such as Lincoln Power Mig 215 or equivalent	93	Spud/pry bar
65	Megohmmeter (calibrated)-manual crank (Greenlee 5778 & 5778-c or equivalent).	94	Tap set, 1/2" to 1-1/2"
66	Mops	95	Tape measures
67	Multimeters-Digital/analog (Greenlee 5882C or equivalent)	96	Tarpaulin(s)
68	Needle scaler, weld flux chipper	97	Tig welders
69	Padlocks, all types	98	Tool boxes or cages
70	Paint brushes, rollers and pans	99	Transformers-Step down transformers
71	Pipe wrenches	100	Tube cutters
72	Pipe stand, Adjustable (all types)	101	Vacuum / blower power fishing system-1/2"-4" conduits (Greenlee 690 or equiv).
73	Pipe threader-manual with dies	102	Vise, bench
74	Plasma cutters up to 3/8" thick steel (Lincoln Procut or equiv.)	103	Visegrips
75	Pliers	104	Wedges, steel/wood/plastic
76	Plumb bob	105	Welder-stick, single use such as Lincoln Idealarc 250
77	Points, degree finders, etc.	106	Welder, chipping hammers
78	Power hacksaw-bandsaw type and blades	107	Welding lead with camlocks
79	Porta power equipment	108	Wire Tag Printer (BRADY LS 2000, TLS2200, BMXC or equivalent).
80	Portable bench grinder	109	Wire Stripper
81	Punches, all types	110	Workbench, steel/wood
82	Push Carts-2 and 4 wheel, including wire, cable and conduit storage carts.	111	Wrenches, all types adjustable/Allen
83	PVC cutters		

PUBLIC VERSION
FORM A
(Electrical Work)

THIS PAGE APPLIES TO ELECTRICAL CONSTRUCTION WORK

General Notes:

1 Small tools for electrical work are defined as those items costing **\$1,500** or less in value new and includes all parts and pieces associated with the tooling such as drill bits, cutoff wheels, etc.

THE FOLLOWING ITEMS ARE EXEMPT FROM BEING CONSIDERED AS A SMALL TOOL OR CONSUMABLE & ARE NOT COVERED BY THE DOLLAR PER CRAFT MANHOUR WORKED SMALL TOOL ADDER ON (Refer to Page 2, Item 18). IF CONTRACTOR SUPPLIES ANY OF THESE ITEMS, THEN CONTRACTOR IS ENTITLED TO REIMBURESENT AT THE ACTUAL INVOICE COST, PLUS APPLICABLE MARKUP (Refer to Page 2 Item, 19)

ID	Description
1	Auger / Bucket Truck (Digger Truck)
2	Bucket Truck
3	Cable Feeder (Greenlee 6810 or Equivalent)
4	Cable Puller with Pulling System-Electrical (Greenlee Super 6001, Ultra 6505, 6800, 6805 or Equivalent)
5	Cable Test Equipment (Wave-Tech , CAT5 & Fiber)
6	Communication / Test Certification Kit (Fluke DTX 1800-CAT5, CAT6 & Fiber)
7	Conduit Benders - Electric with Shoes (Greenlee 555R / Sidewinder or Equivalent)
8	Conduit (2" & Larger) Benders - Hydraulic with Pump, Shoes and Table (Greenlee 880, 884, 885 or Equivalent)
9	Documenting Process Calibrator - Fluke 744
10	MegOhmMeter-5KV (Greenlee 5990 or Equivalent)
11	Field Change / Break Trailer
12	Field Tool / Equipment Trailer
13	Fork Truck
14	Hydraulic Roper Whitney Punch
15	Large Simplex Reel Jacks (Set) 10 Ton (Greenlee 656 Ratchet Cable Reel Stands or Equivalent)
16	MegOhmMeter-5KV (Greenlee 5990 or Equivalent)
17	Pickup Truck
18	Plasma Arc Cutter
19	Pressure Module for Fluke 744
20	PVC Bender (Electric) 1/2"-6" Greenlee 848
21	PVC Bender (Propane) 1/2"-6" Probend 1100
22	Pipe Threader-Geared-(Rigid 141 and 161 or Equivalent)
23	Pipe Cutting & Threading Machines with Dies, Stand & Oiler (2" Conduit & Above) (Rigid #300, 535, 700 1224, 1822) (Wheeler Rex 6590, 6790 or Equivalent)
24	Scissors Lift (Telescoping Manlift)
25	Welder - 300 Amp Gas
26	Welding Machine, 4, 6 & 8 Pack with Converter, 200 Amp Each

Page _____ of _____

**FORM A
(Electrical Work)**

THIS PAGE APPLIES TO ELECTRICAL CONSTRUCTION WORK			
THE FOLLOWING ARE NOT COVERED BY THE SMALL TOOL ADDER AND ARE CONSIDERED TO BE RENTAL ITEMS THAT ARE REIMBURSEABLE PER THE RATES ON FORM B OR AT INVOICE COST PLUS MARKUP.			
ID	Description	ID	Description
1	Air Compressor, 185 ≥CFM or Diesel	18	Tugger, Single Drum Wire Rope w/Air 2,000# or greater
2	Air Compressor, 715 ≥CFM Electric	19	Tugger, 2 Drum wire rope w/air 5,000# or greater
3	Boiler Basket, (Skyclimber/Spider) 1 or 2 man complete	20	Tugger, 2 or 3 Drum wire rope Diesel 150 HP (or similar)
4	Boiler Scaffold (Skyclimber), 20' - 40' pick, 4 man complete	21	Hydraulic Stub Pulling Gun
5	Blocks, 5 sheave, to 50 ton	22	Lead Abatement Equip. HEPA Vac crawler, grinder, scaler, roto pein, & vacuum
6	Blocks, 5 to 8 sheave, 50 ton to 100 ton	23	Level, Paragn Jig w/tripod all types
7	Blocks, 8 - 10 sheave, all lift(s) to 500 ton	24	Personnel & Equip Hauler, JDGator (or similar)
8	Concrete Drill, Truco w/motor (or similar)	25	Pickup Truck, 1/2 or 3/4 Ton 2WD or 4WD
9	Dollie, 5th Wheel, Tandem Axle (or similar)	26	Pipe/Tube Beveler over 5-3/8" O.D., all types
10	Drill Press, Mag Base w/Power Feed	27	Pump, test w/air drive 6,000# or larger
11	Field Office Trailer.	28	Saw Kit, Esco Track type
12	Field Change/Break Trailer.	29	Skip Pan 8,000 pound OSHA approved
13	Field Shower Trailer 4 or 8 Stall	30	Tractor (18 Wheeler) Yard Type
14	Forktrucks	31	Tractor Trailer, Flat Deck
15	Hoist Chain, with air drive over 2 ton	32	Tractor Trailer, Flat Deck Extendable
16	Hoist, Chain with Electric Drive over 3 ton	33	Tractor Trailer, Low Boy Deck 35 Ton
17	Hoist, Chain with Manual Drive over 10 ton	34	Welding Machine, 4, 6 and 8 Pack with Converter, 300 AMP each

Page _____ of _____

PUBLIC VERSION
FORM A
(Electrical Work)

REFER TO PAGE 2, ITEM 20

Unit price per manhour adder for all personal protective equipment required for its employees based on using a half face, full face, or powered air purifying respirator for asbestos abatement or lead abatement work or work involving arsenic or hexavalent chromium. This adder is additive to the straight time and overtime rates. This adder includes, but is not limited to, the use of the following consumables, expendables and equipment including all applicable mark-ups and taxes. Contractor supplied Disposable suits for use in containments or other work involving asbestos abatement such as glovebag work or transite removal shall be blue tyvek and shall be reflected in the unit price adder below.

ID	Description	ID	Description
1	Disposable Shorts	9	Repair Parts for Respirators
2	Disposable Suits	10	Cleaning Supplies for respirators
3	Rubber Boots	11	Storage Bags for Respirators
4	Disposable Gloves	12	Supplies for Respirator Fit Testing
5	1/2 Face or Full Face Air Purifying Respirators	13	Soap
6	Powered Air Purifying Respirators	14	Shampoo
7	Charging Units for PAPR's	15	Disposable Towels used for Showers
8	Filter Cartridges for Respirators	16	Cost associated with laundering protective clothing if reusable.

Not included in this unit price are the following items which will be paid for or supplied by Owner on an as-needed basis. If supplied by Contractor they shall be reimbursed at actual invoice cost plus markup from form A or at the rates submitted on Form B.

ID	Description
1	Rental equipment (i.e., shower trailers, negative air machines, etc.)
2	Labor and materials used in building enclosures
3	Labor and material used in asbestos removal and disposal (Refer to Page 12) for reimbursable items used in asbestos removal and disposal).
4	Rain suits
5	Dual cartridges (i.e., Hepa/Sulfur). Owner will pay the added cost of a dual cartridge.
6	Fire retardant disposable coveralls.
7	Supplied air respirators.
8	Respirator fit testing
9	Personal physicals showing fitness to wear a respirator
10	Blood test associated with lead
11	Air sampling for arsenic, asbestos fibers, lead, or associated with working in a confined space nor the equipment required for taking samples and analysis of the samples.

Administration of the unit price adder is as follows:

1	The unit price adder applies only to craft union manhours including foreman and general foreman. These rates do not apply to superintendent, office manager, timekeeper or safety coordinator manhours.
2	All ST/OT manhours (including paid breaks and clean-up time) are billable with the unit price adder, as long as the person that performs the work involving the use of protective clothing during the timeframe breaks are taken.

Page _____ of _____

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PUBLIC VERSION
FORM B

Page 1 of 6

Construction Equipment Rentals For All Work Types (Sheet 1) - Additional Space Provided on Sheets 2 & 3

Refer to Pages 5 & 6 for notes to aid in completion of this form.

Equipment Drive Adjustment Factors:						
		25% Electric Motor Driven	50% Gas Motor Driven	0% Manual		
*** Highlighted Columns are calculated ***						
Rental Item	Rental Item Description (The text will automatically wrap. Drag down the row to make all text visible)	Hourly Rate (Monthly Rate/176)	Monthly Rate	Hourly Rate (Over 176 Hours) (Electric Motors Only)	Hourly Rate (Over 176 Hours) (Gas Motors Only)	Equipment Drive Type (Select from Pivot Table)
B1	426 Backhoe Diesel	\$		\$		Gas Motor Driven
B2	90-Ton RT Crane Diesel	\$		\$		Gas Motor Driven
B3	563 Compactor Diesel	\$		\$		Gas Motor Driven
B4	D6 Dozer Diesel	\$		\$		Gas Motor Driven
B5	330 Excavator Diesel	\$		\$		Gas Motor Driven
B6	936 Wheel loader Diesel	\$		\$		Gas Motor Driven
B7	9000 lb Telehandler Diesel	\$		\$		Gas Motor Driven
B8	246 Skid Steer Diesel	\$		\$		Gas Motor Driven
B9	Trencher Diesel	\$		\$		Gas Motor Driven
B10	Trench Padding Machine Diesel	\$		\$		Gas Motor Driven
B11	Pull Behind Trailer	\$		\$		Manual
B12	Pick-up Truck Gas	\$		\$		Gas Motor Driven
B13	Mechanics Truck Diesel	\$		\$		Gas Motor Driven
B14	2000 GAL Water Truck Diesel	\$		\$		Gas Motor Driven
B15	Single Reel Cable Trailer	\$		\$		Manual
B16	Triple Reel Cable Trailer	\$		\$		Manual
B17	Side by Side UTV Gas	\$		\$		Gas Motor Driven
B18	60' Boomlift Diesel	\$		\$		Gas Motor Driven
B19	Pile Driver Diesel	\$		\$		Gas Motor Driven
		\$ -	\$ -	\$ -	\$ -	
		\$ -	\$ -	\$ -	\$ -	
		\$ -	\$ -	\$ -	\$ -	
		\$ -	\$ -	\$ -	\$ -	
		\$ -	\$ -	\$ -	\$ -	
		\$ -	\$ -	\$ -	\$ -	
		\$ -	\$ -	\$ -	\$ -	

Contractor : IEA

Specification: South Bend Solar Spec
Initial: _____
Date: 12/14/2018
Page _____ of _____

PUBLIC VERSION
FORM B

ROUND TRIP TRUCKING CHARGES FOR CONSTRUCTION EQUIPMENT							
Plant	Round Trip Miles	Pickup Truck		Flatbed Truck		Tractor Trailer	
		Cost Per Mile	Lump Sum Round Trip Trucking Charge	Cost Per Mile	Lump Sum Round Trip Trucking Charge	Cost Per Mile	Lump Sum Round Trip Trucking Charge
JOB LOCATION EASTERN COAL FIRED PLANTS							
Amos Plant			\$ -		\$ -		\$ -
Big Sandy			\$ -		\$ -		\$ -
Cardinal Plant			\$ -		\$ -		\$ -
Ceredo Generating Station			\$ -		\$ -		\$ -
Clifty Creek			\$ -		\$ -		\$ -
Clinch River Plant			\$ -		\$ -		\$ -
Conesville Plant			\$ -		\$ -		\$ -
Cook Coal Terminal			\$ -		\$ -		\$ -
Dresden Plant			\$ -		\$ -		\$ -
Glen Lyn Plant			\$ -		\$ -		\$ -
Greenville Elec. Gen. Sta.			\$ -		\$ -		\$ -
Kammer Plant			\$ -		\$ -		\$ -
Kanawha River Plant			\$ -		\$ -		\$ -
Kyger Creek			\$ -		\$ -		\$ -
Mitchell Plant			\$ -		\$ -		\$ -
Mountaineer Plant			\$ -		\$ -		\$ -
Robert P. Mone Plant			\$ -		\$ -		\$ -
Rockport Plant			\$ -		\$ -		\$ -
Sporn Plant			\$ -		\$ -		\$ -
JOB LOCATION WESTERN SOLID FUEL FIRED PLANTS							
Dolet Hills			\$ -		\$ -		\$ -
Flint Creek Power Station			\$ -		\$ -		\$ -
Oklunion Power Station			\$ -		\$ -		\$ -
Pirkey Power Station			\$ -		\$ -		\$ -
Turk Power Plant			\$ -		\$ -		\$ -
Welsh Power Station			\$ -		\$ -		\$ -
JOB LOCATION WESTERN NATURAL GAS FIRED PLANTS							
Arsenal Hill			\$ -		\$ -		\$ -
Commanche Station			\$ -		\$ -		\$ -
Knox Lee			\$ -		\$ -		\$ -
Lieberman Plant			\$ -		\$ -		\$ -
Lone Star			\$ -		\$ -		\$ -
Northeastern Power Station			\$ -		\$ -		\$ -
Rio Pecos Power Station			\$ -		\$ -		\$ -
Riverside Power Station			\$ -		\$ -		\$ -
San Angelo Power Station			\$ -		\$ -		\$ -
Southwestern Power Station			\$ -		\$ -		\$ -
J. L. Stall			\$ -		\$ -		\$ -
Tulsa Power Station			\$ -		\$ -		\$ -
Weleetka Power Station			\$ -		\$ -		\$ -
Wilkes			\$ -		\$ -		\$ -
*** Highlighted Columns are calculated ***							
NOTES:							
1	"Round trip trucking charge" means, the portal to portal delivery of equipment to and from Owner's job site.						
2	Round trip trucking charges shall include all cost associated with delivery and return of the equipment from Owner's job site such as labor, food, motels, fuel, road tolls, taxes, overhead and profit.						

Contractor :

Specification:

Initial:

Date:

Page

of

NOTES (Refer to Pages 1, 2 & 3)	
Item	Description
1	In the column, "Monthly Rate", enter the monthly rate, the hourly rate will be automatically calculated. Form is formatted to indicate dollars and cents, do not add dollar sign to the number
2	For electric or gas motor driven equipment, in the column "Equipment Driven Type (Electric or Gas)" highlight a cell, a drop down box will appear to the right of the field. Click on the drop down arrow and highlight either "Electric Motor Driven" or "Gas-Combustion". When one or the other of these choices is selected, it will automatically calculate the hourly rental rate. To change it, highlight the cell and delete the selected Driven Type, Gas, gas combustion or gas motor driven means any internal combustion engine.
3	In the "Rental Item #" column, after B1, consecutively number starting B2, B3 etc for all items that you list as a Rental.
4	The term "construction equipment" means tools and construction equipment not considered to be a small tool as defined on Form A. Contractor shall submit hourly and monthly rental rates on this form for its equipment. Rates shall be for all Contractor-supplied equipment that would typically be required in the performance of its work. An adequate description must be included for each piece of equipment to enable Owner to evaluate the quoted rental rate. For each piece of equipment, Contractor shall specify all applicable parameters; such as:
	A Type of equipment; manufacturer, model and year of manufacture;
	B Type and size of power: diesel, gas, electric, horsepower, etc.;
	C Capacity: weight, volume, CFM, blows per minute, etc.;
	D Size: inches, feet, horsepower, etc.;
	E Reach;
	F Weight (for bulldozer, roller, etc.)
	G Mounting: wheel, crawler, truck and trailer; and
	H Attachments.
5	Items appearing on the Small Tools List on Form A shall not be included on Form B as rental items. Reimbursement will not be allowed for any item listed on Form B if said item is named on Form A as a small tool. Any item listed on Form A as a rental item is acceptable to list on Form B.
6	Third party rentals shall be subject to prior approval by Owner. Owner will not reimburse Contractor for third party rentals if the rental item is considered to be a small tool on Form A.
7	Rental rates for Contractor-supplied construction equipment shall not exceed 100% of the monthly rates listed in the latest edition of the "Rental Rate Blue Book B19 for Construction Equipment" adjusted for geographical region as published by Equipment Watch. If a Rental rate in the Blue Book is not available, at the discretion of Owner, a Blue Book rate for a similar piece of equipment or another published rate will be used.
8	Hourly rental rates are determined by dividing the quoted monthly rate by 176. Hourly rental rates shall apply to a maximum of 176 hours in any calendar month after which the monthly rate shall apply with the following exceptions:
	A Gas or diesel engine driven construction equipment which are used more than 176 hours in a given calendar month (or 30 day period such as may apply) will qualify for compensation at 50% of the submitted rate for hours used greater than the 176 hours.
	B Electrical motor driven construction equipment which are used more than 176 hours in a given calendar month (or 30 day period such as may apply) will qualify for compensation at 25% of the submitted rate for hours used greater than the 176 hours.

Notes Continued on Page 6

Contractor :

Specification:

Initial:

Date:

Page

of

NOTES (Refer to Pages 1, 2 & 3)	
Item	Description
9	Rental Rates provided for herein shall be complete compensation to Contractor for providing and maintaining construction equipment in a safe and efficient operating condition, including the cost of all fuel, lubricants, supplies, tools, parts and labor for routine maintenance; minor and major repairs and major overhauls; and insurance, taxes, depreciation, interest, overhead and profit.
10	Rental rates shall include all accessories associated with the operation of the equipment such as fuel tanks, water & air hoses, nozzles, filters, et. Rental rates for shower trailers shall include water heaters and filters for discharge of the water and a dirty water storage tank if needed. Rental rates for negative air machines and asbestos vacuum cleaners shall include the cost of Hepa filters. Rental rates shall not include operator labor costs.
11	Contractor shall warrant that all equipment it brings to the work site will arrive in first class operating condition and shall be properly maintained. Rental will not be paid on inoperable equipment.
12	Contractor shall not bring on site any of its equipment for which there isn't an approved rental rate. Contractor will not be reimbursed for any of its equipment on Owners work site for the time period the equipment is on site without an approved rental rate. Reimbursement for this equipment will begin on the date the equipment rate has been approved in writing by Owner.
13	For Cost Plus Work, Owner will pay for no more than one pickup truck per shift unless Contractor has demonstrated a legitimate need for additional pickup trucks and has received Owner's Approval.
11	For Cost Plus Work, compensation for Contractors equipment will be for the entire length of time the equipment is specifically required at the Site. Total hours will be determined by the actual time worked by Contractor. For Firm Price Work, Owner will only pay rent on equipment brought to Owners job site for the time period it is actually needed. Rented equipment for specific work activities shall be brought to the job site and removed from the job site in a timely manner. Compensation will not be allowed for equipment sitting idle for excessively long periods of time before work starts or after work is completed.
13	The rate reimbursed for third party rentals shall not exceed the rates submitted on Form B. For example: If Form B shows a rental rate of \$6 per hour for an 8 pack welder and Contractor rented from a third party the same 8 pack welder at \$12 per hour, the maximum Contractor can recover for the 8 pack welder including markup is \$6.
15	Round trip trucking charges to each of Owners work sites that Contractor will be working at, shall be submitted on Form B Page 5 of 5

Contractor : _____

Specification: _____

Initial: _____

Date: _____

Page _____ **of** _____

PUBLIC VERSION

Form C

SUBCONTRACTOR, VENDOR, SUPPLIER & THIRD PARTY INFORMATION

Company Name	Address	EMR	Description of Work	% of Total Work	Diversity Status
ATI	3901 Midway Place NE; Albuquerque, NM 87109		Tracker Manufacturer-Tracker OPT	10%	Not Applicable
Gamechange	152 W 57 Street 44FL; New York, NY 10019		Fixed Rack Manufacturer-Fixed OPT	10%	Not Applicable
Jinko	595 Market Street, Suite 220; San Francisco, CA 94105		395w Module Manufacturer-2019 OPT	30%	Not Applicable
First Solar	350 West Washington St, Suite 600; Tempe, AZ 85281		440w Module Manufacturer-2020 OPT	30%	Not Applicable
TMEIC	1325 Electric Road; Roanoke, VA 24018		Inverter Manufacturer	6%	Not Applicable
Ulteig	5575 DTC Parkway, Suite 200; Greenwood Village, CO 80111		Engineering	1%	Not Applicable
ConnectPV	9929 Hibert Street, Suite D; Sand Diego, CA 92131		Combiner/Harness Manufacturer	1%	Not Applicable
Nor-Cal Controls	4790 Golden Foothill Pkwy; El Dorado Hills, CA 95762		SCADA Vendor	1%	Not Applicable
Earth Images	2121 S. County Rd 1050 E; Indianapolis, IN 46231		Landscaping	1%	Woman Owned
Milestone Fence	13399 McKinley Hwy; Mishawaka, IN 46545		Fencing	1%	Not Applicable

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PUBLIC VERSION

Form C

Notes: 1. If there are no vendors, suppliers or third parties, state "none"
2. Indicate if vendor, supplier or third party is a minority and/or woman owned business.

Contractor: IEA

Specification: South Bend Solar Spec

Initial: Enter Initials

Date: 12/14/2018

Page: 1 **of** 1



PUBLIC VERSION

Diverse and Small Business /Large Business Self- Certification Form

PENALTY FOR FALSE MISREPRESENTATION

PENALTIES FOR FALSE MISREPRESENTATION: 1) FAR 52-219 (e) (4)—Misrepresentations of business status as a small, small disadvantaged, small women-owned, small veteran-owned (including service disabled), and HUBZone small business concern for the purpose of obtaining a subcontract that is to be included as part of or all of a goal contained in the requesting Contractor's subcontracting plan, without remedy, can result in severe penalties. Additionally, 2) -Under 15 U.S.C. 645(d), any person who misrepresents a firm's status in these same categories in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9 or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall (i) Be punished by imposition of fine, imprisonment, or both; (ii) Be subject to administrative remedies, including suspension and debarment; and (iii) Be ineligible for participation in programs conducted under the authority of the Act.

By signing below, the supplier/vendor hereby certifies and represents that the information provided is current, accurate, and complete. The supplier further certifies that it will notify AEP of any changes to said information provided.

1. Supplier Contact information:

Company Name and (DBA): **IEA Constructors, Inc**

Physical Address: **2647 Waterfront Parkway E** City: **Indianapolis** State: **IN** Zip: **46214**

Authorized Representative: **Mick McDaniel** Authorized Signature: _____
Print

Title: **VP, Solar Business Development** Date: **12/12/2018**

Email: **mick.mcdaniel@iea.net**

Telephone Number: **765-820-0096** Fax Number: _____

2. Select business types that apply: (NOTE: A business size must be selected) ☐ Small Business ☒ Large Business

Next, provide the NAICS CODE(s): **237990** _____ . _____

Business code(s) may be referenced at www.naics.com

3. Then, select ALL certified business classification (s) that applies:

☐ Minority-Owned and Controlled (51% or more) ☐ Veteran-Owned (51% or more) ☐ Service Disable Veteran-Owned (51% or more)

☐ Woman-Owned (51% or more) ☐ Small Disadvantaged Business (8a) ☐ LGBT-Owned ☐ HUBZone Certified

If third party certified for any of the above business types please attach copy of your current certification(s)

Definitions and Eligibility Requirements for the above business types may be referenced at SBA.GOV

4. Lastly, select ALL additional minority classification(s) that applies:

☐ African-American ☐ Indian (Sub-Continent) ☐ Native-American

☐ Hispanic-American ☐ Asian/Pacific Islander ☐ Multi-Ethnic

Thank you for taking the time to complete this supplier Self Certification Form. Please return the completed form along with any supporting certification documentation via Fax to: 614-716-3271 or email to: supplierdiversity@aep.com.

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Client name	IEA
Project name	AEP South Bend
Date at which project started operation (if applicable)	n/a
Latitude	41.73
Longitude	-86.1
Elevation	769 ft
AC Capacity [MW]	20
DC Capacity [MW]	25.36524
Total number of modules	58968
Total number of inverters	26 (6 central PCS units)
Modules per string	6
Module Manufacturer and Model	First Solar Series 6 430 W (FX-6430)
Inverter Manufacturer and Model	TMEiC SolarWare 840 Universal Power Conditioner System
Mounting Type Select From Drop-Down	1-axis horizontal East-West tracker
Tilt angle	0 degrees nominal
Azimuth	180 degrees
Pitch (m) (see picture 1)	6.08
Width of sensitive area (m) (see picture 1)	1.96
Distance from lower edge of array to ground (m)	0.762
Module orientation (landscape or portrait)	portrait
Table or Racking configuration (see picture 2)	1x in portrait along tracker torque tube
(If trackers used) Backtracking?	No
(If trackers used) Tracker range (min/max rotation)	52/-52 degrees
Auxiliary loads to subtract from production if any (W/kW)	8.3 Watts loss/kWac (0.2% of total yearly MWh)
Cleaning frequency	depends on Owner preference
Is output curtailed? If so, please provide details.	Grid limit of 20 MW at POI
Number of transformer stages between inverters and energy meter	1

For each transformer stage, please indicate the following	Transformer stage 1	Transformer stage 2 (if any)	Transformer stage 3 (if any)
Rating (MVA)	21 MVA (total of 6 LV-MV transformers in parallel)		
Voltage (kV)	34.5		
No-load loss (%)	0.1		
Load loss at peak power (%)	0.9		
Is night disconnect used?	No		

If transmission line losses are significant, please specify for each line	Line 1 (if any)	Line 2 (if any)	Line 3 (if any)
Loss (%)	0.5% AC loss at full load (total AC system wire losses)		
Line length (km)			
Resistance per unit length (Ω/m)			
Conductors per phase			

Please specify power factor, if not equal to 1	
--	--

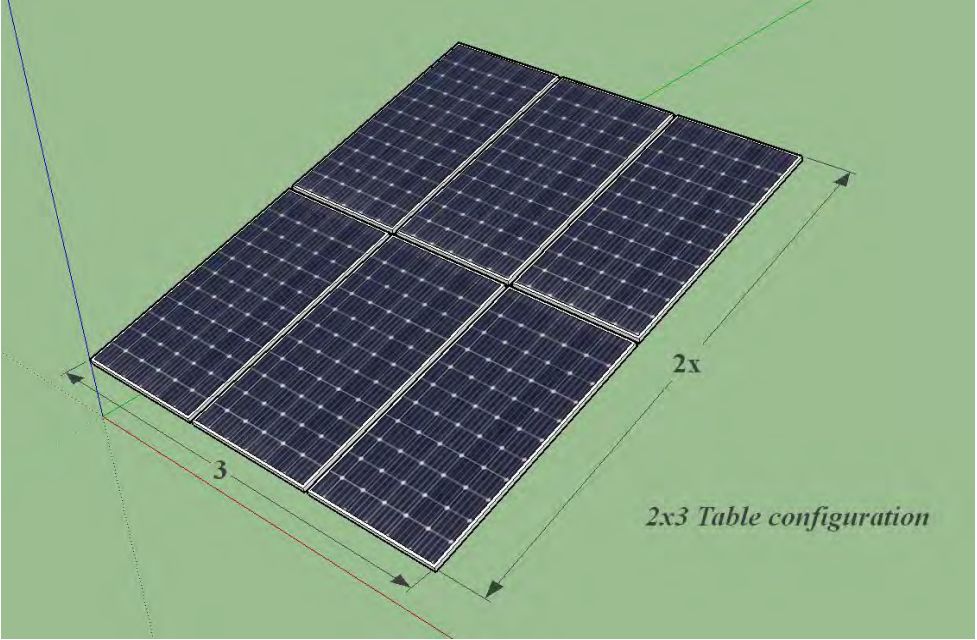
Please provide separately any system-specific loss calculations that have been performed (e.g. AC and DC wiring, auxiliary losses, transmission line losses, soiling)
Please provide separately any information relevant for shading analysis
Please provide separately any other relevant documentation for energy modeling (e.g. single-line diagrams)

IEA Design and Modeling Notes:

DC wiring loss has been calculated at average of 1.2% at STC conditions based on our DC wiring design
AC wiring loss has been calculated at maximum of 0.5% at STC conditions
The project is modeled to have a Grid Limit at the POI such that inverters will be configured to output enough power to overcome transformer and AC wire ohmic losses.
Horizon shading analysis on this site (outside objects) is considered negligible
PVsyst has been used to model yearly DC losses and AC losses are post-processed after the inverter.
Single Line Diagrams have been provided as part of the submittal package
Energy yield 8760 and post processing spreadsheet are provided as part of the submittal package
Meteorological data from Clean Power Research's Solar Anywhere subscription was used for this analysis.
First Solar recommends not to backtrack for their technology on single-axis trackers.



Picture 1



Picture 2

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BIDDER'S RESPONSE SUMMARY: IEA

Complete the following form and return it with BIDDER's Proposal. Energy and power output values shall be at the Point of Interconnection (POI). Expected values are to be provided with BIDDER's base bid (see Section 5.2).

OPTION #1: 2019 Proposed System using Fixed Tilt and Jinko:

Racking Manufacturer (Selected)	<u>GameChange Solar</u>
Row Spacing (back of row to front of row)	<u>28.7</u> ft
Fixed Tilt Angle	<u>25 degrees</u>
Total Acreage Used	<u>88</u> acres
Inverter Manufacturer/Model	<u>TMEIC Ninja 840 kVA</u>
Inverter Capacity	<u>21.840 MVA site total</u>
Module Make/Model	<u>Jinko JKM 395M-72HL-V 395w</u>
System rating at STC	<u>25.1694</u> MW _{DC}

Schedule:

Overall Construction Duration, from NTP to Substantial Completion	<u>April-Dec (36)</u> weeks
--	-----------------------------

BIDDER shall include a conventional Gantt chart that outlines primary activities to be included as part of the EPC schedule for design, procurement and construction of the Project. Furthermore, a Key Date Schedule shall be included in Attachment E.

Annual Energy Production:

Expected First Year	<u>32,166.3</u> MWh _{AC}
Expected Second Year	<u>31,941.1</u> MWh _{AC}

Guaranteed Power Output:

DC/AC Conversion Ratio	<u>1.26</u> DC/AC
------------------------	-------------------

Degradation Rate:

Fixed Tilt System	<u>0.5</u> %
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OPTION #4: 2020 Proposed System using Single Axis Tracking and First Solar:

Tracker Manufacturer (Selected)	<u>Array Technologies Inc.</u>
Row Spacing (back of row to front of row)	<u>19.94</u> ft
Tilt Range	<u>52/-52 degrees</u>
Total Acreage Used	<u>133</u> acres
Inverter Manufacturer/Model	<u>TMEIC Ninja 840 kVA</u>
Inverter Capacity	<u>21.840 MVA total</u>
Module Make/Model	<u>First Solar FS-6 / 430w Series 6</u>
System rating at STC	<u>25.356</u> MW _{DC}

Schedule:

Overall Construction Duration, from NTP to Substantial Completion	<u>April-Dec (36)</u> weeks
--	-----------------------------

BIDDER shall include a conventional Gantt chart that outlines primary activities to be included as part of the EPC schedule for design, procurement and construction of the Project. Furthermore, a Key Date Schedule shall be included in Attachment E.

Annual Energy Production:

Expected First Year	<u>36,787.7</u> MWh _{AC}
Expected Second Year	<u>35,530.2</u> MWh _{AC}

Guaranteed Power Output:

DC/AC Conversion Ratio	<u>1.27</u> DC/AC
------------------------	-------------------

Degradation Rate:

Tracker System	<u>0.5</u> %
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ANNUAL ENERGY PRODUCTION – OPTIONS #3 & #4

BIDDER shall provide an Excel file with BIDDER's estimate of the annual hourly (8,760 hours/year) energy production for their proposed Project design, as specified in the RFP Documents and based on the BIDDER developed Site Layout, to be provided as Attachment B.

BIDDER shall provide estimates of annual energy production from an energy model. Bidder shall provide model documentation as stated in Attachment D. The output from the energy model will result in the Average Expected Energy Generation (AEG), which should be reported in the table below for the first two years of operation.

Option #3 – 2020 Fixed Tilt Mounting System / First Solar Modules:

Site	Size		1 st Year	2 nd Year	Capacity Factor
	DC (MW)	AC (MW)	AEG (MWh/yr)	AEG (MWh/yr)	%
Option 3	25.1705	20.0	31,960.3	31,736.6	18.2

Option #4 – 2020 Single Access Tracker System Upgrade / First Solar Modules (Option):

Site	Size		1 st Year	2 nd Year	Capacity Factor
	DC (MW)	AC (MW)	AEG (MWh/yr)	AEG (MWh/yr)	%
Option 4	25.356	20.0	36,787.7	35,530.2	20.6

The hourly energy production shall be reported in terms of net AC output at the revenue meter (i.e. including all losses up to the POI).

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DESIGN PERFORMANCE FACTOR – 2020 OPTIONS

BIDDER shall provide a design performance factor table for each month of the year that the BIDDER is willing to guarantee based on OWNER's Performance Acceptance Test. These values will be the Design Performance Factor that will be guaranteed as part of the EPC Agreement with successful BIDDER.

Design Performance Factor		
Month	OPTION 3 Fixed Tilt Design PR	OPTION 4 Single Axis Tracking Design PR
January	0.657013	0.606572
February	0.734619	0.704773
March	0.782923	0.793975
April	0.808432	0.820583
May	0.838998	0.836154
June	0.845227	0.840307
July	0.858767	0.858836
August	0.854358	0.857446
September	0.855084	0.849478
October	0.856344	0.834985
November	0.819785	0.787661
December	0.695091	0.66076

Provide:

1. BIDDER's basis and calculations for the Design Performance Factor.
2. A breakdown of auxiliary load assumptions.

See last page.

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PVSYST V6.72	Ulteig Engineers Inc (United States)	10/12/18	Page 1/5
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Grid-Connected System: Simulation parameters

Project :
Geographical Site
Situation
 Time defined as
Meteo data:

IEA_IN_South Bend
IEA_IN_S Bend_CPR32
 Country **United States**
 Latitude 41.75° N Longitude -86.15° W
 Legal Time Time zone UT-5 Altitude 243 m
 Albedo 0.20
IEA_IN_S Bend_CPR32 NREL NSRD : TMY3 - TMY

Simulation variant : **IEA_IN_S Bend_1638s_6m_FS430_5TMEIC840_SAT33g**
 Simulation date 10/12/18 16h06

Simulation parameters	System type	Tracking system	
Tracking plane, tilted Axis	Axis Tilt	0°	Axis Azimuth 0°
Rotation Limitations	Minimum Phi	-52°	Maximum Phi 52°
Trackers configuration	Nb. of trackers	150	Identical arrays
	Tracker Spacing	6.08 m	Collector width 1.96 m
Shading limit angles	Phi limits	+/- 70.9°	Ground cov. Ratio (GCR) 32.2 %
Models used	Transposition	Perez	Diffuse Imported
Horizon	Free Horizon		
Near Shadings	Linear shadings		

PV Array Characteristics
PV module CdTe Model **FS-6430 Dec2017**
 Original PVsyst database Manufacturer First Solar
 Number of PV modules In series 6 modules In parallel 1638 strings
 Total number of PV modules Nb. modules 9828 Unit Nom. Power 430 Wp
 Array global power Nominal (STC) **4226 kWp** At operating cond. 3885 kWp (50°C)
 Array operating characteristics (50°C) U mpp 995 V I mpp 3906 A
 Total area Module area **24325 m²** Cell area 22288 m²

Inverter Model **Solar Ware 840 -PVU-L0840ER(PRERELEASE)**
 Custom parameters definition Manufacturer TMEIC
 Characteristics Operating Voltage 915-1300 V Unit Nom. Power 840 kWac
 Inverter pack Nb. of inverters 5 units Total Power 4200 kWac
 Pnom ratio 1.01

PV Array loss factors
 Array Soiling Losses Loss Fraction 1.0 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
6.9%	6.0%	5.0%	3.8%	2.0%	1.2%	0.0%	0.1%	1.5%	3.2%	4.9%	6.7%

Thermal Loss factor	Uc (const)	30.7 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Global array res.	3.4 mOhm	Loss Fraction	1.2 % at STC
Module Quality Loss			Loss Fraction	-2.1 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Strings Mismatch loss			Loss Fraction	0.10 %

Incidence effect (IAM): User defined IAM profile

0°	30°	50°	60°	65°	70°	75°	80°	90°
1.000	1.000	0.990	0.960	0.940	0.890	0.820	0.690	0.000

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PVSYST V6.72	Ulteig Engineers Inc (United States)	10/12/18	Page 2/5

Grid-Connected System: Simulation parameters

User's needs : Unlimited load (grid)

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PVSYST V6.72	Ulteig Engineers Inc (United States)	10/12/18	Page 3/5
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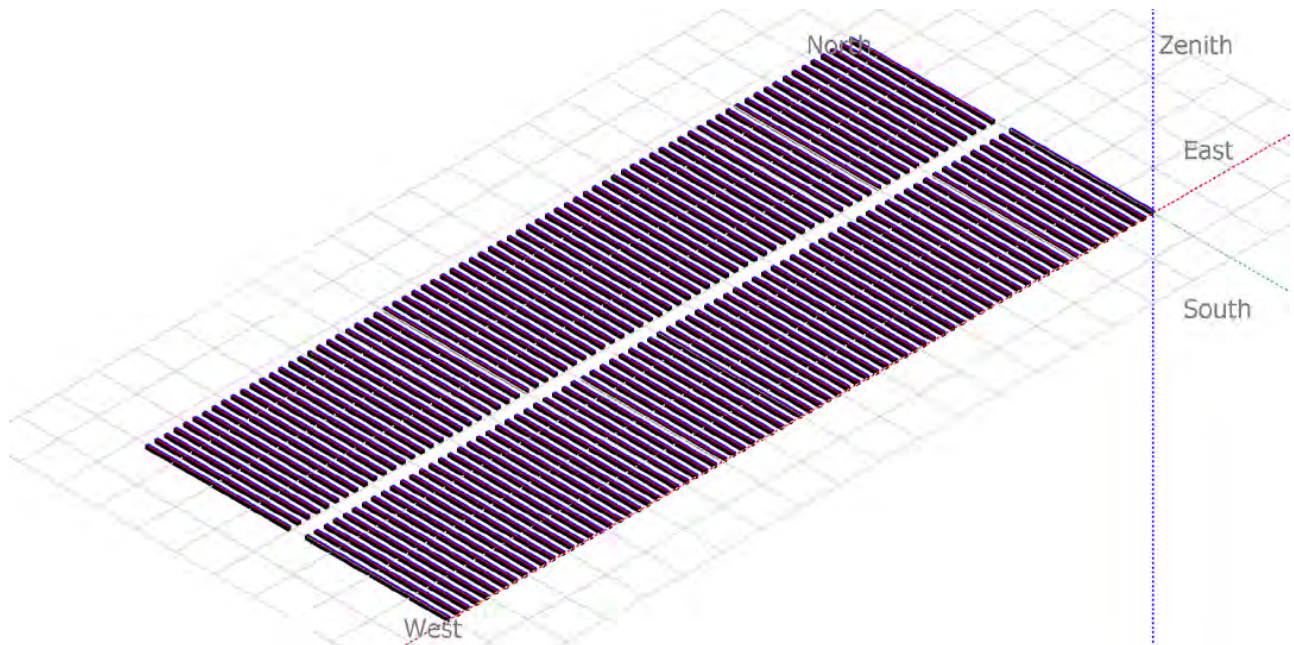
Grid-Connected System: Near shading definition

Project : IEA_IN_South Bend

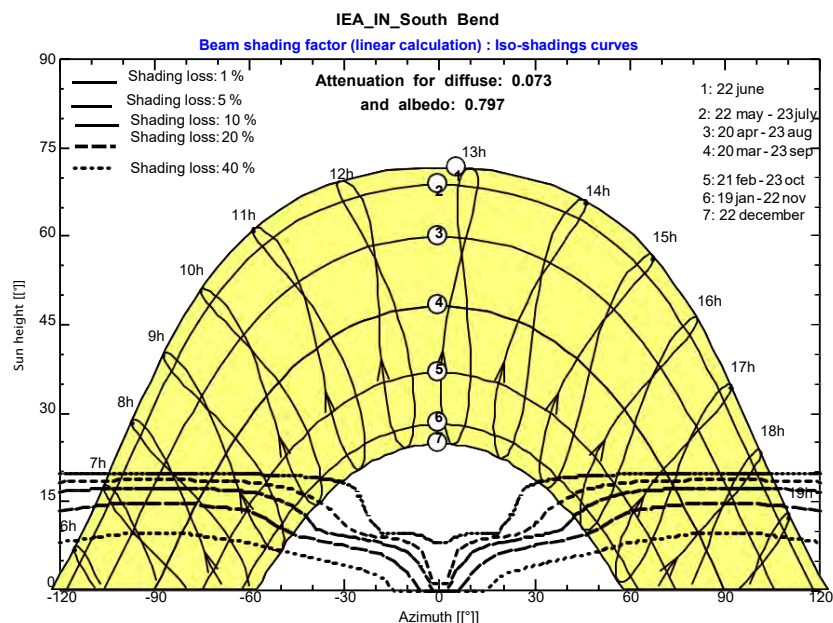
Simulation variant : IEA_IN_S Bend_1638s_6m_FS430_5TMEIC840_SAT33g

Main system parameters	System type	Tracking system
Near Shadings	Linear shadings	
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°
PV modules	Model	FS-6430 Dec2017
PV Array	Nb. of modules	9828
Inverter	Solar Ware 840- PVU-L0840ER(PRERELEASE)	Pnom 840 kW ac
Inverter pack	Nb. of units	5.0
User's needs	Unlimited load (grid)	Pnom total 4200 kW ac

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram



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PVSYST V6.72	Ulteig Engineers Inc (United States)	10/12/18	Page 4/5
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Grid-Connected System: Main results

Project : IEA_IN_South Bend

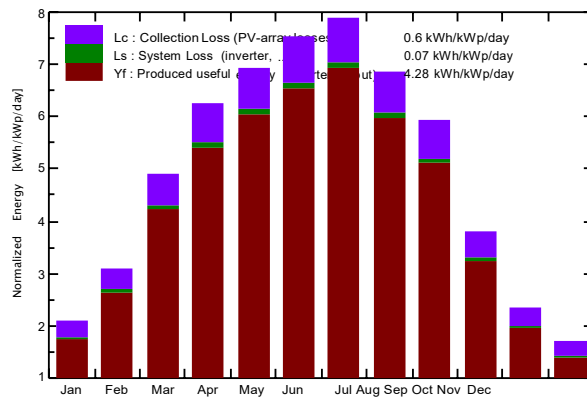
Simulation variant : IEA_IN_S Bend_1638s_6m_FS430_5TMEIC840_SAT33g

Main system parameters	System type	Tracking system
Near Shadings	Linear shadings	
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°
PV modules	Model	FS-6430 Dec2017
PV Array	Nb. of modules	9828
Inverter	Solar Ware 840 - PVU-L0840ER(PRERELEASE)	Pnom 840 kW ac
Inverter pack	Nb. of units	5.0
User's needs	Unlimited load (grid)	Pnom total 4226 kW ac

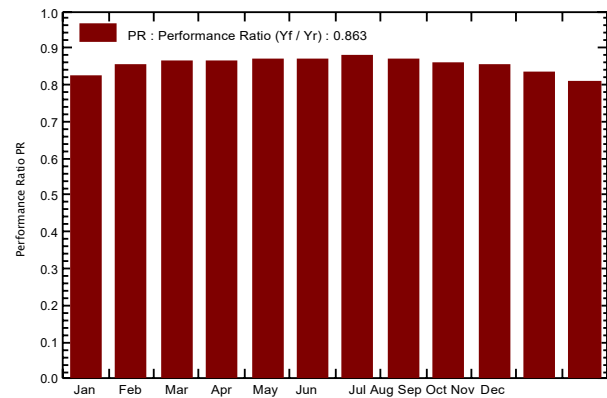
Main simulation results

System Production	Produced Energy 6597 MWh/year	Specific prod. 1561 kWh/kWp/year
	Performance Ratio PR 86.33 %	

Normalized productions (per installed kWp): Nominal power 4226 kWp



Performance Ratio PR



IEA_IN_S Bend_1638s_6m_FS430_5TMEIC840_SAT33g

Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray MWh	E_Grid MWh	PR
January	51.2	33.30	-3.77	65.9	55.3	235.5	230.5	0.827
February	67.6	41.50	-3.47	86.6	74.1	319.8	314.1	0.858
March	114.4	49.64	6.37	152.1	135.3	565.6	555.7	0.865
April	144.4	62.04	11.82	187.6	170.8	697.2	685.6	0.865
May	170.6	75.64	14.98	214.4	199.7	803.1	789.9	0.872
June	183.5	80.88	21.22	225.3	212.0	841.0	827.4	0.869
July	191.0	82.80	21.70	243.9	231.8	921.3	907.1	0.880
August	164.0	70.93	23.20	212.5	201.3	793.4	781.2	0.870
September	130.8	53.58	20.09	178.1	165.0	657.7	647.5	0.860
October	85.9	39.27	11.60	117.7	105.3	433.6	425.8	0.856
November	52.4	26.35	6.41	70.4	60.9	254.1	248.6	0.835
December	41.6	27.68	-3.39	53.8	44.8	188.7	184.1	0.810
Year	1397.4	643.62	10.63	1808.4	1656.2	6710.9	6597.5	0.863

Legends:	GlobHor	Horizontal global irradiation	GlobEff	Effective Global, corr. for IAM and shadings
	DiffHor	Horizontal diffuse irradiation	EArray	Effective energy at the output of the array
	T Amb	Ambient Temperature	E_Grid	Energy injected into grid
	GlobInc	Global incident in coll. plane	PR	Performance Ratio

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PVSYST V6.72	Ulteig Engineers Inc (United States)	10/12/18	Page 5/5
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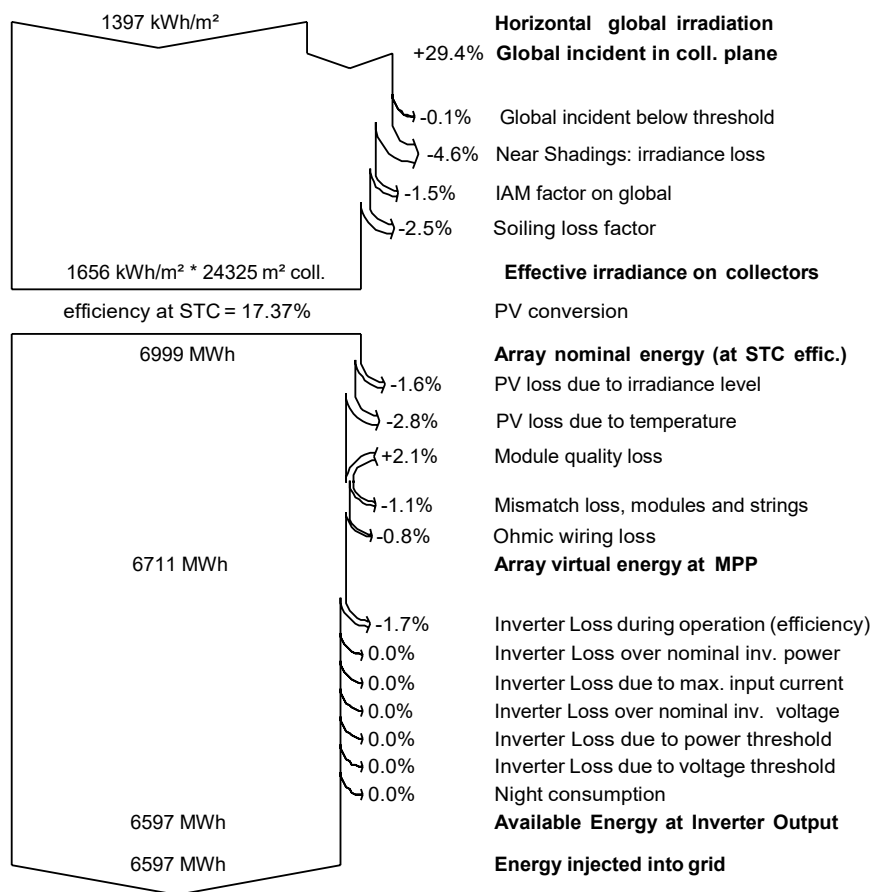
Grid-Connected System: Loss diagram

Project : IEA_IN_South Bend

Simulation variant : IEA_IN_S Bend_1638s_6m_FS430_5TMEIC840_SAT33g

Main system parameters	System type	Tracking system
Near Shadings	Linear shadings	
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°
PV modules	Model	FS-6430 Dec2017
PV Array	Nb. of modules	9828
Inverter	Solar Ware 840- PVU-L0840ER(PRERELEASE)	Pnom 430 Wp
Inverter pack	Nb. of units	5.0
User's needs	Unlimited load (grid)	Pnom total 4226 kWp Pnom 840 kW ac Pnom total 4200 kW ac

Loss diagram over the whole year



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1. BIDDER's basis and calculations for the Design Performance Factor.

The Design Performance Factor is understood to mean the "Performance Ratio" as defined by B. Marion et. al in the NREL Conference Paper NREL/CP-520-37358 titled "Performance Parameters for Grid-Connected PV Systems". IEA's calculation of the Performance Ratio reflects the PVSyst models that IEA generated for all the system options proposed and are based on the Clean Power Research meteorological data set. The Performance Ratio calculation reflects energy measured at the POI which is understood to be the power meter at 34.5kV at the project site and so incorporate all system losses including DC, AC and transformer losses. These calculations also include assumptions for snow and soiling losses that are summarized in the 8760 profiles submitted.

2. A breakdown of auxiliary load assumptions.

IEA has included auxiliary loads that include nighttime transformer losses, tracker drive motor losses (when applicable), auxiliary power that includes relay and telemetry loads, communication loads and HVAC loads for the control building on the site.

PUBLIC VERSION



6325 Digital Way
Suite 460
Indianapolis, IN 46278
Tel (800) 688 3775
www.iea.net

Construction Waste Management Implementation Plan

Overview:

On-site construction waste implementation plan will incorporate the removal of waste from the jobsite according to the following items:

- Disposing of non-hazardous construction waste/material
- Recycling non-hazardous construction waste/material
- Salvaging non-hazardous demolition waste/material

Site Materials:

Excess/unusable onsite material will be sorted into dumpsters labeled either 1) construction waste or 2) Salvageable/Recyclable material. Multiple dumpsters may be used for each depending upon the variance of material expected to be delivered to the site. The overall goal will be to divert as much material as possible from a landfill.

Expected waste material to be produced by the site:

- Aggregate
- Concrete
- Geotextile
- Spare parts such as wiring, conduit, harnesses, tracker/rack material other accessories
- Lumber
- Metals
- SWPPP materials
- Packaging materials such as paper, cardboard, boxes, plastic, crates

Site Implementation Plan:

Site execution will include the following steps:

- Plan implementation with site team.
- An on-site employee will be named waste management coordinator; this employee will also have other responsibilities.
- Training will occur in order to make sure the entire site staff understands waste management for the project.
- Site waste controls will be implemented to assure the plan will be followed and the site is kept as clean and as organized as possible.
- Hazardous wastes, if encountered, will be handled according to local regulations.

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Material Tracking:

Site supervision will provide a report for materials based upon the following:

- Whether the material is recycled, salvaged, or landfill bound material
- Hauler/location for disposal
- Quantity of materials hauled

Disposal Site:

Disposal site will be determined prior to construction but will be use one of the following locations:

- Waste Management
- Republic Services
- Michiana Recycling & Dispose

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CONTRACTOR ACQUIRED PERMITS

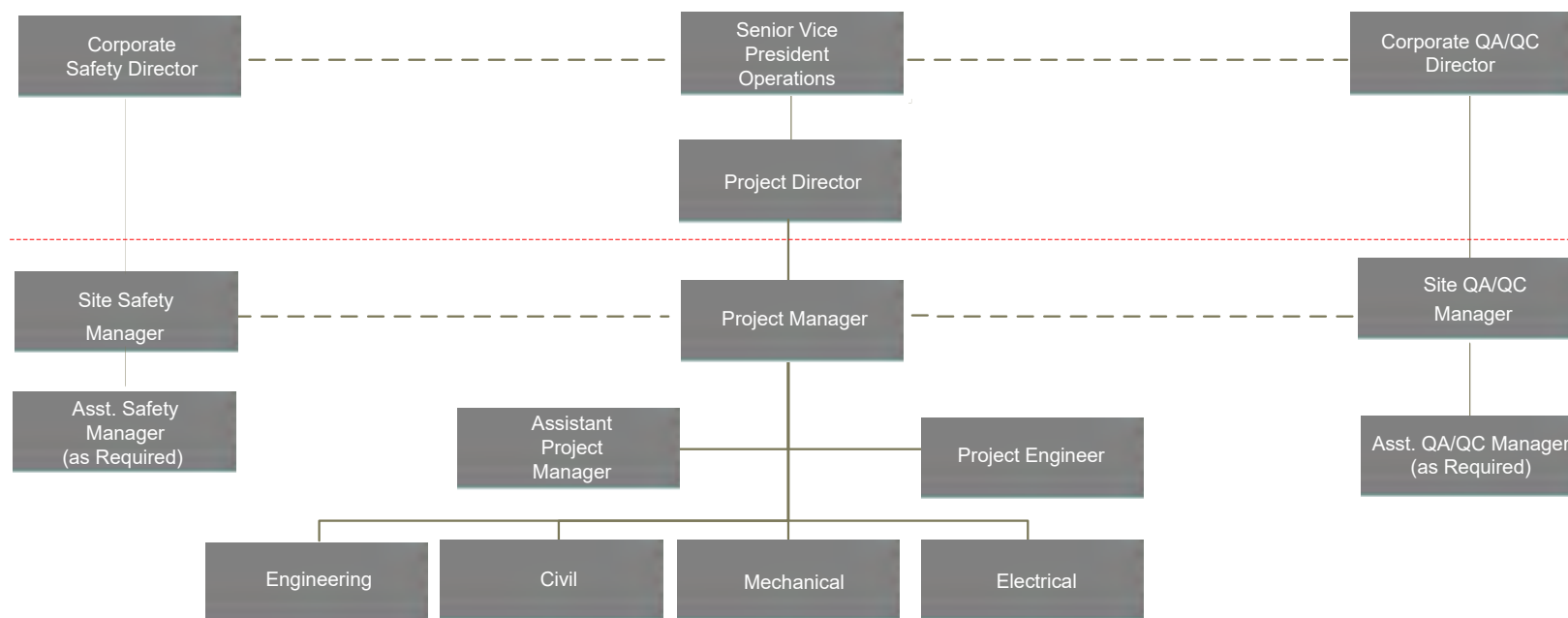
BIDDER to list all permits and regulatory approvals required to complete the scope as described herein:

Permit/Approval	Agency
401 Water Quality Certification	IDEM
404 Dredge & Fill Permit	USACE
Utility/Construction Permit	St. Joseph County
Driveway Permit(Commerical)	St. Joseph County
SWPPP Permit	St. Joseph County
Electrical Permit	St. Joseph County
Building Permit	St. Joseph County
Application for Construction Design Release (ACDR) Category D	IN Gov

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Typical Solar Project Organizational Chart

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Note: Employees below red dashed line are considered full time field employees, with a minimum of 80% spent on site

PUBLIC VERSION

First Solar Series 6™ Thin Film Modules

NEXT GENERATION SOLAR TECHNOLOGY



PUBLIC VERSION

Higher Energy Yield. Lower LCOE. Superior Return.

First Solar Series 6™ photovoltaic (PV) modules deliver the highest power output for large-scale solar projects. This landmark module features our proven thin film technology to deliver more energy, more efficiently than ever before. For asset and power generation owners, engineers and installers, this means more power per module, reduction of balance of system costs and enabling a lower Levelized Cost of Electricity (LCOE) for a superior return on investment.



NEW DESIGN MEANS MORE BENEFITS FOR YOUR BOTTOM LINE

The Series 6 thin film module was developed using over a decade of engineering expertise and a track record of more than 17 gigawatts (GW) of modules produced. This experience, combined with input from customers and industry experts allows us to provide our proven module technology in a larger form factor with a more economical design. The results deliver more benefits and cost-efficiencies for your application, including:

More Watts Per Module

These easy-to-install, thin film modules deliver more watts per connection (420+ watts) than 72-cell silicon modules (<400 watts).

Reduced Shipping Costs

The under-mount frame is designed to enable a horizontal stacking configuration, optimizing shipping density, reducing breakage and minimizing waste.

Best Environmental Profile

With the smallest CO₂ footprint, lowest water use and fastest energy payback, Series 6 modules are the industry's most eco-efficient PV solution.

Reduced Maintenance Costs

The innovative under-mount frame design provides the cleaning benefits of a frameless module.



INNOVATIVE
UNDER-MOUNT FRAME



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MOUNTING SLOT ALLOWS
FOR QUICK INSTALLATION



LOWER INSTALLATION COSTS

Series 6 modules are designed for a quick and easy, two-person installation. The under-mount frame allows for versatile mounting to common fixed-tilt and tracking systems to minimize onsite engineering to reduce material costs, while enabling more watts per lift. Additionally, the dual junction box design eliminates the need for wire management for module-to-module connections.



DUAL JUNCTION BOXES
REDUCE MODULE-TO-MODULE
WIRE MANAGEMENT

MORE ENERGY IN REAL WORLD CONDITIONS

First Solar Series 6 modules offer exceptional performance that delivers on the financial promise of your project, with:

More MWh per Installed MW

Series 6 modules deliver up to 8% more energy per watt installed than conventional silicon modules in many climates.

Superior Temperature Coefficient and Spectral Response

Our innovative thin film technology features a low temperature coefficient of $-0.32\%/^{\circ}\text{C}$, resulting in more annual energy, especially in hot climates.

First Solar modules are also less sensitive to the reductions of specific wavelengths of available light in humid climates. As a result, these modules have a superior spectral response behavior compared to c-Si modules that translates into up to 4% more annual energy in high humidity conditions.

Better Shading Response

Series 6 modules are less sensitive to power loss from shading through their unique cell design. With Series 6, only the shaded area is impacted; typical silicon modules turn off disproportionately large portions due to their electrical design.

Industry-Leading Long-Term Reliability

First Solar Series 6 modules are built with methods and processes adapted from Series 4, one of the most tested solar modules in the industry. This technology is independently tested and certified for reliable performance beyond IEC standards in high temperature, high humidity, extreme desert, coastal applications, and passes the industry PID tests to ensure robust performance in the harshest environments.

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THE ADVANTAGE OF COLLABORATIVE DESIGN

Developing next-generation technology required a next-generation approach. First Solar launched an extensive listening campaign with leading mounting structure providers, our partners in the field, to identify controlling factors that would help define maximum watts-per-lift while retaining two-person installation teams. We also turned to these partners for direct input on every aspect of the module to ensure we designed and built a superior product for the market.

The result is a module that will have among the lowest costs per-watt-installed in the market, optimized for more than 40 fixed-tilt and tracker mounting systems.

40+ STRUCTURE PROVIDERS
With more on the way!

FIRST SOLAR IS YOUR PROVEN ENERGY PARTNER

At First Solar, innovation is at the core of everything we do. Through an unwavering commitment to research and development we are continually discovering new and inventive solar energy solutions, while making today's PV technologies more efficient. Our Series 6 modules are the latest technological achievement in our long history of industry advancements.

As your energy partner, we maintain a strong balance sheet that is backed by a lengthy track record of meeting or exceeding performance expectations. That is why First Solar solutions are widely recognized as the most bankable in the industry.

MIT TECHNOLOGY REVIEW

TOP 50
2017 SMARTEST
COMPANIES



SECURE YOUR NEXT GENERATION OF ENERGY PROFITABILITY

Learn how First Solar Series 6 modules will deliver a superior return on your energy investment with higher yields, reduced risk and a lower LCOE. For more information, contact us and let's start the conversation.

firstsolar.com/S6 | info@firstsolar.com

MaxSpan™

PILE DRIVEN
GROUND SYSTEMS



Technical Data Sheet

Best Quality And Priced Pile Driven Fixed Tilt Systems



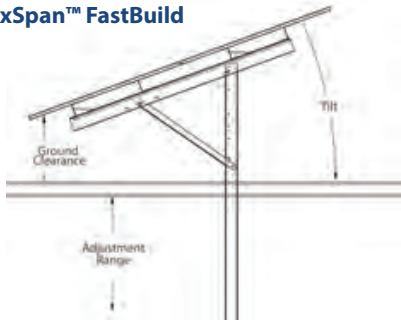
32 MW - NC - MaxSpan™ System - Installed for Leading Utility

FAST INSTALL & HANDLES SLOPING GROUND

Industry's longest spans and fewest foundations: as few as 190 per MW for 2 up portrait and 130 per MW for 3 up portrait

LESS PILES
UNMATCHED SPAN
UP TO 15%
TERRAIN SLOPES

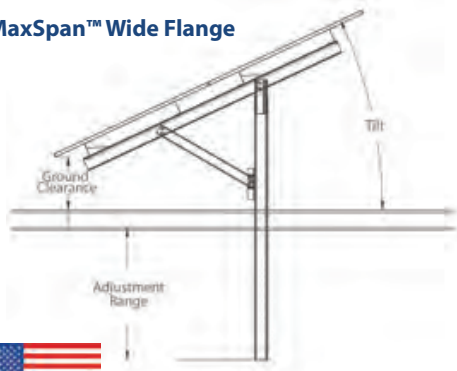
MaxSpan™ FastBuild



Supports all poly, glass and thin film modules

Rugged design enables 150mph [67.06 m/s] wind and 90 psf [4.31 kPa] snow loads

MaxSpan™ Wide Flange



Turnkey install, pull test and geotech services available

Galvanized Z purlins have integrated trays for easy wire management

5° to 35° tilt with multiple inter-row spacing options



CERTIFIED
INSTALLER

BLACK &
VEATCH



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MaxSpan™ PILE DRIVEN
GROUND SYSTEMS

Tel: +1 212 388 5160
info@gamechangesolar.com
gamechangesolar.com



Technical Data Sheet



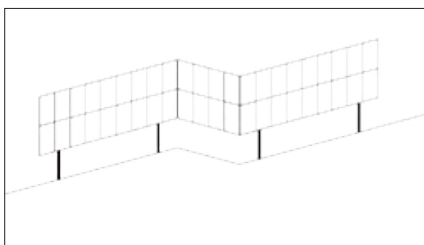
MaxSpan™ FastBuild's rugged beam and brace rapidly attach to pile with just six bolts and nuts - fewest parts in the industry



MaxSpan™ WideFlange's telescoping post bracket with up to 5 inches vertical adjustment for fast top of pile leveling



Patent pending articulating purlin connection to navigate sloping terrain



Articulating purlin connections to navigate up to 15% terrain slopes

Features

MaxSpan™ FastBuild

StickyPile™: G235 galvanized steel (HDG available), purlins, beams & braces:
G90 galvanized steel

20 men install 1.55MW per week

Three axes of adjustability demanded by installers for navigating real world site conditions where significant adjustability in the field is required

The unmatched span capability of MaxSpan™ means there are fewer foundations than competing systems, which means less piles and less pile installation cost. As few as 190 piles per MW

Standard system has 3.5" [8.89cm] vertical adjustability

Optional post extenders allow 10" [25.4cm] vertical adjustability

MaxSpan™ Wide Flange

Industry's most flexible racking system handles undulating ground conditions

Telescoping post bracket with over 5" [12.7cm] vertical adjustment for fast top of pile leveling

Multiple options with Wide Flange

Test & Certification

- Meet IBC and ASCE standards for structural loading
- ETL / UL 467 GameChange top mount clamps or star washers included
- ETL / UL 2703 tested
- Wind tunnel tested by industry leader CPP
- Independent assessment by Black & Veatch
- Warranty 20 years - Made in USA

Calculations

- 100% code compliant designs for any locality
- Structural PE drawings & calculations for foundation & racking structure
- Available 2 up in portrait and 4 up in landscape poly as well as multiple glass on glass module configurations incl. First Solar Series 4 & 6™
- Design loads according to IBC 2006 or 2009

Pull Test, Geotech & Installation Services

- Free pull test on orders over 5 MW
- Vertical and lateral capacity of the post is determined by pull test
- Test data is then analyzed by our in-house engineering team in parallel with geotechnical report to give the most efficient embedment depths, spans and post type
- Turnkey installation of piles, racks and modules available

Material

- Post: G235 galvanized steel (HDG ASTM123 option also available)
- Galvanized Purlins, NS Beam, Brace: G90 galvanized steel
- Star washer or ETL / UL top mount teether module clamp: stainless steel
- Associated hardware: Magnacoat 3/8", 1/2" and 3/4" x 1" hex or serrated flange hex bolts, 3/8", 1/2" and 3/4" serrated flange nuts HDG or magnacoat, 3/4" washers; stainless steel 1/4" - 20" serrated flange nuts, 1/4" - 20" x 3/4" hex bolts; or if mounting modules using stainless steel module mounting clamps: 1/4" - 20" x 2 1/2" hex bolts, or 1 1/2" - 2 1/2" T-bolts, stainless steel 1/4" - 20" serrated flange nuts

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PUBLIC VERSION

DuraTrack® HZ v3

RELIABILITY IS POWER.

167X

fewer components than
competitive trackers

99.996%

Uptime Reliability

ARRAY TECHNOLOGIES, INC.

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Albuquerque, NM 87109 USA

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+1 855.TRACKPV (872.2578)
+1 505.881.7572

sales@arraytechinc.com

arraytechinc.com

THE MOST RELIABLE TRACKER UNDER THE SUN

HIGHEST POWER DENSITY.

Higher density means more power and more profit. DuraTrack HZ v3 offers the unique ability to maximize the power density of each site, boasting 6% more density than our closest competitor.

LEADING TERRAIN ADAPTABILITY.

Uneven terrain? Hill yes! Our flexibly linked architecture, with articulating driveline joints and forgiving tolerances, create the most adaptable system in market for following natural land contours and creates the greatest power generation potential from every site.

FEWER COMPONENTS. GREATER RELIABILITY.

Less is more. Array was founded on a philosophy of engineered simplicity. Minimizing potential failure points (167 times fewer components than competitors), DuraTrack HZ v3 consistently delivers higher reliability and an unmatched uptime of 99.99%.

FAILURE-FREE WIND DESIGN.

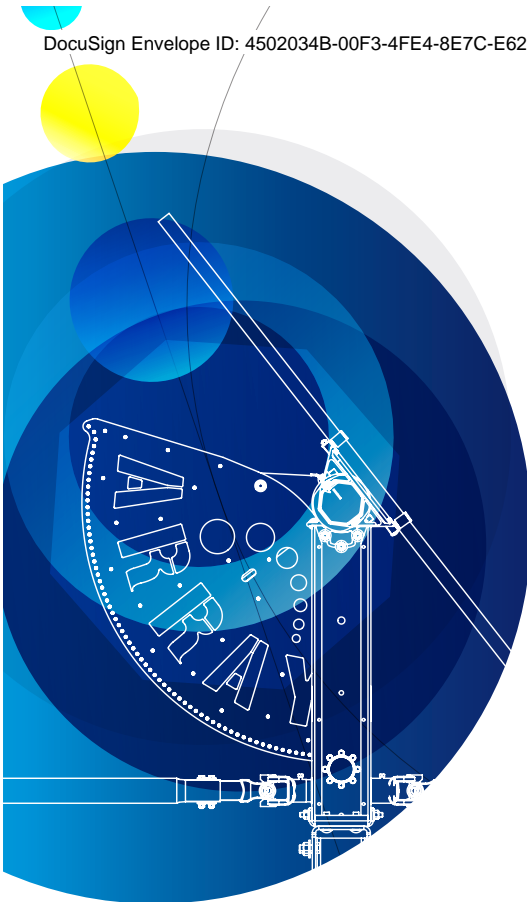
DuraTrack HZ v3 was designed and field tested to withstand some of the harshest conditions on the planet. It is the only tracker on the market that reliably handles wind events with a fully integrated, fully automatic wind-load mitigation system.

ZERO SCHEDULED MAINTENANCE.

Three decades of solar tracker system design, engineering and testing has resulted in uncompromising reliability. Maintenance-free motors and gears, fewer moving parts, and industrial-grade components means maintenance-free energy generation.

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DuraTrack® HZ v3

COST VERSUS VALUE

We believe value is more than the cost of a tracking system. It's about building with forgiving tolerances and fewer parts so construction crews can work efficiently. It means protecting your investment with a failure-free wind management system. It also includes increasing power density. But most of all, value is measured in operational uptime, or reliability. Ours is 99.996%... and we're still improving on it.

THE GLOBAL LEADER IN RELIABILITY

Array has spent decades designing and perfecting the most reliable tracker on the planet. Fewer moving parts, stronger components and intelligent design that protects your investment in the harshest weather are but a few of the innovative differences that keep your system running flawlessly all day and you resting easy at night.

STRUCTURAL & MECHANICAL FEATURES/SPECIFICATIONS

Tracking Type	Horizontal single axis
kW per Drive Motor	Up to 907 kW DC using 360W crystalline
String Voltage	Up to 1,500V DC
Maximum Linked Rows	28
Maximum Row Size	80 modules (crystalline, 1,000V DC) & 90 modules (crystalline, 1,500V DC)
Drive Type	Rotating gear drive
Motor Type	2 HP, 3 PH, 480V AC
Motors per 1 MW AC	Less than 2
East-West / North-South Dimensions	Site / module specific
Array Height	54" standard, adjustable (46" min height above grade)
Ground Coverage Ratio (GCR)	Flexible, 28–45% typical, others supported on request
Terrain Flexibility	N-S tolerance: 0°–8.5° Standard, option to increase Driveline: 40° in all directions
Modules Supported	Most commercially available, including frameless crystalline and thin film
Tracking Range of Motion	± 52°
Operating Temperature Range	–30°F to 130°F (–34°C to 55°C)
Module Configuration	Single-in-portrait standard. Two-or-three in landscape (framed or frameless), four-in-landscape (thin film) also available.
Module Attachment	Single fastener, high-speed mounting clamps with integrated grounding. Traditional rails for crystalline in landscape, custom racking for thin film and frameless crystalline per manufacturer specs.
Materials	HDG steel and aluminum structural members
Allowable Wind Load (IBC 2012)	135 mph, 3-second gust exposure C
Wind Protection	Passive mechanical system relieves wind and obstruction damage — no power required

ELECTRONIC CONTROLLER FEATURES/SPECIFICATIONS

Solar Tracking Method	Algorithm with GPS input
Control Electronics	MCU plus Central Controller
Data Feed	MODBUS over Ethernet to SCADA system
Night-time Stow	Yes
Tracking Accuracy	± 2° standard, field adjustable
Backtracking	Yes

INSTALLATION, OPERATION & MAINTENANCE

PE Stamped Structural Calculations & Drawings	Yes
On-site Training & System Commissioning	Yes
Connection Type	Fully bolted connections, no welding
In-field Fabrication Required	No
Dry Slide Bearings & Articulating Driveline Connections	No lubrication required
Scheduled Maintenance	None required

GENERAL

Annual Power Consumption (kWh per 1 MW)	400 kWh per MW per year, estimated
Land Area Required per 1 MW	Approx. 5 to 5.75 acres per MW @ 33% GCR (site and design specific)
Energy Gain vs. Fixed-Tilt	Up to 25%, site specific
Warranty	10 year structural, 5 year drive & control components
Patent Numbers	US patent 8,459,249. US patent 9,281,778. US patent 9,581,678 B2 and patents pending
Codes and Standards	UL Certified [3703 & 2703]

PUBLIC VERSION



TMEIC Corporation

Office: 1325 Electric Road, Suite 200, Roanoke, VA 24018 USA
Mailing Address: 2060 Cook Drive, Salem, VA 24153 USA

TMEIC Ninja

The New Benchmark in PV Inverters

TMEIC's current generation of inverters is the Samurai family; which was designed for the US market at 1000V. It immediately earned a reputation for extreme reliability. This family evolved to the 1500V family that is now shipping into projects across the US. Our cumulative availability across over 2GW and 1300 inverters is 99.9%+!

TMEIC undertook a redesign of the Samurai packaging with a focus on ease of installation. The new Ninja inverter platform (also referred to as the Universal Power Conditioner System) has been introduced. Our core technology, and what has allowed us to build our great reputation, the IGBT's (conversion engines), the controls system and the cooling system all remain intact, other than modifications for packaging. We have migrated from a large central inverter of 3.36MW to a large "string" (or small central) inverter of 840kW, that is designed to be assembled in up to 6 units to create a very flexible platform. The performance of the Ninja family will be almost identical to the Samurai.

Some of the key technology features are:

- Flexibility: Ninja models can be assembled in 800kW-920kW building blocks up to 6 units in a single lineup.
- Modular: Ninja inverters are also truly modular in design with independent cooling, operation and control system.
- Multiple MPPT: Each Ninja inverter offers single MPPT for site optimization.
- Night Time VAR: Ninja models are capable of Night time VAR in +/-0.8PF window.
- ESS Ready: Ninja models with additional charge circuitry can be used as bi-directional ESS inverter. This will allow easy integration to future storage addition and minimum spare parts difference.
- Cost of Ownership: Filter-less design provides part-replacement free maintenance for first 10 years of operations on top of TMEIC's industry leading technology and reliability.

Some of the cost savings are from:

- Removing the DC Recombiner, each Ninja has independent DC inputs
- Polymer cabinet over Aluminum frame, no more steel cabinet, no more worries of rust, scratches etc.
- Removing the AC Controls cabinet, controls are distributed across each inverter
- Remove the Air Circuit breaker, this is an expensive and failure prone device

To reiterate, the Ninja inverter platform will perform just about identically to the well-respected Samurai family of inverters, adds significant and valuable features, and reduces cost.



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Example Technical Specification

Universal Power Conditioner System PV / ESS Inverter

(Preliminary - Under Development)

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Mailing Address: 2060 Cook Drive, Salem, VA 24153

Table of Contents

1. PURPOSE, STANDARDS, AND SCOPE	3
1.1. Statement of Purpose.....	3
1.2. General Scope	3
1.3. Documentation	3
1.4. Packaging, Transportation and Storage.....	3
1.5. Product Testing	3
1.6. Maintenance Contract	3
1.7. Commissioning	4
1.8. Dispatch of TMEIC Engineers	4
1.9. Rules & Standards	5
1.10. Dimensional Units	5
1.11. Site Conditions	6
2. DETAILS OF EQUIPMENT SUPPLIED [Base Bid]	7
2.1. PCS Circuit and Common Features	7
2.2. PV-PCS	14
2.3 ESS-PCS.....	16
2.4 System Line Up and Configuration	18
2.5 System Line Up with Hybrid System of PV and ESS	22
3. BILL OF MATERIAL (Per PCS).....	23
3.1. A. Inverter	23
3.1. B. Integration	23
3.1. C. MV 3-Phase Transformer for 5 x 840kW/840kVA Inverter Lineup	24
3.1. D. Factory Tests	25
3.1. E. Power Plant Controller (Option).....	26
3.1. F. Structural Outline *Preliminary	27



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1. PURPOSE, STANDARDS, AND SCOPE

1.1. Statement of Purpose

TMEIC will provide broad-based customer support including post sales application support and commissioning services. The equipment described in the specification below is intended to be used as a Grid-Connected Photovoltaic Inverter System for a photovoltaic generation power plant.

1.2. General Scope

This specification will cover the design, fabrication, commissioning, and supply of the following equipment:

Equipment	Description
Inverter Unit	4200kW/4200kVA (5x 840kW units, maximum output at 25°C)
MV/LV 3-phase Transformer (MV TR) - Liquid-Filled MTR Pad mounted	3360/4200kVA, 630V - 34.5kV
PV Skid	Outdoor type

1.3. Documentation

All submittals will be in electronic form and will include:

- Final Specification
- Test Reports
- Instruction Manual
- Installation Manual
- Schematic Diagrams
- Outline Drawing

1.4. Packaging, Transportation and Storage

The equipment may be divided into several sections for protection during transportation when necessary. The equipment will be properly packaged for the respective mode of transportation. Customer is responsible for disposal of packaging materials. Special notations such as "Fragile", "This side Up", "Center of Gravity", "Weight", etc.. when necessary, will be clearly labeled on each package. Manufacturer's recommendations for storage should be followed upon receipt.

1.5. Product Testing

Testing will be carried out at the manufacturer's facility for each piece of equipment. Test reports of major equipment will be submitted.

1.6. Maintenance Contract

Performing scheduled inspections and maintenance will improve the reliability of the equipment and prolong its service life. It is recommended that periodical inspections and maintenance be performed by specialists of the service representative. Such maintenance is not included in this scope and can be quoted separately. The warranty is dependent upon performing periodical inspections and maintenance as per the manufacturer's manual.



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1.7. Commissioning

The equipment presented in this specification will require authorized startup & commissioning services by TMEIC.

The commissioning scope includes but is not limited to the following:

- De-energized checks including proper installation of equipment, torque mark verification, and proper electrical connections between major equipment.
- Energized checks including software updates, verification of set-points and IP addresses, and proper operation of communications and equipment.
- Commissioning tests will be performed per TMEIC Commissioning Checklist

Note: Testing of grid protection relay is not included. Post-shipping tests of the MV Transformer, such as NETA tests, are not included and can be quoted separately.

The commissioning scope and price are based on the following conditions:

- The pre-commissioning checklist must be filled out and returned to the TMEIC project manager at least two weeks before resources will be scheduled to mobilize to site.
- DC voltage and polarity from array inputs inside the DC recombiner box have been verified and documented by others.
- Back feed is available upon arrival of TMEIC technicians.
- De-energized and energized checks will be completed during the same trip.
- Inverters will be available for commissioning continuously.
- Conditions outside of the TMEIC technician's control which result in delay may be subject to extra charge. Conditions could include, but not limited to: Waiting time for grid connection, bad weather to clear out, other related equipment required for PV inverter commissioning to be installed.
- Technicians will not travel with commissioning spares; critical spares will be available either via client stock on hand, or via TMEIC customer support process.
- Brief operations and maintenance overview can be provided immediately following the conclusion of commissioning to available onsite personnel. This is not a formal O&M training class. TMEIC offers regularly scheduled formal classroom and hands-on training. Schedule, curriculum, and pricing can be found at <https://www.tmeic.com/customer-support/commissioning-training-field-service>.

Any deviation from these conditions will result in extra charges in accordance with TMEIC's published rate sheet during the time that the work is completed. See TMEIC Terms and Conditions for additional information.

Added Services Technical advisory services for supervision of equipment installation and post commissioning services can be quoted but are not within the scope of TMEIC commissioning services.

1.8. Dispatch of TMEIC Engineers

Except for the purpose of implementing the repair under the warranty set forth in 3.3.5, the dispatch of TMEIC engineers for any service whatsoever will be made under a separate agreement offering the buyer to pay additional fees for services.



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1.9. Rules & Standards

IEEE 1547	IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.
UL1741-SA	Inverter, Converter, Controllers and Interconnection System Equipment for Power Systems.
NEC 2017 / NFPA 70	National Electric Code 2017
IEEE 1547.1	IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.
IEC 62109-1	Safety of power conversion equipment for use in photovoltaic power systems-Part 1: General Requirements
IEC 62109-2	Safety of power converters for use in photovoltaic power systems – Part 2: particular requirements for inverters
IEC 62933-5-1:2017	Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification
IEC 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
IEC 61727	Photovoltaic (PV) systems - Characteristics of the utility interface
IEC 62116	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
BDEW TR3, TR4	

1.10. Dimensional Units

All bolts, nuts and screws will conform to the Metric Thread of ISO (International Organization for Standardization). All manufacturing and design of the equipment will conform to the metric system standards.



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1.11. Site Conditions

Grounding System

The inverter must be negatively grounded providing a grounding resistance of less than 5 ohms.

Installation and Operation Environment

When installing or operating the inverter and related devices, ensure that the installation and operation environment complies with Table 1. Failing to observe these standards may result in deterioration of the insulation, causing short life and malfunctions. Before installation, measure and evaluate the environment of the installing location. The inverter must be protected from marine environments and must be sealed from corrosive gas and salty air in accordance with Table 1. The warranty is dependent upon meeting the environmental conditions.

Table 1. Inverter installation and operation environment guidelines

No.	Item	Environment Standard
1	Installation location	Outdoors
2	Full power ambient temperature range	-25 ~ 25DegC
	Operational Ambient temperature	-25 ~ 60DegC (10% power reduction from 25-50C, 100% power reduction from 50-60C)
3	Relative humidity	The relative humidity must be held between 5 and 95%. There must be no condensation due to temperature change.
4	Altitude	Up to 2000 meters above sea level.
5	Air pressure	The air pressure must be maintained in the range 860 to 1060 hPa. (pending)
6	Vibration and mechanical shock (pending)	Vibrations in the installation environment must have frequencies lower than 10 Hz, or higher than 20 Hz. For vibrations less than 10 Hz, the resulting acceleration must not exceed 0.5G. For vibrations between 20 Hz and 50Hz, the resulting acceleration must not exceed 0.5G. For vibrations between 50Hz and 100Hz, the total amplitude must not exceed 0.1 mm.
7	Dust	Dust in the air where the inverter is installed must not exceed normal atmospheric dust levels. In particular, that dust must not include electrically conductive particles, oils or fats, or organic materials such as silicone.
8	Flammability	There should be no flammable or explosive gas present.
9	Corrosive factors	Inverter should be installed in an environment rated less than C4 corrosive factor for Steel, Zinc, and Copper as defined by ISO 9266.



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2. DETAILS OF EQUIPMENT SUPPLIED [Base Bid]

2.1. PCS Circuit and Common Features

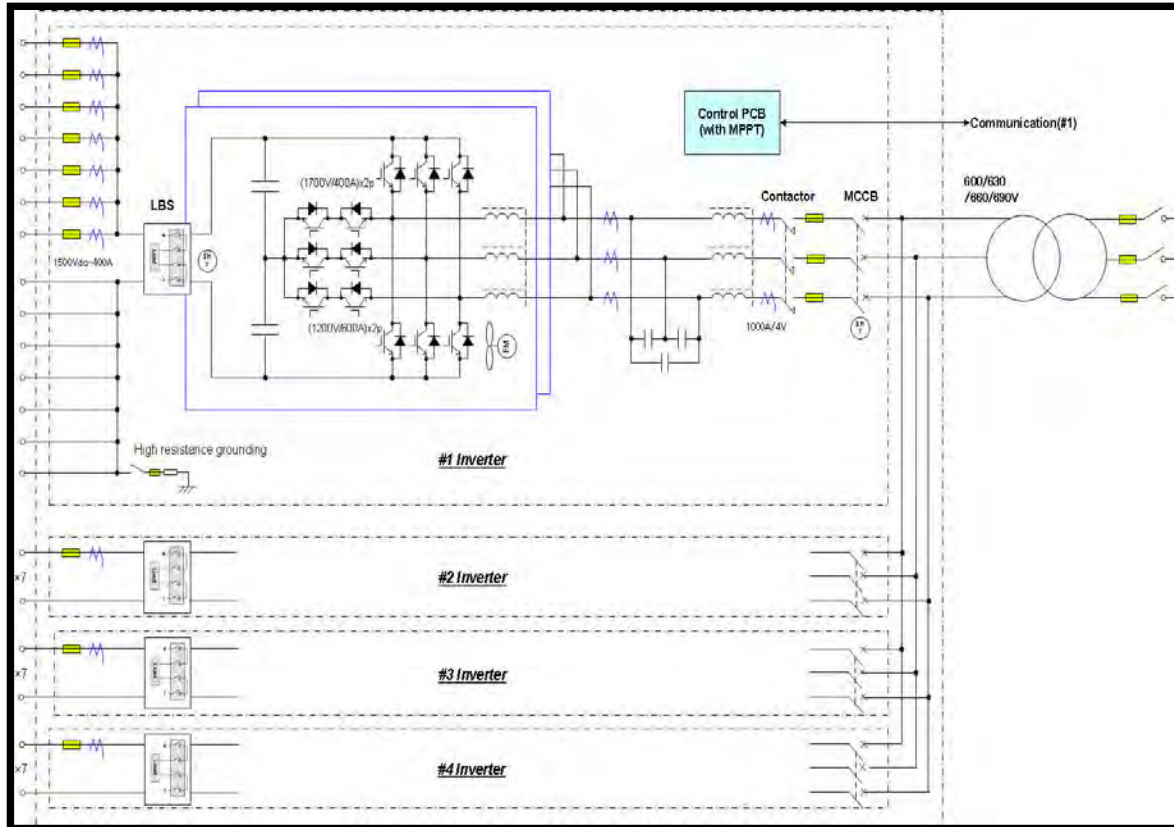


Figure 2.1: Circuit diagram of 4 PCS coupled

Benefits and Features:

1. Stackable Power Blocks: 800kW-4600kW
2. Modular Design
3. Each UPCS (PV or ESS) has independent:
 - a. Operation, Control System, Cooling System
 - b. Isolation on DC (Load Break Switch) and AC (MCCB and Contactor)
 - c. DC inputs (PV 8 inputs per block, ESS 1 input per block)
 - d. Individual MPPT tracking
4. For PV-PCS, Negative Grounding with CTs on each input.
5. For ESS-PCS, the system shall also include the Pre-Charge Circuit, which is connected to the DC battery side.



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840kW Inverter Unit

Main Circuit Type

Conversion method	Voltage source inverter with instantaneous current control
Switching method	Pulse Width Modulation (PWM) control
Inverter configuration	Three-phase bridge
Isolation method	External Transformer is required to isolate inverter
Cooling method	Forced Air cooling

Grid Connection Features

(1) Anti-islanding protection

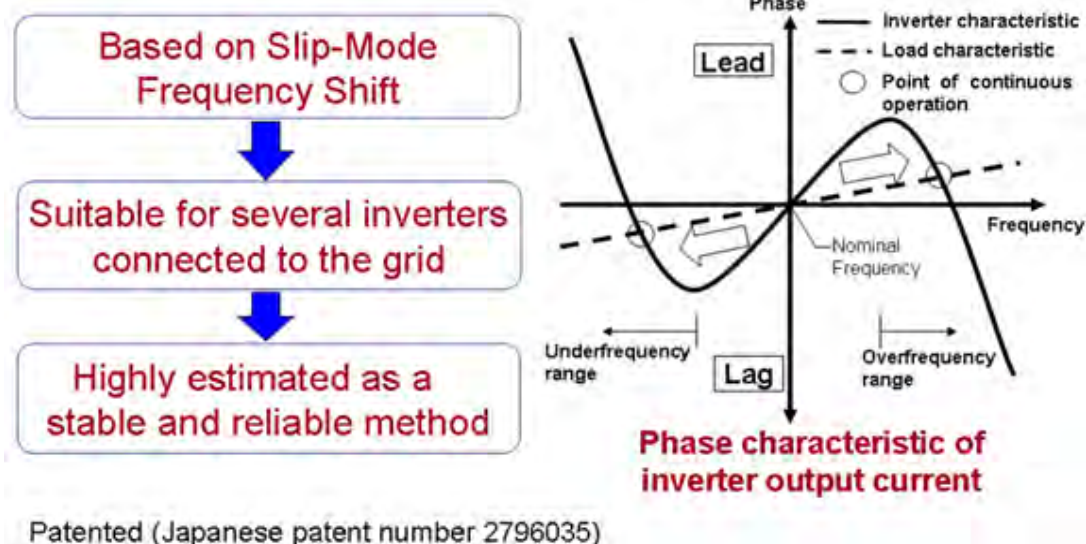
The objective of this system feature is to detect the islanding condition and drive the system to a stable operating condition.

(2) Reactive Power Control

Reactive power can be injected to the grid according to the grid voltage through the TMEIC Power Plant Controller. The TMEIC Power Plant Controller will communicate with each inverter via a communication port, in a Modbus protocol.

(3) Active Power Limit

Site wide active power can be controlled via TMEIC's Power Plant Controller.





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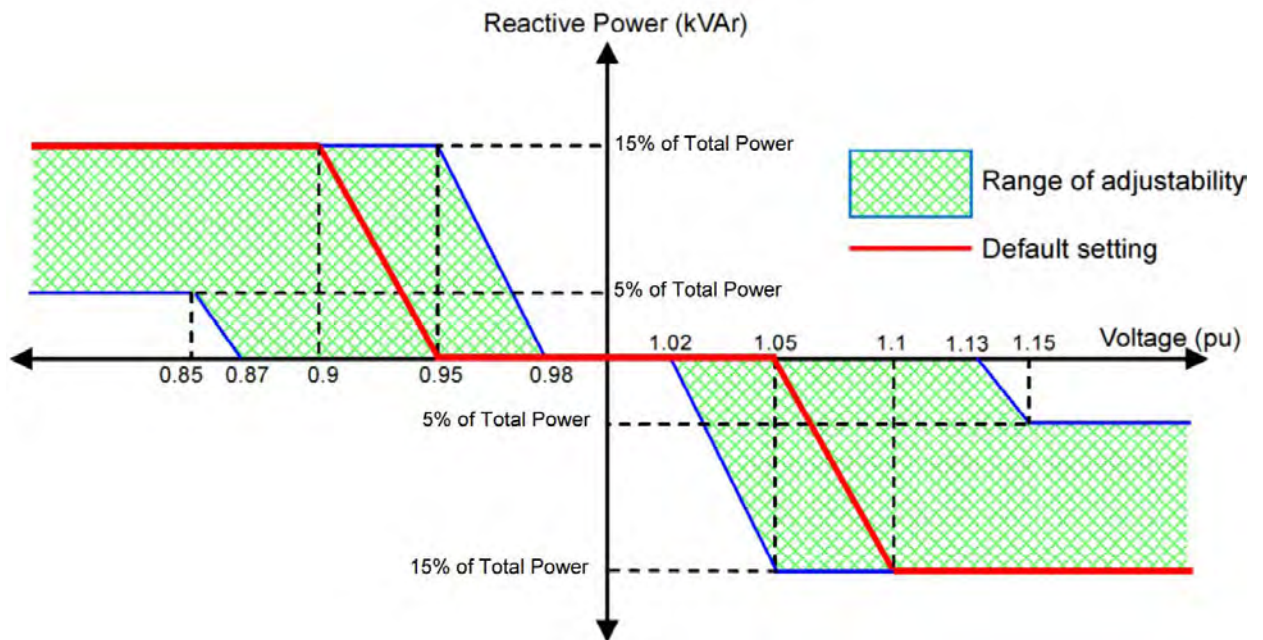
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Grid Support Functionality (1741-SA smart features)

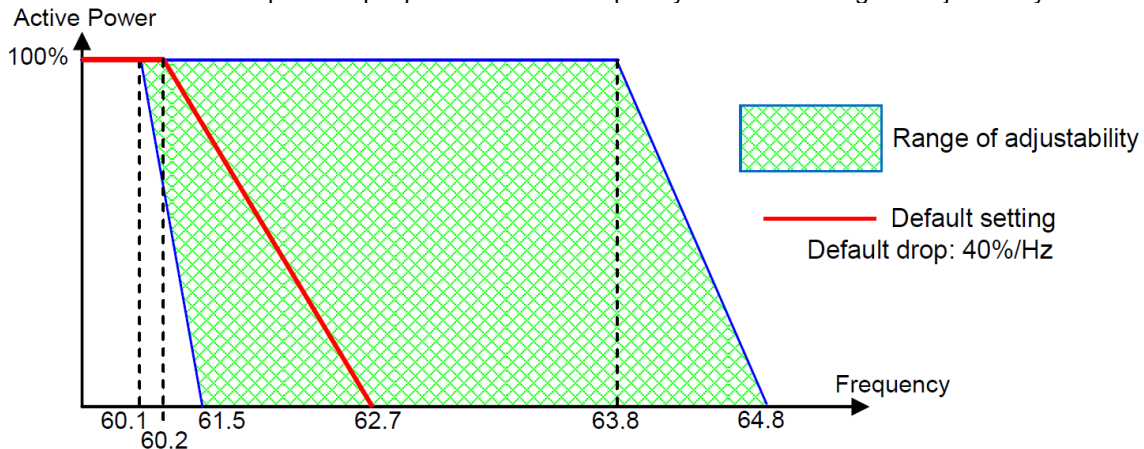
(1) Volt-Var

This function operates under reactive power priority, which means that the inverter will derate for active power instead of reactive power when the maximum kVA rating of MVA is reached.



(2) Frequency – Watt

This function will ramp the output power down as frequency increases. Range of adjustability is TBD.



(3) Dynamic VAR Compensation

Inverter capable of injecting reactive current during low voltage ride through events. Capability shall be in line with limits set forth in BDEW TR3, TR4.

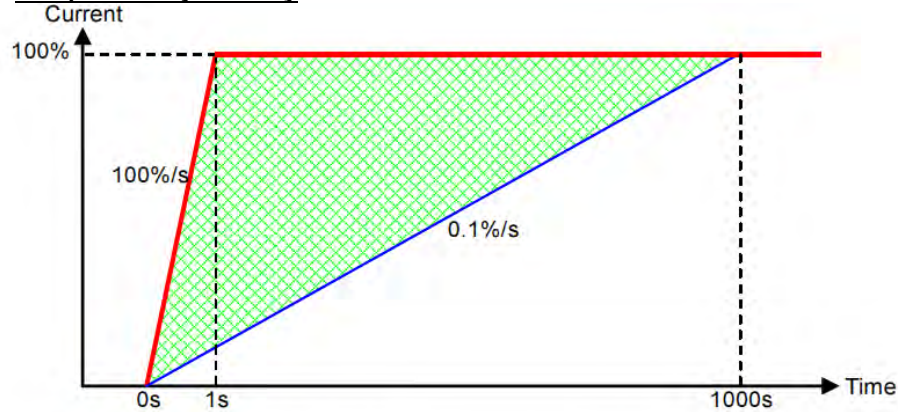


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(4) Ramp Rate Adjustability



Range of adjustability: 100%/s to 0.1%/s



Range of adjustability



Default setting: 100%/s

Normal and soft-start ramp rate are under the same settings. They cannot be programmed independently.



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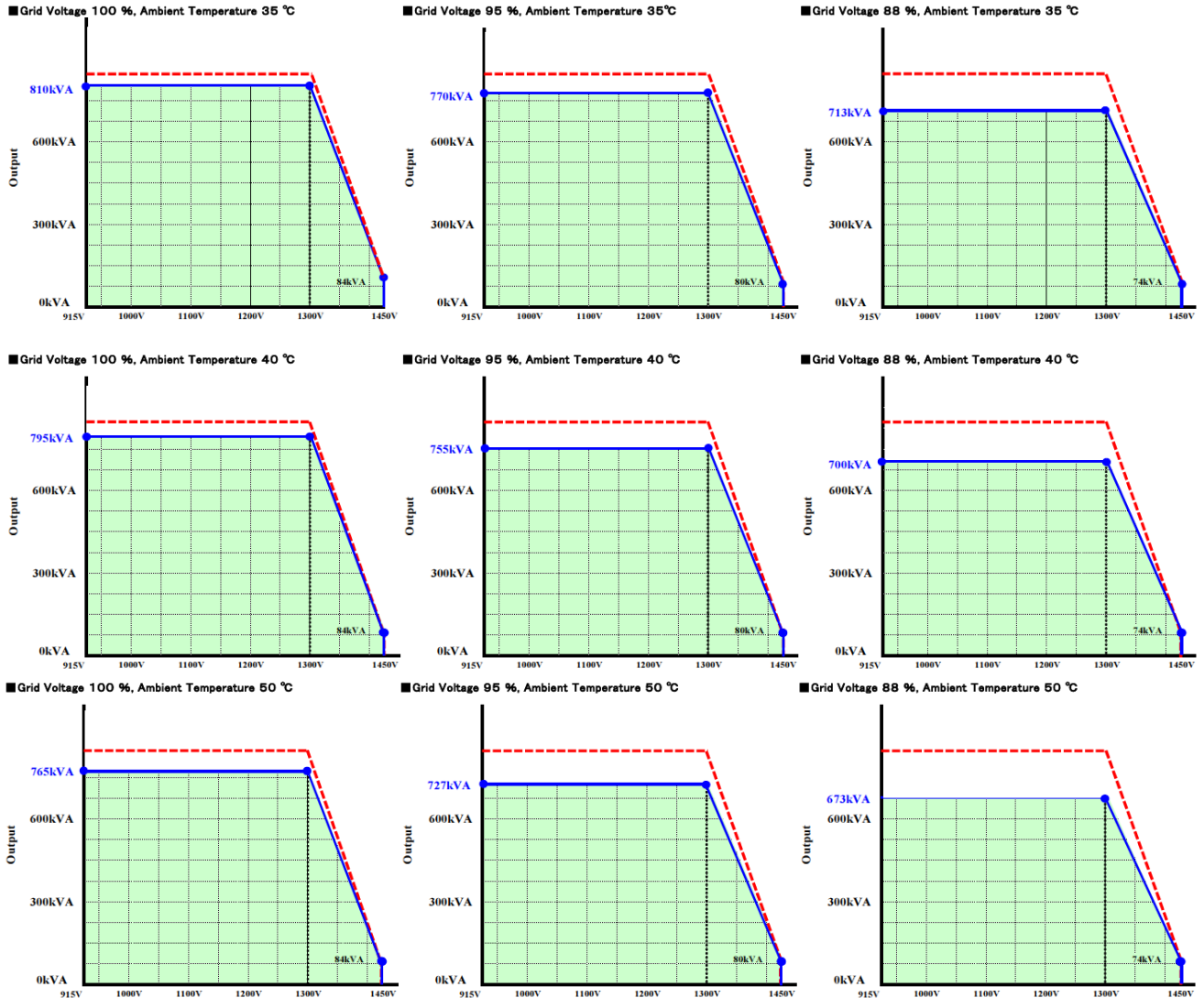
Temperature Derate Curve

The curves below define the inverter de-rate characteristics at different ambient and grid voltage conditions.

840kVA/840kW PV Inverter Power Characteristics



Cases based on various Temperatures and Grid Voltages





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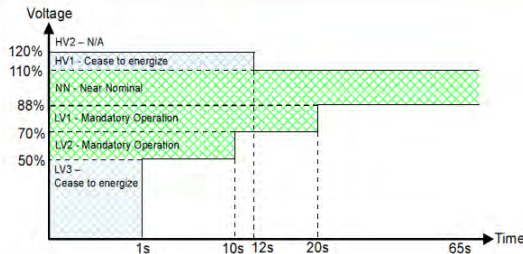
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LVRT and FRT Functionality

Fault Ride through Capabilities for Universal PCS with Rule 21 for illustration. The inverter is capable of more than what is shown below.

Voltage

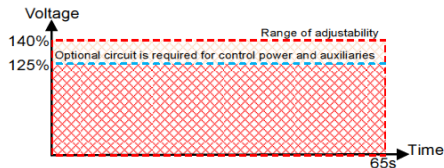
Rule 21



Name	Description	Default setting	
		% of nominal	trip time
OVR	OVR4	Grid overvoltage detection level 4	120%
	OVR3	Grid overvoltage detection level 3	110%
	OVR2	Grid overvoltage detection level 2	110%
	OVR1	Grid overvoltage detection level 1	110%
UVR	UVR1	Grid undervoltage detection level 1	88%
	UVR2	Grid undervoltage detection level 2	70%
	UVR3	Grid undervoltage detection level 3	50%
	UVR4	Grid undervoltage detection level 4	50%
Cease to energize		Cease to energize for overvoltage	110%
		Cease to energize for undervoltage	50%

*Inverter will provide Dynamic Var Compensation as per BDEW TR3 and TR4, as well as the elimination of momentary cessation of current.

Range of Adjustability

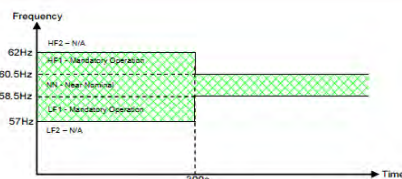


Remarks:

- 1) For voltage settings over 125%, an optional circuit is required for the control power supply.
- 2) The inverter is not set to supply reactive power during the fault above the settings prior to the fault.
- 3) For overvoltage events, there may be an impact on power quality when the DC voltage is close to the minimum.
- 4) Current may be not perfectly sinusoidal for some asymmetrical faults.

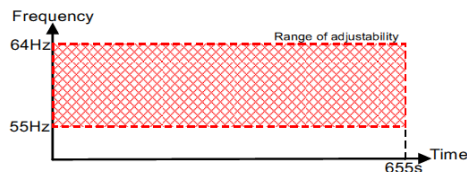
Frequency

Rule 21



Name	Description	Default setting	
		Frequency	Trip time
OFR	OFR3	Grid over-frequency detection level 3	62Hz
	OFR2	Grid over-frequency detection level 2	60.5Hz
	OFR1	Grid over-frequency detection level 1	60.5Hz
UFR	UFR1	Grid under-frequency detection level 1	58.5Hz
	UFR2	Grid under-frequency detection level 2	58.5Hz
	UFR3	Grid under-frequency detection level 3	58.5Hz
	UFR4	Grid under-frequency detection level 4	58.5Hz
	UFR5	Grid under-frequency detection level 5	57Hz

Range of adjustability



Remarks:

- 1) Maximum continuous operation is 64Hz for UL1741-SA compliant inverters and 63Hz for other models

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Structural Specification

(1) General Construction of Equipment		TBD
(2) Inverter Cabinet Dimensions (Height X Width X Depth)		: 1950mm X 1150mm X 1150mm
(3) Weight		: TBD
(4) Paint	Outside general surface	: Sand White
	Inside surface	: Sand White
	Base	: Sand White
(5) Input/output interface	DC input	: Bottom Cable Entry
	AC output	: Output on back/side of the inverter
	Control Wire	: TBD
	Grounding Wire	: TBD



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2.2. PV-PCS

Control Method for PV-PCS

DC side control functions	Maximum Power Point Tracking (MPPT) control
Grid side control functions	Active power control, reactive power control, Voltage Control Mode*
Operation	Auto start/stop (soft-start at startup)
Other functions	Output power limiter. (If the capacity of solar power exceeds the generation capacity of the Inverter, the Inverter limits the output power)

*Voltage Control Mode is available via TMEIC Power Plant Controller integration.

Electrical Ratings of PV-PCS

Item	Specification
Rated AC Voltage	600VAC 630VAC 660VAC 690VAC
Rated Power@25°C	800kW 840kW 880kW 920kW
Rated Power @50°C	730kW 765kW 800kW 840kW
MPPT Range	875-1300VDC 915-1300VDC 960-1300VDC 1005-1300VDC
Rated Frequency	50/60 Hz
Maximum Efficiency	98.5%
CEC Efficiency	98.5%
Inverter Dimensions (Tentative)	1100 X 1900 X 900 mm (W X H X D)
Weight (tentative)	<1000kgs
Enclosure Rating	NEMA 3R
Installation	Outdoor
AC Protection	MCCB and Fuse
DC Protection	Fuses
Communication	Modbus TCP
DC Inputs	Maximum 8 per Inverter Each input rating is a maximum of 400A
Harmonic Distortion of AC Current	≤ 3% THD (At rated power)
Standard Control Power Supply	Control Power Supply from Inverter output and Capacitor backup circuit (3 sec. compensation)
Maximum Line Up	Maximum Line up of a total of 6 panels
Noise Level	75dBA at 1 meter
Short Circuit Ratio	Above 2.0 (Below 2.0, TMEIC will do simulations and confirm)
Short Circuit Withstand Current	AC Side– 65kA DC Side – 100kA (20ms)
Cooling Method	Independent Forced Air Cooling with no Air Filters

* Maximum output power rating is de-rated by input DC voltage, output AC voltage and temperature condition.

** Transition from constant DC voltage mode to MPPT mode occurs 10V before minimum MPPT range for each respective o.

*** Rated output power and power factor variation range is only for rated voltage condition.



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Protective Functions

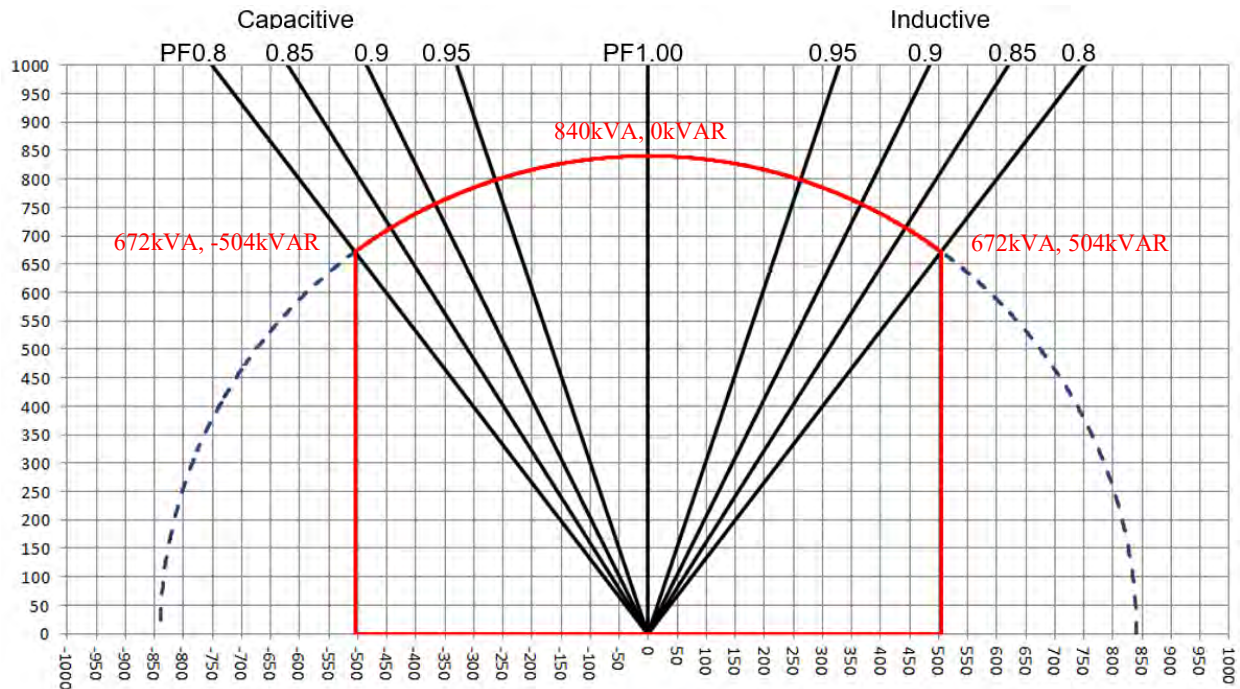
Input (DC) side	Ground Fault, DC Reverse Current, Over Voltage, Over Current
Grid (AC) side	Anti-islanding, Over/Under Voltage, Over/Under Frequency, Over current

Protective Devices

Input (DC) side	Surge protective device: IN=10kA/UCpv=1500V
Grid (AC) side	Surge protective device: IN=15kA/AC690V

Power Factor Control

The D-Curve depicted below shows the Ninja PF characteristics. The inverter offers a power factor range from +/- 0.8 with derated power shown in the graph below at 25C ambient temperature, grid voltage of 1pu and nominal DC voltage. PF characteristics will be de-rated according to the change of AC voltage, DC voltage, and ambient temperature.



P-Q Curve of PV-PCS @ 25°C, 630Vac(Grid Voltage= 1p.u.), Nominal Vdc



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2.3 ESS-PCS

Control Method of ESS-PCS

DC side control functions	DC Voltage will depend on the State of Charge of Battery
Grid side control functions	Active power control, reactive power control, Voltage Control Mode*
Operation	Dependent on the command from an external controller

Electrical Ratings of ESS-PCS

Item	Specification
Rated AC Voltage	480VAC 600VAC 630VAC
Rated Power@25°C	630 kW 800 kW 840 kW
Rated Power @50°C	570kW 730 kW 765 kW
MPPT Range	710-1300 VDC 875-1300 VDC 915-1300VDC
Rated Frequency	50/60 Hz
Maximum Efficiency	98.5%
CEC Efficiency	98.5%
Inverter Dimensions (Tentative)	1100 X 1900 X 900 mm (W X H X D)
Weight (tentative)	<1000kgs
Enclosure Rating	IP 55/ NEMA 3R
Installation	Outdoor
AC Protection	MCCB and Fuse
DC Protection	Fuses
Communication	Modbus TCP
DC Inputs	1 per Inverter
Harmonic Distortion of AC Current	≤ 3% THD (At rated power)
Standard Control Power Supply	Control Power Supply from Inverter output and Capacitor backup circuit (3 sec. compensation)
Maximum Line Up	Maximum Line up of a total of 6 panels
Noise Level	75dBA at 1 meter
Short Circuit Ratio	Above 2.0 (Below 2.0, TMEIC will do simulations and confirm)
Short Circuit Withstand Current	AC Side– 65kA DC Side – 100kA (20ms)
Cooling Method	Independent Forced air cooling with no Air Filters

* Maximum output power rating is de-rated by input DC voltage, output AC voltage and temperature condition.

** Transition from constant DC voltage mode to MPPT mode occurs 10V before minimum MPPT range for each respective o.

*** Rated output power and power factor variation range is only for rated voltage condition.



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Protective Functions

Input (DC) side	Ground Fault, DC Reverse Current, Over Voltage, Over Current
Grid (AC) side	Anti-islanding, Over/Under Voltage, Over/Under Frequency, Over current

Protective Devices

Input (DC) side	Surge protective device: IN=10kA/UCpv=1500V
Grid (AC) side	Surge protective device: IN=15kA/AC690V

Power Factor Control

The D-Curve depicted below shows the 8450kW Outdoor ESS-PCS PF characteristics. The inverter offers a power factor range from +/-0.8 at full rated power with 1pu grid voltage, nominal DC voltage and 25C ambient temperature. PF characteristics will be de-rated according to the change of AC voltage, DC voltage, and ambient temperature.

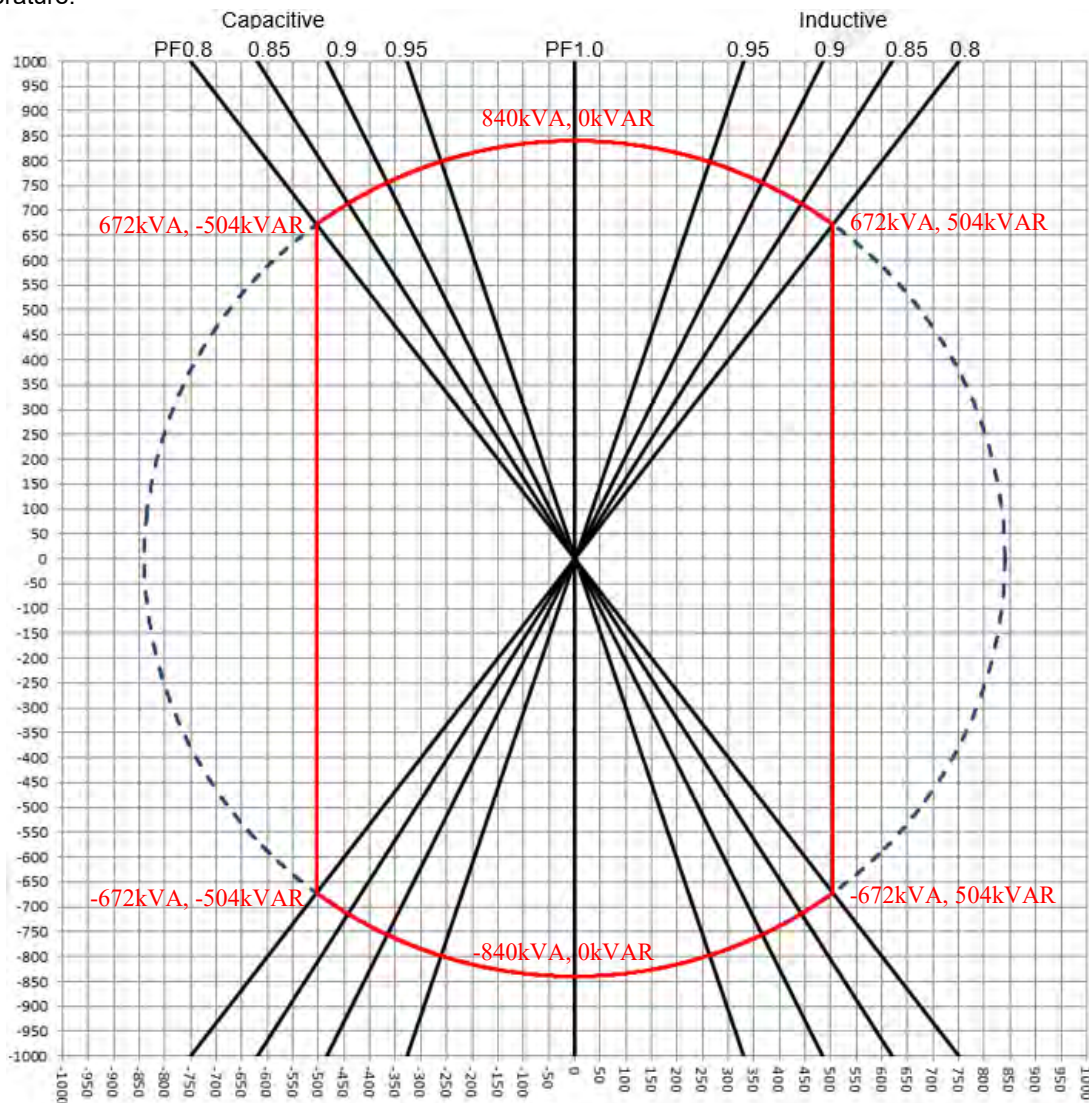


Figure 5.2: P-Q Curve of ESS-PCS @ 25°C, 630Vac(Grid Voltage= 1p.u.), Nominal Vdc



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2.4 System Line Up and Configuration

The Universal PCS can operate as an ESS-PCS, a PV-PCS and a hybrid that consists of PV-PCS and ESS-PCS on a common low Voltage AC same bus. When the system is a PV-PCS only or an ESS-PCS only, units are placed in parallel to form an Inverter System of consisting of the following rating:

Table 2.4.1: PV Only @25°C

Panel Rating	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
920kW	690VAC	920 kW	1840 kW	2760 kW	3680 kW	4600 kW	5520 kW
880kW	660VAC	880 kW	1760 kW	2640 kW	3520 kW	4400 kW	5280 kW
840kW	630VAC	840 kW	1680 kW	2520 kW	3360 kW	4200 kW	5040 kW
800kW	600VAC	800 kW	1600 kW	2400 kW	3200 kW	4000 kW	4800 kW

Table 2.4.2: PV Only @35°C

Panel Rating	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
920kW	690VAC	888 kW	1776 kW	2664 kW	3552 kW	4440 kW	5328 kW
880kW	660VAC	848 kW	1696 kW	2544 kW	3392 kW	4240 kW	5088 kW
840kW	630VAC	810 kW	1620 kW	2430 kW	3240 kW	4050 kW	4860 kW
800kW	600VAC	772 kW	1544 kW	2316 kW	3088 kW	3860 kW	4632 kW

Table 2.4.3: PV Only @40°C

Panel Rating	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
920kW	690VAC	872 kW	1744 kW	2616 kW	3488 kW	4360 kW	5232 kW
880kW	660VAC	832 kW	1664 kW	2496 kW	3328 kW	4160 kW	4992 kW
840kW	630VAC	795 kW	1590 kW	2385 kW	3180 kW	3975 kW	4770 kW
800kW	600VAC	758 kW	1516 kW	2274 kW	3032 kW	3790 kW	4548 kW

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Table 2.4.4: PV Only @50°C

Panel Rating	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
920kW	690VAC	840 kW	1680 kW	2520 kW	3360 kW	4200 kW	5040 kW
880kW	660VAC	800 kW	1600 kW	2400 kW	3200 kW	4000 kW	4800 kW
840kW	630VAC	765 kW	1530 kW	2295 kW	3060 kW	3825 kW	4590 kW
800kW	600VAC	730 kW	1460 kW	2190 kW	2920 kW	3650 kW	4380 kW



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Table 2.4.5: ESS Only @25°C

Panel Ration	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
840kW	630VAC	840 kW	1680 kW	2520 kW	3360 kW	4200 kW	5040 kW
800kW	600VAC	800 kW	1600 kW	2400 kW	3200 kW	4000 kW	4800 kW
630kW	480VAC	630 kW	1260 kW	1890 kW	2520 kW	3150 kW	3780 kW

Table 2.4.6: ESS Only @35°C

Panel Ration	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
840kW	630VAC	810 kW	1620 kW	2430 kW	3240 kW	4050 kW	4860 kW
800kW	600VAC	772 kW	1544 kW	2316 kW	3088 kW	3860 kW	4632 kW
630kW	480VAC	606 kW	1212 kW	1818 kW	2424 kW	3030 kW	3636 kW

Table 2.4.7: ESS Only @40°C

Panel Ration	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
840kW	630VAC	795 kW	1590 kW	2385 kW	3180 kW	3975 kW	4770 kW
800kW	600VAC	758 kW	1516 kW	2274 kW	3032 kW	3790 kW	4548 kW
630kW	480VAC	594 kW	1188 kW	1782 kW	2376 kW	2970 kW	3564 kW

Table 2.4.8: ESS Only @50°C

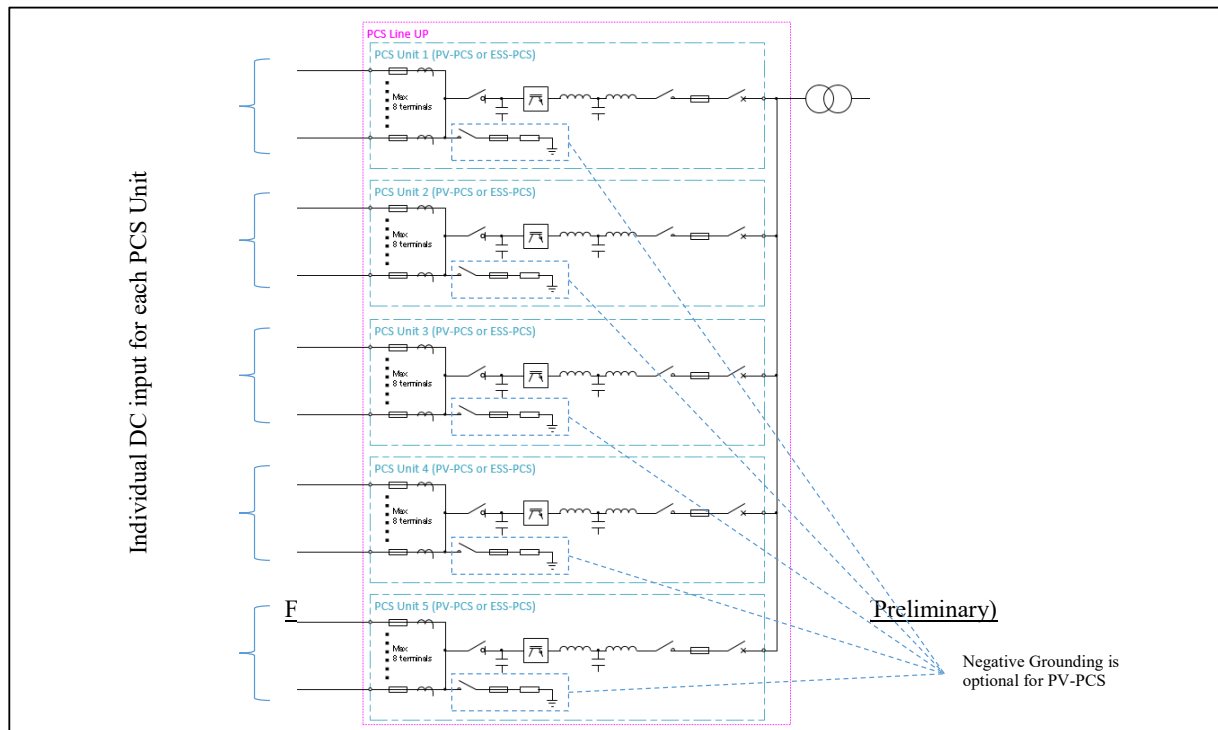
Panel Ration	AC Voltage	1 PCS	2PCS	3PCS	4PCS	5PCS	6 PCS
840kW	630VAC	765 kW	1530 kW	2295 kW	3060 kW	3825 kW	4590 kW
800kW	600VAC	730 kW	1460 kW	2190 kW	2920 kW	3650 kW	4380 kW
630kW	480VAC	570 kW	1140 kW	1710 kW	2280 kW	2850 kW	3420 kW



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2.5 System Line Up with Hybrid System of PV and ESS

In a hybrid system, the Line UP consists of both the PV-PCS and the ESS-PCS in the same system. In such a system, typically TMEIC proposes to have one ESS system per line up. In this case the system shall consist of five Inverters and one Energy storage Inverter. The transformer is rated as per the PV inverters only. The system reduces the overall losses and improves the roundtrip efficiency of the system.

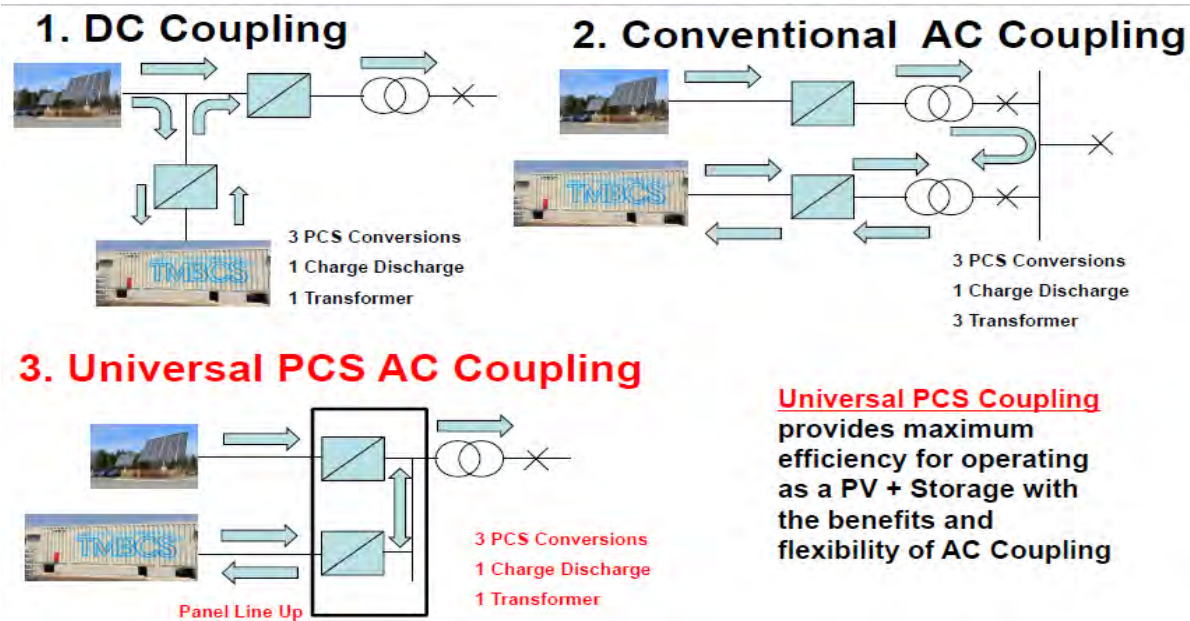
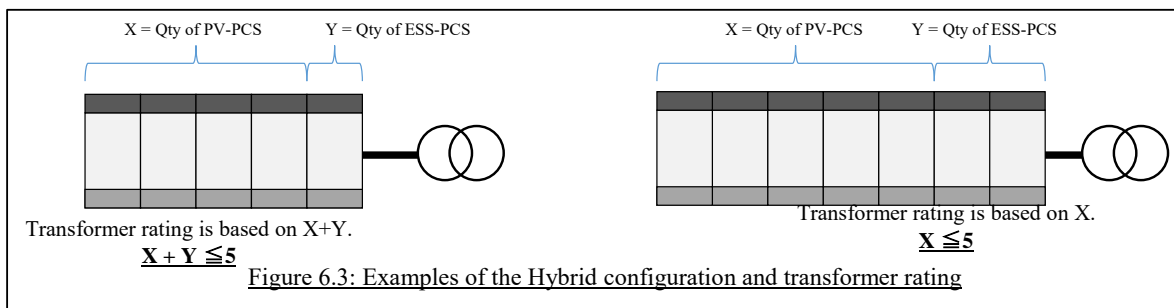


Figure 2.5.2 Comparisons of DC Coupling/Conventional AC Coupling/Universal PCS AC Coupling

The step up transformer rating depends on the requirement of the system and application. The limitation of the step up transformer is based on 5 PCS Units/ transformer; however with adequate control to ensure that excess power from the PV is stored in the ESS the line can be increased.





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3. BILL OF MATERIAL (Per PCS)

3.1. A. Inverter

5 x 840kW/840kVA Universal PCS inverter units will be installed, per skid.

3.1. B. Integration

Generic System configuration is shown in Figure 1. The equipment described below will be installed on the

Engineering	Package integration engineering for 4.2MW Skid.
Control Circuit and Communication Wiring	Control circuit and communication wiring for TMEIC supplied equipment are included.
Auxiliary Power	No Auxiliary Equipment is included in this quote.
Canopy Shade Structure	Not included
Customer Furnished Equipment (CFE)	SCADA, DAS and site data controller should be provided by others. Wiring and Installation of customer supplied equipment is not included in the base price. Optional pricing can be provided with additional information on CFE equipment. FO cables and tracker motor wiring are also not included.
Stairs and Safety Railings	If the skid(s) are to be mounted on piers requiring stairs and safety railings, the stairs and safety railings are not part of this quote and will be supplied by others.
Stamped Drawings	PE stamped drawings may be included, if required.
Back-up Power Requirement	This quote does not include any backup power provision (UPS or Generator). If this is required, it will be quoted separately. This can also affect the length of the skid and overall skid pricing.

Note: The skid dimensions are approximately 29'L x 4'W. Customer is to provide other means for additional maintenance space if required to meet any code or county specific requirements.



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3.1. C. MV 3-Phase Transformer for 5 x 840kW/840kVA Inverter Lineup

Item	Specifications (customized for project)
kVA	3360kVA / 4200kVA
Special Application	Two-Winding
Temperature Rise	65 degree rise at 30C ambient, 40C maximum ambient temperature
Cooling Class	ONAF (actively cooled) (KNAF and other options available)
Frequency	60 Hz
Duty Cycle	Designed for step-up operation
Insulating fluid	Mineral Oil (biodegradable fluids available)
Elevation	Designed for operation at 1000 m (3300 ft.) above sea level
Sound Level	NEMA TR1 Standard
High Voltage	34500 Delta Volts, 150 kV BIL (available in other voltages/configurations)
Electrostatic Shield	Electrostatic Shield between Primary & Secondary Windings. Ground Shield Bushing
kV Class	35 kV
High Voltage Configuration	Dead Front, Loop Feed
High Voltage Bushings	600 amp Cooper dead break one-piece bushings (Qty: 6)
Neutral Bushings	250 amp 2 hole spade bushing
Load-break Switching	15-38 kV, 2 Position switch
Switch Cover	Padlock cover over Switch (Outside of Cabinet)
Overcurrent Protection	Internal Cartridge in Series with Parallel oil-immersed partial range current limiting fuse x 6
Expulsion Fuses	Internal Expulsion (ABB pro-link) x 3
Low Voltage	630 Ungrounded Wye Volts, 30 kV BIL (available in other configurations)
kV Class (LV)	1.2 kV
Low Voltage Bushings	Integral aluminum 8-hole spade bushings (Qty: 3)
Bushing Supports	Standard LV Bushing Support Assembly
Cabinet hardware	Penta-head cabinet door bolts
Coatings	Touch-up paint (Qty: 2)
Taps	2 - 2.5% taps above and 2 - 2.5% taps below nominal
Certifications	UL Listed (UL logo on nameplate), ANSI C57
Notifications	Shock and Arc Flash Warning Decal
Gauges & Fittings	Liquid level gauge with Alarm Contact, Thermometer, dial-type with Alarm Contact, Pressure/vacuum gauge with Alarm Contact, Schrader valve, Pressure relief device, 50 SCFM, Drain valve with sampler (1") located outside of cabinet, with cover Oil Fill Plug
Tank accessories	IEEE standard two-hole ground pads (Qty: 3), Nitrogen Blanket
Special Feature	Load break switch located outside cabinet on HV side padlocked door, Padlock cover over drain valve



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3.1. D. Factory Tests

The following standard factory tests will be performed on the MV Transformer according to ANSI C57.12.90 including:

- Ratio, Polarity and Phase Rotation Test
- Resistance Test
- Routine Impulse Test
- Applied Potential Test
- Induced Potential Test
- Loss Test
- Leak Test
- Nameplate verifications, alarm, trip setting verifications
- Physical and Mechanical inspections
- Demag Test
- No-Load Loss and Excitation Current

Transformer is pressurized at manufacturer's facility and may vary depending on site location and conditions; customer is responsible for maintaining transformer pressure per manufacturer's recommendations.



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3.1. E. Power Plant Controller (Option)

Hardware

1 - RTAC SEL-3355-4 Real Time Automation Controller

Communications	
Ethernet Ports	2 rear; 10 or 100/Mbps, RJ-45
USB Ports	2 front, 4 rear
Encrypted Communications	RDP
Protocols	DNP3, Modbus TCP/IP

Physical	
Dimensions	19" (W) x 5.22" (H) x 11.49" (D)
	482.6mm (W) x 132.6mm (H) x 291.8mm (D)
Weight	20 lbs. (9.072kg)
Enclosure	Treated for chemically harsh / humid environments
Power Supply	125/250 VDC or 120/240 VAC, 160W HV power supply
Operating Temperature	-40C to +75C
Maximum Altitude	2000m

Power Plant Controller Function

One Power Plant Controller communicates over an Ethernet network to control multiple power converters for a single site.

1) Sequential Start-up/Shut-down

- Based on a command from the HMI, the Power Plant Controller issues a single command to start and stop all inverters.

2) Power Factor Control

- Using power generation feedback from the inverter network, the Power Plant Controller will calculate a reactive current reference for each power converter such that the total power factor does not change with load.

3) Output Limitation Control

- Using power generation feedback from the inverter network, the Power Plant Controller will calculate a power limit for each inverter such that the power output of the entire site does not exceed a preset value.

4) Power slew rate control

- Based on an adjustable power slew rate the Power Plant Controller controls the rate at which power output from the system changes.

5) Live Trending

- Capable of monitoring inverter signals such as input current, total power output, power factor etc.

6) Data Historian

- Record of all site signals that are processed by the Power Plant Controller. One-second poll rate data is kept on an external hard drive for one year before old data is overwritten.

7) Dynamic Power Factor Control:

- Using feedback from a Power Factor meter at the POCC (customer supplied), the Power Plant Controller will adjust the behavior of the inverters to meet a required PF at the measured point.
- VAR levels will be set and dynamically adjusted to keep the Power Factor (as measured at the PF meter) to a setting within a range.
- The Ninja inverters can produce VARs to support a power factor range of +/-0.8 at the inverter. The resultant range of Power Factor at the PF meter will depend on the site equipment between the inverters and the PF meter. Refer to D-Curve provided in Temperature Derate Curve section.
- These ranges can be achieved when the DC bus voltage is greater than 915VDC and the grid voltage is no more than 10% above nominal.
- Total apparent power (available as real power or VAR) is 4200 kVA at temperatures up to -20 ~ 25DegC, 1 pu, and 915Vdc ~ 1300Vdc condition. Please refer to derate curves provided in Temperature Derate Curve section.

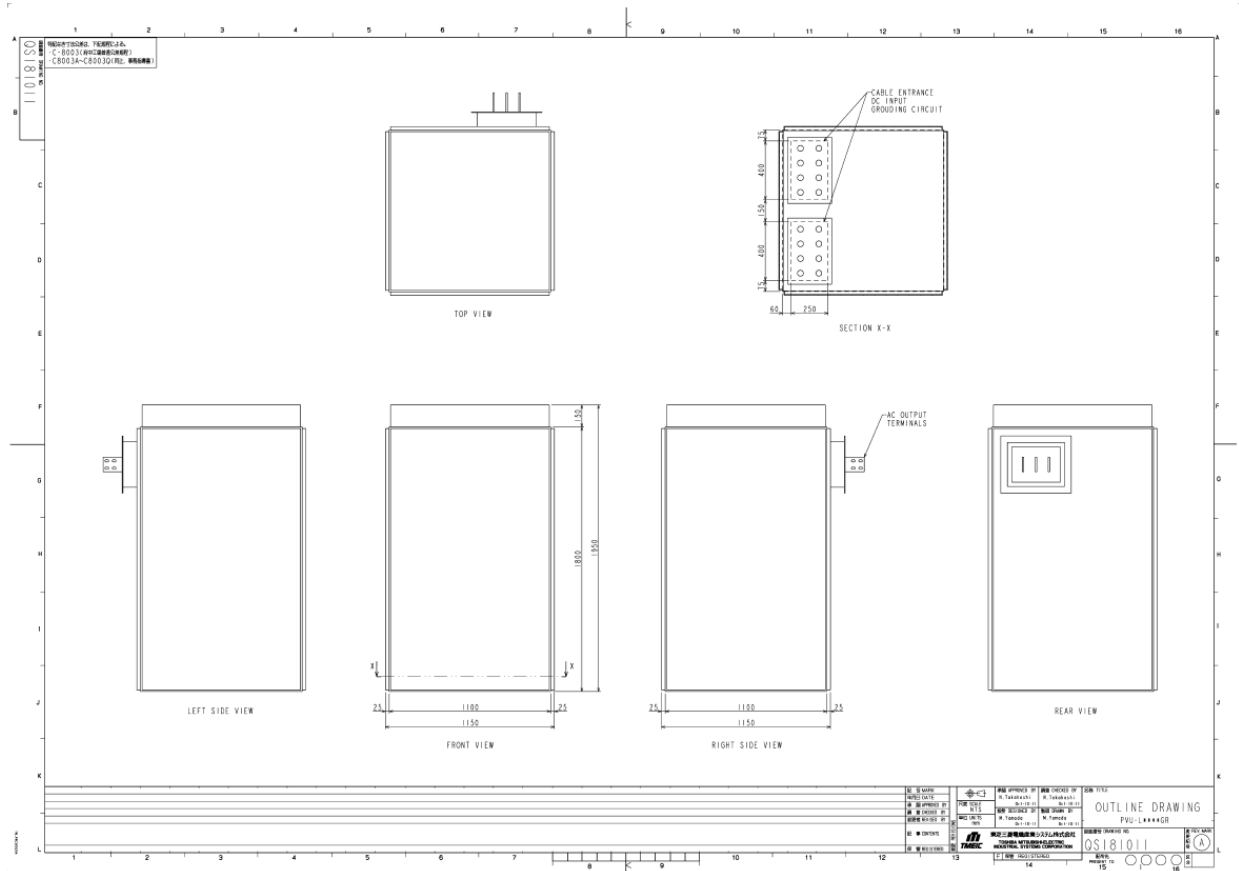


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TMEIC Corporation

Office: 1325 Electric Rd, Roanoke, VA 24018 USA
Mailing Address: 2060 Cook Drive, Salem, VA 24153

3.1. F. Structural Outline *Preliminary



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Stormwater Pollution Prevention Plan

For

South Bend Solar

St. Joseph County
Granger, IN 46530



Preparation Date: January 31, 2019
Estimated Project Dates: April 1, 2019 – December 31, 2020

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Contents

SECTION 1: INTRODUCTION	5
1.1 NPDES Regulatory History.....	5
1.2 Indiana Department of Environmental Management Contact Information	6
SECTION 2: SITE EVALUATION, ASSESMENT, AND PLANNING	6
2.1 Project/Site Information	6
2.2 Discharge Information	6
2.3 Existing Conditions - Environmental	7
SECTION 3: Project Information.....	8
3.1 Project Operator Information.....	8
3.2 Site Map	8
3.3 Construction Activity.....	8
3.3.1 General Description of Project	8
3.3.2 Size of Construction Project.....	9
3.3.4 Access Road	9
3.3.5 Communications and Collection System	9
3.4 Sequence and Estimated Dates of Construction Activities.....	9
SECTION 4: DOCUMENTATION OF COMPLIANCE WITH OTHER STATE AND FEDERAL REQUIREMENTS.....	10
4.1 Endangered Species Protection	11
4.2 Historic Preservation.....	11
4.3 Contaminated Soil or Groundwater.....	11
4.4 Removed Substances	11
4.5 Site Permit and Documentation	12
SECTION 5: EROSION AND SEDIMENT CONTROLS	12
5.1 Allowable Non-Stormwater Discharges.....	12
5.2 Discharges Not Allowed Under this SWP3 Plan and IDEM Permit	13
5.3 Natural Buffers.....	13
5.3.1 Buffer Compliance Alternatives	13
5.4 Sediment and Erosion Controls BMPs	14
5.5 Maintenance Schedule of Sediment Control BMPs.....	15
5.6 Off-Site Runoff	16
5.7 Perimeter Controls.....	16
5.9 Stockpiled Soil	17
5.10 Dust Control	17
5.11 Disturbance to Defined Drainage Courses.....	17
5.13 Topsoil.....	17
5.14 Soil Compaction	18
5.15 Storm Drain Inlets	18
5.16 Constructed Stormwater Conveyance Channels	18
5.17 Sediment Basins.....	18
5.18 Chemical Treatment.....	18
5.19 Dewatering Practices	18

PUBLIC VERSION

5.19.1	Specific Dewatering Practices	19
5.20.4	Concrete Truck Wash-out Areas	20
5.21	Site Stabilization.....	20
SECTION 6: POLLUTION PREVENTION STANDARDS		21
6.1	Potential Sources of Pollution	21
6.2	Spill Prevention and Response.....	22
6.3	Fueling and Maintenance of Equipment or Vehicles.....	22
6.4	Washing of Equipment and Vehicles	23
6.5	Storage, Handling, and Disposal of Construction Products, Materials, and Wastes.....	23
6.5.1	Storage and Handling.....	23
6.5.2	Disposal	23
SECTION 7: INSPECTION AND CORRECTIVE ACTION		24
7.1	Inspection Requirements	24
7.2	Corrective Action	25
7.3	Changes to Inspection Schedule	25
7.4	Delegation of Authority	25
SECTION 8: TRAINING.....		26
SECTION 9: CERTIFICATION AND NOTIFICATION		26
SECTION 10: SWP3 Plan Amendments		27
10.1	SWP3 Plan Amendments	27
10.2	Transfer of Ownership	27
SWP3 PLAN APPENDICES		28

PUBLIC VERSION

List of Tables:

Table 1 – Project Name and Description	6
Table 2 – Names of Receiving Waters	7
Table 3 – Impaired Waters / TMDLs (Answer the following for each surface water listed in Table 2 above).....	7
Table 4 – Tier 2, 2.5, or 3 Waters (Answer the following for each surface water listed in Table 2 above)7	
Table 5 – Contact Information for SWP3 Plan Operator.....	8
Table 6 – Contact Information for Team Members	8
Table 8 – Non-Stormwater Discharges.....	12
Table 9 – Sediment and Erosion Controls Proposed for South Bend Solar.....	14
Table 10 – BMP Maintenance Requirements	16
Table 11 – Dewatering BMPs.....	19
Table 13 – Site Stabilization Requirements.....	21
Table 14 – Reportable Pollutant Spill Quantities for the State of Indiana.....	21
Table 15 – Potential Site Pollutants	21
Table 16 – SWP3 Plan Inspection Schedule Requirements.....	24
Table 17: Training Requirements	26
Table 18: Documentation for Completion of Training.....	26

PUBLIC VERSION

SECTION 1: INTRODUCTION

This preliminary Stormwater Pollution Prevention Plan (WP2 Plan) has been prepared for the construction activities associated with the construction of access roads, perimeter fencing, piling, solar panels, and electrical collection at South Bend Solar by Indiana Michigan (I&M) Power Company, the owner and primary operator. American Electric Power is the contractor and secondary operator that will have day-to-day control over the project construction activities and will be responsible for compliance with this SWP3 Plan. Final SWP3 Plan will be submitted before construction and include additional St. Joseph County and site-specific details. This SWP3 Plan includes the necessary elements required to comply with the U.S. Environmental Protection Agency's (EPA) baseline national permit, as well as the requirements of the NPDES General Permit administered by the Indiana Department of Environmental Management (IDEM) in accordance with the National Pollution Discharge Eliminations System (NPDES). The General Permit Authorization Number received from IDEM is TBD INR000000. The Notice of Intent (NOI) for South Bend Solar was filed on TBD.

The intent of this SWP3 Plan is to provide construction guidelines to limit to the extent practicable the pollutants and sediment originating from the construction-site from transferring to nearby surface waters. The report contains recommended best management practices (BMPs) for construction activities, as well as inspection and maintenance procedures to be used throughout construction. It is always required that this SWP3 Plan be on-site during construction, with all records kept on-site throughout the duration of the project. Upon submittal of the notice of termination (NOT) all records associated with the implementation of this SWP3 Plan and construction must be kept for 3 years.

1.1 NPDES Regulatory History

The history of federal and state regulation of stormwater discharges dates back to 1972 when Congress passed the Clean Water Act (CWA). The overall goal of the CWA was to protect the quality of the surface and groundwater across the nation. It is in the CWA that the National Pollutant Discharge Elimination System (NPDES) was authorized. The NPDES program's original focus was to eliminate the pollutants that enter the water system through industrial and municipal wastewater. In the NPDES's effort to control the industrial and municipal wastewater it determined that during rain or snow falls, water runoff from urban streets, parking lots and construction-sites was carrying oil, grease, sediment and other pollutants, either directly or indirectly through storm drains, into surface waters. Stormwater is one of the leading causes of pollution to our nation's waters today.

The purpose of the construction stormwater program is to protect the waters of the State from contamination. Owners or operators of any project or combination of projects who engage in construction activities which will disturb one (1) or more acres must have authorization to discharge stormwater runoff under the construction stormwater general permit. Anyone who disturbs less than one acre may require authorization to discharge stormwater runoff when the IDEM believes the water quality impact warrants consideration. All Municipal Separate Storm Sewer System (MS4) operators previously exempt from construction stormwater permitting requirements must now also apply for authorization to discharge stormwater runoff from construction activities under the requirements of this general NPDES permit.

Application for the construction stormwater permit is made by completing a Notice of Intent (NOI) form which needs to be submitted at least 90 days before the start of the scheduled construction, or if utilizing electronic submittal, prior to commencing construction activities. The primary requirement of the general permit is for the permittee to develop and implement a SWP3 Plan. When the soil disturbing activities are completed and final stabilization of the site is achieved, the permittee must notify IDEM to terminate the authorization to discharge.

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1.2 Indiana Department of Environmental Management Contact Information

All notifications, forms, reports, or other correspondence which must be submitted to IDEM as required by this NPDES general permit shall be sent to:

Indiana Department of Environmental Management
Office of water Quality, Storm Water Program
100 North Senate Avenue Room 1255
Indianapolis, IN 46204

Website: <https://www.in.gov/idem/stormwater/2402.htm>

E-mail: rbraun@idem.IN.gov

SECTION 2: SITE EVALUATION, ASSESMENT, AND PLANNING

2.1 Project/Site Information

Table 1 – Project Name and Description

Project Description	
Project Name:	South Bend Solar
State:	Indiana
County:	St. Joseph County
Nearest Town:	Granger
Latitude:	41°43'45.31"N
Longitude:	86° 6'35.95"W

American Electric Power, as the secondary operator, will have day-to-day responsibility to install and maintain BMPs, make revisions to the site map when needed, maintain the SWP3 Plan, and perform inspections and retain records during construction.

Additionally, American Electric Power will maintain operational control over the construction plans and specifications and is responsible for final modifications of this SWP3 Plan after construction is completed. American Electric Power will transfer responsibilities to operations once construction is complete. American Electric Power will be responsible for filing the Notice of Termination (NOT) within thirty (30) days once final stabilization occurs. The contact information for team members associated with this project is listed in Table 6.

2.2 Discharge Information

Are there any surface waters that are located within 50 feet of your construction disturbances?

☒ Yes ☐ No

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Table 2 – Names of Receiving Waters

Name(s) of the first surface water that receives stormwater directly from your site and/or from the MS4 (note: multiple rows provided where your site has more than one point of discharge that flows to different surface waters)
1. Juday Creek
2. Gast Ditch

Table 3 – Impaired Waters / TMDLs (Answer the following for each surface water listed in Table 2 above)

	Is this surface water listed as "impaired"?	If you answered yes, then answer the following:			
		What pollutant(s) are causing the impairment?	Has a TMDL been completed?	Title of the TMDL document	Pollutant(s) for which there is a TMDL
1.	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	N/A	<input type="checkbox"/> YES <input type="checkbox"/> NO	N/A	N/A
2.	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	N/A	<input type="checkbox"/> YES <input type="checkbox"/> NO	N/A	N/A

Describe the method(s) you used to determine whether or not your project/site discharges to an impaired water:

The Indiana Department of Environmental Management List of Impaired Waters (found at <https://www.in.gov/idem/nps/3889.htm>) was reviewed. This list is compiled every two years, with the 2010 list being the most recently published list. Through review of this publication it was found that none of the receiving water on this project site are Impaired Waters.

Table 4 – Tier 2, 2.5, or 3 Waters (Answer the following for each surface water listed in Table 2 above)

	Is this surface water designated as a Tier 2, Tier 2.5, or Tier 3 water? (https://19january2017snapshot.epa.gov/sites/production/files/2017-01/documents/2017_cgp_final_appendix_f_-_tier_3_tier_2_tier_2.5_waters.pdf)	If you answered yes, specify which Tier (2, 2.5, or 3) the surface water is designated as?
1.	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	N/A
2.	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	N/A

2.3 Existing Conditions - Environmental

- Soil types and conditions
 - Existing soil conditions can be categorized as Surficial soil underlain by native granular soil up to 30 feet depth. Boring hole # 6 contain native cohesive soil up to a depth of 3.5 feet. See Geotechnical report for further clarification on soil mechanics.
- Current land use of project area
 - The existing project site is located on an agricultural field. The land contains Juday creek and multiple irrigation ditches.

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- Stormwater run-off analysis and design considerations
 - Existing ground surface slope ranges from 3-5%.

SECTION 3: Project Information

3.1 Project Operator Information

Table 5 – Contact Information for SWP3 Plan Operator

Operator Contact Information	Operator Responsibility Information
Company: American Electric Power	Primary Operator <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Contact Name: TBD	Shared SWP3 PLAN <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Title: TBD	Secondary Operator <input type="checkbox"/> Yes <input type="checkbox"/> No
Address: TBD	Operational Control over SWP3 PLAN Compliance <input type="checkbox"/> Yes <input type="checkbox"/> No
Contact Phone: TBD	Operational Control of subs? <input type="checkbox"/> Yes <input type="checkbox"/> No
Contact Email: TBD	Operational Control over Plans / specs? <input type="checkbox"/> Yes <input type="checkbox"/> No

Table 6 – Contact Information for Team Members

Title	Company	Name	Contact Number
Project Manager	American Electric Power	Project Manager	###-###-####
Facility NPDES Permit and SWP3 Plan Contact	American Electric Power	Contact	###-###-####
Primary Operator	American Electric Power	Operator	###-###-####
Compliance Contact/Site Inspector/24-hr Contact	American Electric Power	Contact	###-###-####
SWP3 Plan Preparer	Ulteig Engineers Inc.	Preparer	701.280.8500

3.2 Site Map

Site maps can be found in Appendix A.

3.3 Construction Activity

3.3.1 General Description of Project

The South Bend Solar is located in St. Joseph County, Indiana on mostly undeveloped and agricultural land. The closest community to the project is Granger, IN 46530, located roughly 1.5 miles North. The project consists of the construction of a solar facility. The primary objective of completing the South Bend Solar will be to generate and sell electricity.

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3.3.2 Size of Construction Project

The South Bend Solar Project will be constructed on privately owned land in St. Joseph County, Indiana. The construction of the Solar facility is expected to disturb 142 acres of which approximately 116.5 acres will be permanently disturbed upon completion of the project.

3.3.4 Access Road

The South Bend Solar will consist of the construction of new access roads. The overall project will require that a total of 2 miles of new access roads be constructed, the delivery route to the site is TBD.

During the construction phase of the project, the access roads will be constructed to a width of 24 feet to allow crane movement on the roads and to provide adequate drainage. In steeper areas of construction, the access road construction may require additional disturbed area to allow for road embankment cuts and fills.

3.3.5 Communications and Collection System

The communications and collection system are both vital components to the operation of the Solar farm, as the communications system controls when the system is operational, and the collection system is needed to transmit the power collected to the project substation.

3.4 Sequence and Estimated Dates of Construction Activities

The construction of the South Bend Solar will be completed in four phases. The major construction activities of each phase are listed below. In the event that the construction phases change or need to be altered, the contractor should contact Ulteig to update this SWP3 Plan before construction proceeds.

Phase I

Road improvements/Construction of Access Roads/Preparation of Laydown Yard
(Estimated dates: TBD)

Construction activities:

- A. Apply BMP's for temporary stabilization and perimeter sediment control.
 - a. Control measures to be implemented:
 - b. When to be implemented:
 - c. Who is responsible:
- B. Stripping and stockpiling of top soil either side of road.
- C. Complete grubbing in areas where deemed necessary.
- D. Mass grade and compact subgrade.
- E. Install gravel base and grade per grading Plans.
- F. Install permanent and temporary intersection improvements.
- G. Install permanent and temporary culverts.
- H. Install remaining BMP's required for following phase of project.
- I. Maintain BMP's throughout phase.

Phase II

Solar foundation construction and inverter pads.
(Estimated dates: TBD)

Construction activities:

- A. Apply BMP's for temporary stabilization and perimeter sediment control.

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- a. Control measures to be implemented:
- b. When to be implemented:
- c. Who is responsible:
- B. Drive piles.
- C. Pour foundations for inverter skids.
- D. Install concrete washout areas per design.
- E. Backfill foundations with stockpiled material.
- F. Maintain BMP's throughout phase.

Phase III

Install underground collection system
(Estimated dates: TBD)

Construction activities:

- A. Apply BMP's for temporary stabilization and perimeter sediment control.
 - a. Control measures to be implemented:
 - b. When to be implemented:
 - c. Who is responsible:
- B. Excavate and stockpile backfill material for collection system cables.
- C. Install collection system cables.
- D. Backfill and compact collection trenching.
- E. Commission turbines.
- F. Maintain BMP's throughout phase.

Phase IV

Reclamation of construction-site
(Estimated dates: TBD)

Construction activities:

- A. De-compact soils in construction areas that are to be restored to preconstruction conditions.
 - a. When to be implemented: TBD
 - b. Who is responsible: TBD
- B. Permanently stabilize disturbed soil with approved seed mixes and methods.
 - a. When to be implemented: TBD
 - b. Who is responsible: TBD
- C. Remove temporary intersection improvements and restore to preconstruction conditions.
 - a. When to be implemented: TBD
 - b. Who is responsible: TBD
- D. Remove and restore laydown areas to preconstruction conditions.
 - a. When to be implemented: TBD
 - b. Who is responsible: TBD
- E. Remove remaining BMP's not necessary for site stabilization after project completion.
 - a. When to be implemented: TBD
 - b. Who is responsible: TBD
- F. Coordinate with local government personnel to close any open permits for the project.

SECTION 4: DOCUMENTATION OF COMPLIANCE WITH OTHER STATE AND FEDERAL REQUIREMENTS

If soil contamination, hazardous substances, threatened or endangered species, or historical or archeological sites are discovered during construction activities, the SWP3 Plan shall be modified or amended to reflect this new information in accordance with the requirements and conditions of Part 7.3 of this NPDES general permit

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4.1 *Endangered Species Protection*

Using the IPaC Information for Planning and consultation tool provided by the U.S. Fish & Wildlife Service it was determined there are no critical habitats within the project area. Report located in appendix L.

Any discovery during construction activities of threatened or endangered species on the site or in the downstream receiving waters, or of a historical or archeological site, that were not previously identified or addressed in the SWP3 Plan needs to be reported to the Indiana ecological Services Field Office, 620 South Walker Street Bloomington, Indiana 47403, (812)-334-4261. Until site evaluations have been completed and instruction has been provided by the appropriate agencies, construction activities in the affected area shall cease.

4.2 *Historic Preservation*

At the time of completion of this SWP3 Plan no official Historic Preservation Study had been submitted to Ulteig. The operator of this SWP3 Plan shall submit this official study once received to be added to Appendix M. In the event that historical preservation measures should be taken in areas of the project boundaries specific BMPs and construction practices will be suggested in this SWP3 Plan.

Indiana Historical Society, 450 W Ohio St, Indianapolis, Indiana 46202.

Any discoveries during construction activities of a historical or archeological site on the site or in the downstream receiving waters that were not previously identified or addressed in this SWP3 Plan need to be reported to the Indiana Historical Society and IDEM - Bureau of Water. Until site evaluations have been completed and instruction has been provided by the appropriate agencies, construction activities in the affected area shall cease.

4.3 *Contaminated Soil or Groundwater*

Soil disturbing activities where contaminated soils or contaminated groundwater may be present on the site are reviewed by IDEM on a case-by-case basis and may require coverage under this NPDES general permit or an individual permit even if less than one acre (< 1.0 acre) of soil is disturbed. For sites where contaminated soil or groundwater is present, contact IDEM Bureau of Water - Industrial Programs Section at (785) 296-5549 for a determination on the need for coverage under this NPDES general permit.

In the event contaminated soil, groundwater contamination, or contamination from hazardous substances are discovered at the site during construction activities, the operator of this SWP3 Plan shall report the discovery to IDEM verbally within 24 hours to (785) 296-5549, and within 5 business days in writing at the stated address in Part 10 of this NPDES general permit (Appendix B of this SWP3 Plan). Until site evaluations have been completed and instruction has been provided by IDEM, construction activities in the contaminated area shall cease and additional provisions shall be provided to immediately mitigate discharges from the contaminated area.

4.4 *Removed Substances*

Solids, sludge, sediment, filter backwash, or other pollutants removed during treatment or control of stormwater runoff shall be properly managed, utilized, and/or disposed of in accordance with applicable statutes and regulations to prevent pollution of surface water, groundwater, or soil. The operator of this SWP3 Plan can contact IDEM Bureau of Water - Industrial Programs Section at (785) 296-5549 for further information on this matter.

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4.5 Site Permit and Documentation

A copy of the IDEM's authorization letter and the cover page of the General Permit shall be posted at the construction-site in a prominent place for public viewing (such as alongside a building permit) from the date construction activities are initiated until final stabilization is achieved and coverage under this General Permit is terminated through a Notice of Termination (NOT) to the IDEM.

Records which shall be maintained on-site by the operator include, but are not limited to:

- The NOI indicating the Authorization by IDEM to discharge stormwater runoff from the construction activities and supporting documentation used to apply for authorization under this NPDES general permit
- This SWP3 Plan for the construction-site named in the authorization to discharge stormwater runoff, and any amendments to this SWP3 Plan
- All site inspection records
- Any clearance letters, from KDWP&T, KSHS, COE, or any other agency providing clearance
- Individual Lot Certification (ILC) forms or portions of the contract for land sale with equivalent wording
- A copy of the Notice of Termination (NOT) submitted to IDEM

SECTION 5: EROSION AND SEDIMENT CONTROLS

5.1 Allowable Non-Stormwater Discharges

All sources of non-stormwater discharges shall be controlled with appropriate pollution prevention measures adequate for the flows. These discharges, including water removed from excavations and erosion control structures, should be filtered or otherwise processed by contractors to remove soil, silt, and other contaminants prior to discharge into receiving waters.

Table 8 – Non-Stormwater Discharges

Non-Stormwater Discharges and Appropriate BMPs	
Anticipated Non-stormwater Discharge	Discharge and Erosion Management BMPs
Water for road construction	No runoff expected from proper work practices.
Water used for rinsing streets or structures that DOES NOT contain cleansers, detergents, solvents or additives.	Install silt fence were necessary to control sediment runoff
Water for dust control	No runoff expected from proper work practices.
Water for foundation construction and curing	No runoff expected from proper work practices.
Concrete truck chute washout	Washout pit constructed with discharge controls (e.g. silt fence, fiber roll) around perimeter. If washout material is to be removed from site an impermeable liner shall be installed.
Water for foundation backfill and compaction activities	No runoff expected from proper work practices.
Water from dewatering of excavations	Follow practices described in section 5.15 of this SWP3 PLAN
Discharge from firefighting activities	No runoff expected from proper work practices.

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Water used to wash vehicles where detergents are NOT used	Designated washing stations with sediment/discharge control (e.g. silt fence, fiber rolls, berms). Locate washing stations away from surface waters to limit to the extent practicable no direct discharge into waters.
Routine external building wash-down that does not include detergents.	Sediment and discharge control through installation of silt fence and fiber rolls.
Uncontaminated air conditioner or compressor condensate	No runoff expected from proper work practices.
Irrigation to establish vegetation	No runoff expected from proper work practices.

5.2 Discharges Not Allowed Under this SWP3 Plan and IDEM Permit

Potential discharges not allowed on this project are the follow. The contractor shall properly manage these potential discharges using BMP's described in this SWP3 Plan to fulfill all local, state, and federal regulations.

- Hazardous substances or oil from an on-site spill or improper handling and disposal practices
- Wash and/or rinse waters from concrete mixing equipment including ready mix concrete trucks
- Contaminated groundwater
- Wastewater from washout and clean out of stucco, paint, form release oils, curing compounds and other construction materials
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance
- Soaps or solvents used in vehicle or equipment washing
- Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed by appropriate controls.

Refer to Part 3 in the IDEM General Permit (Appendix B) for a complete list of discharges not covered by this SWP3 Plan and the project IDEM permit.

5.3 Natural Buffers

When feasible, natural buffers should be utilized for sediment and erosion control. Appropriate measures should be taken by the operator not to disturb natural buffers during construction activities. All buffer areas (shown in the Site Civil Plans – Appendix D of this SWP3 Plan) should be marked by the operator prior to soil disturbance on-site to ensure these areas are left undisturbed. All disturbed buffers should be restored to their pre-construction condition upon project completion.

A minimum of a 50-foot natural buffers shall be maintained around all surface waters, water of the United States, and defined drainage channels. If infeasible to maintain a 50-foot buffer, the operator shall install redundant sediment controls spaced a minimum of 5 feet between BMP's were feasible.

5.3.1 Buffer Compliance Alternatives

The proposed site design, including crane paths ect. Due to this, it is infeasible to provide a natural buffer of any size to control sediment runoff in these locations. Appropriate BMP's shall be installed and maintained in such areas to limit to the extent practicable stormwater runoff pollution of these waters. Inspections of the BMP's shall occur at the IDEM approved intervals described in Section 7 of this SWP3 Plan.

Are there any surface waters within 50 feet of your project's earth disturbances? ☒ YES ☐ NO

Check the compliance alternative that you have chosen:

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- ☐ I will provide and maintain a 50-foot undisturbed natural buffer.
- ☒ I will provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by additional erosion and sediment controls, which in combination achieves the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
- ☐ It is infeasible to provide and maintain an undisturbed natural buffer of any size, therefore I will implement erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
- Operator to utilize temporary sediment control devices described in Table 9. Any use of alternative sediment control devices may require updates to the current SWP3 Plan and Civil Site Plans and shall be reviewed by Ulteig prior to implementation.
 - Maintenance of sediment control devices to follow guidelines listed in Table 10-BMP Maintenance Requirements in section 5.5 of this SWP3 Plan.

5.4 Sediment and Erosion Controls BMPs

Sediment/erosion controls are required in disturbed areas where construction activity has temporarily or permanently ceased for more than fourteen (14) days. The erosion controls must be continuously maintained throughout construction and reinstalled as necessary until replaced with permanent erosion controls and/or restoration is complete.

Table 9 – Sediment and Erosion Controls Proposed for South Bend Solar

Sediment and Erosion Controls			
Area of Potential Erosion	BMPs	Temporary / Permanent	Notes
Stream Crossing	Culverts, Rip-Rap, Erosion Control Blankets, Silt Fence, Cabled Concrete	Temporary and Permanent Applications	<ul style="list-style-type: none"> • Immediately install erosion control from bank to bank after disturbing stream. • Downstream erosion control depends on velocity of storm water through culvert (6 ft/s and above requires rip-rap). • Refer to Civil Site Plans (Appendix D) for details. • Operator to contact necessary local and state regulating entities prior to working in streams and wetlands. • Minimize stream bed disturbance to greatest extent possible during culvert installation.
Slope Erosion	Slope Breaker: <ul style="list-style-type: none"> • Berms • Silt fence • Staked hay/straw bales • Rock check dam 	Temporary and Permanent Applications	<ul style="list-style-type: none"> • Intended use to reduce runoff velocity and divert water from site and ROW • Outfall of slope breakers should be directed to stable, well vegetated areas and or an energy dissipating structure such as a rock apron or rip rap.

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	<ul style="list-style-type: none"> Sand bag check dams Erosion control blankets 		<ul style="list-style-type: none"> Refer to Civil Site Plans (Appendix D) for details and spacing specifications.
Slope Erosion	Erosion Control Blankets	Temporary Applications	<ul style="list-style-type: none"> Install per manufactures recommendations on spacing, overlapping lengths, and staking requirements.
Sediment Runoff	<ul style="list-style-type: none"> Silt fence Staked hay/straw bales Fiber rolls Sand bags Mulching Hydro-seeding 	Temporary Applications	<ul style="list-style-type: none"> Install at base of slopes adjacent to road crossings until disturbed vegetation has been reestablished. Install in locations in danger of silt infiltration into water bodies and/or wetlands in or near the construction area Must be inspected and maintained until permanent revegetation measures are successful or the uPland areas adjacent to wetlands, water bodies, or roads are stabilized
Stormwater flow onto disturbed areas	<ul style="list-style-type: none"> Earthen diversion dikes Drainage swales 	Temporary Applications	<ul style="list-style-type: none"> Disturbed soil on earthen diversion dikes and drainage swales must be immediately stabilized with mulch or other similarly effective soil stabilizing BMPs.
Sediment Runoff	<ul style="list-style-type: none"> Peripheral native vegetation 50' natural buffer Replanting of native grasses on disturbed soils 	Permanent Applications	<ul style="list-style-type: none"> Existing native vegetation may be used as buffers to catch sediment. Inspections must be conducted to ensure buffers are not overloaded with sediment and no permanent harm is occurring to vegetation Upon construction completion, natural buffers should be returned to pre-construction conditions

5.5 Maintenance Schedule of Sediment Control BMPs

Per the Indiana Department of Environmental Management (IDEM) requirements, American Electric Power, as the primary operator of this SWP3 Plan shall adhere to the following maintenance schedule listed in Table 10. The inspection schedule described in Section 7 must also be implemented during the project's duration.

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Table 10 – BMP Maintenance Requirements

BMP	Condition	Maintenance
Temporary Sediment Controls <ul style="list-style-type: none"> Berms, Silt Fence, Staked Hay or Straw Bales, Sand Bags, Sedimentation Ponds 	-BMP half full of sediment deposits. -BMP has been reduced to half of the original height.	-Remove accumulated sediments. -Install secondary sediment control structure up or down stream of current structure as needed to control sediment run-off. -Maintenance/repair to occur within twenty-four (24) hours of observed issue.
Perimeter Sediment Control: <ul style="list-style-type: none"> Berms, Silt Fence, Staked Hay or Straw Bales, Sand Bags, Topsoil/Earthen Berm 	-BMP is half full of sediment deposits. -BMP has been reduced to half of the original height.	-Remove accumulated sediments. -Install secondary sediment control structure up or down stream of current structure. -Maintenance/repair to occur within twenty-four (24) hours of observed issue.
Sediment Track-out Control: <ul style="list-style-type: none"> Tracking Pad Street sweeping Street washing 	-Significant track-out of sediment material onto paved public roads. -Significant buildup of sediment material on track-out pad minimizing its effectiveness of eliminating/reducing material track-out off project site.	-At minimum street sweeping shall be performed on a set repeating schedule. -Adhere to all state and federal regulations while working on public roads and highways. -Maintenance/repair to occur within twenty-four (24) hours of observed issue.

5.6 Off-Site Runoff

Margin or border BMPs, such as a buffer area or vegetation strips, to control stormwater runoff where it leaves the site boundary, shall be installed or marked for preservation before general site clearing is started. Stormwater runoff from disturbed areas which leave the site shall pass through an appropriate sediment control, such as a sedimentation basin, sediment trap, or silt fence prior to leaving the construction-site.

In the event that sediment escapes the construction-site, the operator shall remove the off-site accumulations of sediment at a frequency sufficient to minimize impacts.

5.7 Perimeter Controls

Operators are required to install sediment controls along the down slope portion of areas of the site that will receive stormwater from earth-disturbing activities. Controls shall be installed before earth disturbing activities begin on the project. Inspections and maintenance of all BMP's shall occur at the IDEM approved intervals described in Section 7 of this SWP3 Plan. The operator shall utilize perimeter control BMPs listed in Table 10. Alternatives to BMPs in Table 10 shall be approved by Ulteig prior to installation. Specifications of the perimeter control BMPs can be referenced in Appendix D.

PUBLIC VERSION

5.8 Sediment Track-Out Controls

Track-out control measures shall be implemented to reduce/eliminate the track-out of material from the project site onto public roads and highways. Controls shall be installed prior to earth work activities on the project. The operator shall utilize track-out control BMPs listed in Table 10. Specifications of the track-out control BMPs can be referenced in Appendix D.

Inspections and maintenance of the BMP's shall occur at the IDEM approved intervals described in Section 7 of this SWP3 Plan. In the event of sediment track out onto public roadways, sediment shall be cleaned up at the end of each work day. Sites with contaminated soils must provide wheel washing and tanks for holding of the wash water, if feasible, or other equivalent practices if the vehicles can track the contaminated soil off site.

5.9 Stockpiled Soil

During the construction of roads and foundations the stockpiling of topsoil and subsoil will be necessary. Stockpiles will require specific BMPs and proper grading to limit their erosion and sediment removal. Perimeter controls should be implemented to manage run-off and erosion of stockpiles. The contractor shall utilize perimeter control BMPs listed in Table 10. Inspections and maintenance of the BMP's shall occur at the IDEM approved intervals described in Section 7 of this SWP3 Plan. Specifications of the perimeter control BMPs can be referenced in Appendix D. Stockpiles that are inactive for more than 14 days should be stabilized to limit/eliminate erosion and sediment transfer. Reference Section 5.21 for stabilization requirements.

5.10 Dust Control

Dust control will be necessary on all dirt/gravel roads and construction areas on the project site. The operator should utilize a water truck throughout construction activities to minimize dust. The operator is required to arrange scheduling of water trucks to ensure areas of high traffic are thoroughly watered during construction activities. Alternative dust control measures shall be reviewed and approved by Ulteig prior to implementation in the project.

5.11 Disturbance to Defined Drainage Courses

Where changes to defined drainage courses are to occur as part of the project, clearing and grubbing within 50 feet of the defined drainage course shall be delayed until all materials and equipment necessary to complete the drainage change are on-site. Changes to defined drainage courses shall be completed as quickly as possible once the work has been initiated. The area impacted by the construction of the drainage course change is to be re-vegetated or stabilized to minimize the length of time the area is exposed. At a minimum, the last 200 feet of the downslope portion of the disturbed drainage course shall be stabilized within 24hrs of disturbance.

5.13 Topsoil

Topsoil should be separated and stored away from subsoils to enable topsoil reapplication at the end of the construction process. Topsoil stockpiling should be utilized during all dirt work that will require restoration upon the completion of the project. Stockpiles should use the erosion control BMPs discussed in Sections 5.3 and 5.6 around the perimeter and downslope sides. The operator should stockpile material as close as practically possible from its point of origin to ensure adequate redistribution during site restoration activities. Where feasible, topsoil stockpiles should be divided up into several small piles to minimize soil degradation due anaerobic conditions within large stockpiles.

PUBLIC VERSION

5.14 Soil Compaction

Soil compaction shall be avoided as practicable as possible during construction activities on areas that are not intended to be compacted in the project's final design. During reclamation of the project area, de-compaction of soil shall be completed by the operator before final reseeding.

To minimize soil compaction the contractor shall utilize the following recommendations:

- Minimize construction traffic
 - Operator to minimize construction traffic on soils to be restored post construction
 - Route changes and management shall be utilized by the operator to reduce compaction of soils
- De-compaction of soils
 - Operator to rip/scarify soils during restoration and reseeding of project
 - Operator's discretion to be used when specifying equipment to be used for soil de-compaction

5.15 Storm Drain Inlets

At the time of completion of this SWP3 Plan it was not anticipated that any storm drain inlets would be present and/or affected by the construction activities of the South Bend Solar. Mostly sheet or channelized flow is anticipated for the project. In the event that it is found that storm drains inlets will be affected by the construction activities, the operator shall consult with Ulteig before resuming construction.

5.16 Constructed Stormwater Conveyance Channels

At the time of completion of this SWP3 Plan it was not anticipated to have constructed stormwater conveyance channels on South Bend Solar. In the event that constructed stormwater conveyance channels are encountered/installed on the project site the operator shall consult with Ulteig before resuming construction.

5.17 Sediment Basins

Due to no contiguous 10 acre drainage areas discharging to a single point on the South Bend Solar there are no anticipated sediment basins designed on the project. If it is found that basins are necessary, the operator shall consult Ulteig prior to construction of basins. If alternative sediment controls must be installed in place of a sediment basin the rationale must be documented and placed here.

5.18 Chemical Treatment

At the time of completion of this SWP3 Plan it was not anticipated that any chemical treatment would be used on the South Bend Solar. If it is found necessary for use of chemical treatment during construction the operator shall contact Ulteig prior to resuming construction.

5.19 Dewatering Practices

The operator shall comply with the EPA's CGP Part 2.1.3.4 Dewatering Practices. These approved practices consist of the following:

- Do not discharge visible floating solids or foam.
- Use an oil-water separator or suitable filtration device (such as a cartridge filter) that is designed to remove oil, grease, or other products if dewatering water is found to contain these materials.

PUBLIC VERSION

- To the extent feasible, utilize vegetated, upland areas of the site to infiltrate dewatering water before discharge. In no case will surface waters be considered part of the treatment area.
- At all points where dewatering water is discharged, reduce water velocity as much as feasibly possible.
- Replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specification.

5.19.1 Specific Dewatering Practices

The operator shall utilize the BMP's found in Table 11 during dewatering activities. Specifications and details of these practices can be found in Appendix D.

Table 11 – Dewatering BMPs

BMP	Notes
Filter Bag	<p>General Notes:</p> <ul style="list-style-type: none"> ▪ Filter bags to be used to remove sediments from discharged water before discharge. ▪ Use filter bag when temporary sediment basins are not available or practicable during dewatering activities. ▪ When feasible, use filter bag in conjunction with sump pit for further sediment removal. <p>Installation/Maintenance:</p> <ul style="list-style-type: none"> ▪ Operator to refer to manufactures specification when sizing filter bags. ▪ Discharge from bag should be on well vegetated area or otherwise stabilized area. ▪ Where necessary, install silt fence or fiber rolls down slope from filter bags to reduce erosion of surrounding area. ▪ Operator to inspect filter bag during use to ensure adequate sediment removal. ▪ Filter bag and sediment to be disposed offsite or on-site as directed by land owner.
Sump Pit	<p>General Notes:</p> <ul style="list-style-type: none"> ▪ During dewatering practices sump pits shall be utilized to collect water before pumped out of excavation or inundated area. ▪ Sump pits are a practical means of reducing sediment transfer during dewatering practices. <p>Installation/Maintenance:</p> <ul style="list-style-type: none"> ▪ Water pumped from sump pit shall be discharged through a filter bag or other appropriate BMPs when found necessary for erosion and sediment transfer control. ▪ Where feasible and practical, install 12"-24" perforated stand pipe in center of sump pit to collect water. ▪ Where feasible and practical, install 12" of 2" aggregate at bottom of sump pit and place around perforated stand pipe. ▪ Operator shall inspect sump pits daily during use. Excessive sediment buildup shall be removed from sump pit when found to limit pumping capacity.

PUBLIC VERSION

5.20.4 Concrete Truck Wash-out Areas

Concrete trucks should only wash out in specified areas on the project site. The operator is responsible for specifying concrete truck wash-out areas on-site, and clearly marking areas on-site during construction with appropriate signage. Wash-out area locations, details, and specifications can be found in Appendix D.

In general, concrete wash-out areas should include impermeable liners (geotextiles, plastic coverings, or compacted clay), and should implement the following:

- Structural controls preventing direct discharge, such as:
 - Berms
 - Shallow pits
 - Storage tanks with slow rate release
- Areas with minimal slope that allow infiltration and filtering of wash-out water

Concrete trucks are prohibited from washing out in areas with direct discharge to surface water or storm sewers, or in areas where groundwater contamination is a concern.

5.21 Site Stabilization

Site stabilization must be implemented and maintained throughout construction activities as described below. Stabilization methods can be found in Table 9 in Section 5 of this SWP3 Plan.

Stabilization of disturbed areas must, at a minimum, be initiated immediately whenever any clearing, grading, excavating, or other soil disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. The disturbed areas shall be protected from erosion by stabilizing the area with mulch or other similarly effective soil stabilizing BMPs. Initial stabilization activities must be completed within 14 days after soil disturbing activities cease.

During mass grading activities a grading and stabilization log should be filled out and kept up to date by the operator. This log can be found in Appendix I of this SWP3 Plan.

Stabilization of disturbed areas is not required if the intended function of a specific area of the site necessitates that it remains disturbed. However, appropriate sediment control measures shall be provided on the down slope side of all such areas where the intended function necessitates that the area remain disturbed.

Such areas include:

- Stockpiles of soil materials (such as structural soils and clays, but not stockpiles of topsoil) that are intended for a use that prohibits introduction of vegetation, mulch or other foreign materials into the soil
- Dirt tracks, courts and other amenities designed or otherwise intended to remain un-stabilized
- Disturbed floors and banks below the anticipated pool elevation of ponds and basins

Disturbed areas that exhibit ice, frozen soil conditions, or have consistent snow cover extending across 70 percent or more of the area are considered to be temporarily stabilized until thawing occurs across the affected area. Stabilization of such iced, frozen, or snow-covered areas must be completed within 14 days following the first subsequent inspection requires under Part 7.2.10 of the IDEM General Permit (Appendix B of this SWP3 Plan) that finds the affected area thawed and no longer stabilized due to ice, frozen soil conditions, or snow cover.

PUBLIC VERSION

Table 13 – Site Stabilization Requirements

Area Classification	Vegetative Stabilization Requirements	Non-Vegetative Stabilization Requirements
All areas (excluding agricultural lands to be returned to agricultural use)	<ul style="list-style-type: none"> 70% established uniform coverage Perennial coverage established 	<ul style="list-style-type: none"> Permanent stabilization measures employed (gravel, riprap, geotextiles)
Agricultural Land (to be returned to agricultural use)	<ul style="list-style-type: none"> Land to be brought to pre-construction condition 	<ul style="list-style-type: none"> Land to be brought to pre-construction condition

SECTION 6: POLLUTION PREVENTION STANDARDS

6.1 Potential Sources of Pollution

The potential sources of pollution on the project site must be considered and properly managed. Potential sources of pollution include construction waste and materials, cement and concrete admixtures, petroleum products, and sanitation waste. Proper storage and housekeeping will be essential to mitigate the possibility of spills and pollution issues. Storage of potential pollutants should be in original container with proper labeling of health risks and mitigation recommendations and stored in the smallest quantiles possible to reduce spill risks. Storage areas should also be covered and secured from the elements and unauthorized personnel. A copy of all MSDS of pollutants shall be kept on-site at all times.

Proper installation and maintenance of BMPs should mitigate risks of stormwater discharge from site. A site specific SPCC shall be developed for sites that have the capacity to store more than 1,320 gallons of petroleum products. The SPCC shall be implemented and maintained per Plan specifications at all times, and personnel trained to properly manage and mitigate pollution risks due to spills. Spill kits should be present at storage locations and in all vehicles. Proper training of spill mitigation and clean-up shall be incorporated into project orientation of all on-site crews.

Ensure that the proper authority's numbers are listed on-site in the event that a spill or discharge of a hazardous material of a reportable quantity has occurred. **In the event of a reportable incident, contact the U.S. EPA National Response Center at 1.800.424.8802, Indiana Office of Land Emergency Response Program at 888-233-7745, and the IDEM Spill Report Hotline at 785.296.1679.** For additional information on spill response and reportable quantities reference <https://www.in.gov/idem/cleanups/2352.htm>, and review the "Indiana Land Emergency response" in Appendix O.

Table 14 – Reportable Pollutant Spill Quantities for the State of Indiana

Pollutant	Location of Discharge	Reportable Spill Quantities
Hazardous Substance	Land	All quantities Refer to Table 302.4 at https://www.ecfr.gov/cgi-bin/text-idx?SID=5eb9206a60662143cb26a1b0a7263e74&mc=true&node=se40.28.302_14&rgn=div8
Petroleum Product	Land	All quantities
Petroleum Product	Water	Enough to create a sheen on water

Table 15 – Potential Site Pollutants

Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)	Location on-site (or reference SWP3 PLAN site map where this is shown)	Control Measure
Gasoline	Vehicle/Equipment/Fuel Tanks	Secondary Containment/Drip Pan/

PUBLIC VERSION

Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)	Location on-site (or reference SWP3 PLAN site map where this is shown)	Control Measure
		Routine Inspection
Diesel Fuel	Vehicle/Equipment/Fuel Tanks	Secondary Containment/Drip Pan/ Routine Inspection
Grease	Vehicle/Equipment	Secondary Containment/Drip Pan/ Routine Inspection
Hydraulic Oils/Fluids	Vehicle/Equipment	Secondary Containment/Drip Pan/ Routine Inspection
Cleaning Solvents	Contractor	Secondary Containment/Covered Storage/ Routine Inspection
Portable Toilets	Site Wide	Toilets Properly Secured by Service Provider/ Routine Inspection
Trash/Construction Debris	Site Wide	Dumpster/ Routine Inspection
Paints	Contractor	Secondary Containment/Covered Storage/Routine Inspection
Glues and Adhesives	Contractor	Secondary Containment/Covered Storage/ Routine Inspection
Grout (Epoxy/Cementitious)	Contractor	Secondary Containment/Covered Storage/Wash Out Area/ Routine Inspection
Sediment	Site wide – exposed/disturbed areas	Erosion, Tracking, and Runoff Control BMPs/ Routine Inspection
Landscaping Materials/Fertilizer	Contractor	Secondary Containment/Covered Storage

6.2 Spill Prevention and Response

A site-specific Spill Prevention, Control, and Countermeasure (SPCC) Plan shall be completed for the South Bend Solar. Site specific spill prevention and response BMPs shall be referenced from the SPCC and implemented on the project.

6.3 Fueling and Maintenance of Equipment or Vehicles

When fueling and maintenance of equipment and vehicles will take place on-site, proper pollution prevention standards and mitigation practices shall be implemented to reduce pollution potentials. All on-site crews should be properly trained on proper practices and procedures for fueling and maintaining equipment on-site. This training should be incorporated into the project specific orientation given to all on-site crews. When possible and feasible, complete all maintenance of vehicles and equipment offsite at an approved maintenance facility.

Specific Pollution Prevention Practices

1. Comply with the Spill Prevention Control and Countermeasures (SPCC) requirements pertaining to fueling and maintaining equipment and vehicles on-site.
2. Ensure adequate supplies are available at all times to handle spills, leaks, and disposal of used liquids.
3. Use drip pans and absorbents under or around leaky vehicles.
4. Dispose of or recycle oil and oily wastes in accordance with federal, state, tribal, or local requirements.
5. Clean up spills or contaminated surfaces immediately, using dry clean up measures where possible. Control the source of any spills to limit to the extent practicable a discharge or a furtherance of an ongoing discharge.
6. Do not clean surfaces by hosing the area down.

PUBLIC VERSION

6.4 Washing of Equipment and Vehicles

Equipment and vehicle washing shall occur in only the designated areas that are noted on the site map. Proper BMPs, such as sediment basins, and containment areas should be implemented. Contaminated water should be contained, pumped, and removed from site for proper disposal at a waste water facility. In the event that equipment or vehicle has a visible leak of hazardous material, no washing shall occur on-site until the leak is properly repaired and cleaned. Degreasing of engine shall not be done on-site. When possible and feasible, all equipment and vehicle washing should be done offsite at an approved washing facility.

If detergents will be stored on-site, proper storage must be provided including (1) proper covers (e.g., plastic sheeting or temporary roofs) to prevent potential discharges from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from the storage area.

6.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

Construction materials should be stored, handled, and disposed of in an approved way at all times during the project. All federal, state, tribal, and local regulations must be followed during storage and disposal of construction materials.

6.5.1 Storage and Handling

- Construction materials should be stored in covered containers. Containers should be properly secured from unauthorized personnel and vandalism.
- Original containers with proper safety labels should be used for storage of hazardous materials.
- MSDS information of all materials shall be available on-site in a central location.
- All spills and leaks should be contained and cleaned up immediately. Spill kits should be located in convenient and available locations to be accessed in an easy and timely manner in the event of a spill. Contractor should refer to manufacture's recommendations on proper cleanup of materials.
- All leaks should be repaired as soon as possible. Equipment found to have leaks of hazardous material should be taken out of service until properly repaired.
- Storage areas of hazardous materials shall not be within 200 ft of identified critical areas.
- Effort should be made to store only necessary amounts of material on-site. Storage of excess hazardous materials is discouraged.
- All portable toilets and sanitation waste should be contained in approved units and adhere to all federal, state, tribal, and local regulations pertaining to storage and treatment of human waste.
- Storage and disposal of pesticides, herbicides, insecticides and fertilizers should be done in accordance to all federal, state, tribal, and local regulations.

6.5.2 Disposal

- Used material shall be removed from site on a regular basis and sent to an approved disposal facility. Storage of used/unnecessary materials on-site for extended amounts of time is prohibited.
- Collected solids, sludges, grit, or other pollutants removed in the course of treatment shall be properly disposed of in a manner to prevent any pollutant from entering waters of the state.
- Sewage should be pumped from site at least once per week in all portable toilets and sewage containers. Waste should be brought to an approved disposal facility offsite.
- Dumpsters should be placed in a central location for collection of construction and domestic wastes. Dumpsters should be inspected and replaced when necessary to discourage excess waste build up.
- Construction and domestic waste should be removed from site and disposed of at an approved facility. All waste disposal facilities should adhere to all applicable federal, state, tribal, and local regulations.
- When necessary, covers should be used on dumpsters to discourage wildlife from entering.

PUBLIC VERSION

SECTION 7: INSPECTION AND CORRECTIVE ACTION

7.1 Inspection Requirements

A consistent inspection schedule should be planned and adhered to throughout the duration of the project. The operator shall ensure the entire construction site including but not limited to disturbed areas, BMPs, waste and construction storage areas, drainage areas, locations where stormwater can flow from the construction-site, and temporarily stabilized areas is inspected on a regular schedule and, with the exception of Saturdays, Sundays, established Federal Holidays and the day after Thanksgiving, by the end of the next day following a rain event which results in a rainfall total of 0.5 inches or greater. Inspection reports shall be completed within 24 hours of the inspection excluding Saturdays, Sundays, and established Federal Holidays and shall be signed by the person performing the inspection. An inspection report template can be found in Appendix E of this SWP3 Plan. If weather or site conditions render access to any portion of the site to be unsafe or infeasible for inspection activities, the inspection report shall document the reason why access is unsafe or infeasible.

The inspection schedule must meet the minimum requirements listed in the Table 16 below. The inspector should be qualified and familiar with the construction activities on the project and the requirements of the site specific SWP3 Plan and the project IDEM TBD INR000000 permit.

Rainfall totals used to establish when a construction site inspection is required shall be determined from local weather station reports of daily rainfall totals such as the 1200 GMT end-of-day totals available through the National Weather Service and their cooperative observers or from regularly scheduled on-site rain gauge monitoring performed and recorded each work day by project personnel.

Table 16 – SWP3 Plan Inspection Schedule Requirements

Site Activity	Inspection Interval Required	Notes
Active	<ul style="list-style-type: none"> At least once every fourteen (14) calendar days and within 24 hours of a rainfall event of ½" or greater, or a snowmelt event that causes surface erosion. The cumulative total of two consecutive monitoring events when the rainfall total of the first monitoring event is less than ½". 	<ul style="list-style-type: none"> Rain amount should be documented daily. A rain gauge should be installed on-site for rain amount documentation. Online weather reporting resources can also be used to document rainfall/snowfall events on-site.
Temporarily/Permanently Stabilized Areas	<ul style="list-style-type: none"> At minimum once per month 	<ul style="list-style-type: none"> Areas where work is complete and bare ground has been stabilized using appropriate ground cover. Areas where permanent ground cover has not reached 70% cover.
Arid, Semi-arid, and Drought-stricken Areas	<ul style="list-style-type: none"> At minimum once per month Within 24 hours of rain events of ½" or greater 	
Disturbed areas that are Temporarily Stabilized (at least 70%) by Ice, Frozen Soil Conditions, or Consistent Snow	<ul style="list-style-type: none"> Inspections may cease until ground becomes unfrozen. 	<ul style="list-style-type: none"> Thawing of these areas shall be noted during first subsequent inspection,

PUBLIC VERSION

Site Activity	Inspection Interval Required	Notes
Cover		<p>when stabilizing conditions are no longer present.</p> <ul style="list-style-type: none"> Operator remains responsible for temporarily stabilized areas during frozen conditions.

Once a portion of the project area meets the final stabilization criteria specified in Table 13 of this SWP3 Plan, no further inspection of that final stabilized portion is required provided that the area is identified in the SWP3 Plan as having obtained final stabilization; however, the permitted shall remain responsible to correct any conditions within such areas that are identified as contributing to the discharge of sediment or other pollutants from the project site.

7.2 Corrective Action

In the event that deficiencies are found during inspections, the primary operator is required to take adequate corrective actions to remedy the deficiencies. Corrective action should be taken to:

- Repair, modify, or replace any stormwater control used at the site
- Clean up and properly dispose of spills, releases, or other deposits
- Remedy a permit violation

Upon discovery of non-compliance to pollution control measures designed in this SWP3 Plan corrective actions must be taken before the next anticipated storm event or within seven (7) calendar days of identifying the need for maintenance, whichever comes first. When correction of any noted deficiency within seven (7) calendar days is infeasible, the inspection report shall document the reason why such correction is infeasible and provide a specific timeframe for completing all needed maintenance and repairs of installed control measures and installation or modification of all control measures and management practices identified as missing, ineffective or inadequate as soon as feasible. A log of corrective actions taken should be updated throughout the project. This log can be found in Appendix F of this SWP3 Plan.

7.3 Changes to Inspection Schedule

Changes to the inspection schedule shall only be made at the beginning of each calendar month. This includes the change of status from “active construction areas” to “stabilized areas.” All changes in the inspection scheduled must be documented in the inspection forms, including the reason for the changes. An inspection form can be found in Appendix E of this SWP3 Plan. Alterations to the inspection form are permissible upon review and approval from Ulteig.

7.4 Delegation of Authority

A designated representative of the operator must sign the Delegation of Authority Form found in Appendix K. The designated person will be responsible for reviewing and signing reports done concerning the Stormwater Pollution Prevention Plan on-site, ensuring all regulations are met and that all necessary corrective actions are completed when deficiencies are found on-site. The name and title of the designated person is also listed in Section 3 of this SWP3 Plan.

PUBLIC VERSION

SECTION 8: TRAINING

EPA requires personnel training for employees responsible for implementing any component of the SWP3 Plan. Specific training requirements are listed below in Table 17. The EPA's Construction General Permit (CGP) Part 6 may also be referenced for training requirements.

If personnel will be taking course training (which is not required as part of the CGP), a course completion tracking form may be found in Appendix J to track completion of this training.

Table 17: Training Requirements

Personnel	Requirements
<ul style="list-style-type: none"> Personnel responsible for SWP3 Plan: <ul style="list-style-type: none"> Design Installation Maintenance Repair Inspections Personnel responsible for taking corrective actions 	<ul style="list-style-type: none"> Personnel shall be trained in: <ul style="list-style-type: none"> Location of all stormwater controls on the project Proper maintenance of BMPs The proper procedures to follow with respect to the permit's pollution prevention requirements When and how to conduct inspections When and how to take corrective actions

Employees that have completed the required training should be tracked in Table 18 below and kept with this SWP3 Plan. Update this table during the project duration to ensure all required training has been completed by the appropriate employees.

Table 18: Documentation for Completion of Training[illegible]

SECTION 9: CERTIFICATION AND NOTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for

PUBLIC VERSION

gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____ Title: _____

Signature: _____ Date: _____

[Repeat as needed for multiple construction operators at the site.]

SECTION 10: SWP3 Plan Amendments

10.1 SWP3 Plan Amendments

This SWP3 Plan may need to be amended during the project duration depending on changing conditions, regulations, and requirements. Changes to this SWP3 Plan that do not require an official amendment are considered modifications, and do not need to be submitted to IDEM. Modification of site erosion and sediment controls based on field conditions or site phasing do not require approval by a professional. Modifications that involve the relocation or reconfiguration of any sedimentation basin or corresponding outlet structure shall be prepared under the supervision of a licensed or certified professional.

Amendments shall be made when any of the following occur:

- Significant design changes that will affect stormwater discharge and may add to pollution of surface waters.
- Changing site conditions, including changing contractual scopes of contractors and owners that may affect the stormwater discharge on the project.
- Results from inspections done by governmental agencies or third parties.
- When stormwater will discharge into a surface water not originally receiving stormwater from the permitted site construction activities.
- When determined as significant by IDEM upon notification of any discovery of contaminated soil or groundwater, potential historic or archeological sites, or threatened or endangered species during the construction that was not identified and addressed in the SWP3 Plan.

In the event that amendments are deemed necessary to be made to this SWP3 Plan or Site Civil Plans they must be documented and tracked in this SWP3 Plan Amendment Log found in Appendix G.

10.2 Transfer of Ownership

Coverage under and the requirements of this NPDES general permit are transferable but transfer is not automatic and must be accepted by IDEM. The permit may be transferred only to a party that meets the definition of "Owner", "Owner or operator", or "owner/operator" for the entire authorized project scope. The current permittee and the new permittee shall complete a Notice of Transfer of Owner/Operator (NOTO) form, bearing original signatures, and submit to IDEM at the address given in Part 10.2 of this NPDES general permit.

A complete list of permit transfer details can be referenced in Part 8 in the IDEM General Permit found in Appendix B of this SWP3 Plan.

PUBLIC VERSION

SWP3 PLAN APPENDICES

Appendix A – Site Maps

Appendix B – Copy of 2013 Indiana Construction General Permit

Appendix C – Copy of Project NOI

Appendix D – Site Civil Plans and Specifications

Appendix E – SWP3 PLAN Inspection Form

Appendix F – Corrective Action Form

Appendix G – SWP3 PLAN Amendment Log

Appendix H – Subcontractor Certifications/Agreements

Appendix I – Grading and Stabilization Activities Log

Appendix J – SWP3 PLAN Training Log

Appendix K – Delegation of Authority Form

Appendix L – Endangered Species Documentation

Appendix M – Historic Properties Documentation

Appendix N – Indiana Spill Reporting Instructions

Appendix O – Historic Preservation Documentation

Appendix P – Hazardous Materials Reporting Requirements in Indiana

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Appendix A – Site Maps

To be added after final design

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Appendix B – Copy of 2013 Indiana Construction General Permit

<http://www.IDEMks.gov/stormwater/>

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Appendix C – Copy of Project NOI

To be added upon completion.

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Appendix D – Site Civil Plans and Specifications

To be added upon completion.

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Appendix E – SWP3 PLAN Inspection Form

Stormwater Construction-site Inspection Report

General Information			
Project Name			
Permit No.		Location	
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Describe present phase of construction			
Type of Inspection: <input type="checkbox"/> Regular <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, provide: Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds <input type="checkbox"/> Other: Temperature:			
Have any discharges occurred since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe: 			
Are there any discharges at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe: 			

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Subcontractor/Secondary Operators				
Subcontractor Name	TPDES Number	Scope on Project	Compliance with site SWP3 PLAN?	Correction Actions Needed and Notes
			Y / N	
			Y / N	
			Y / N	
			Y / N	
			Y / N	

Site-specific BMPs

- Number the structural and non-structural BMPs identified in your SWP3 PLAN on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.
- Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action(s) Required/Notes
1		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action(s) Required/Notes
11		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
13		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
14		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
15		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
16		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
17		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
18		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
19		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
20		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Is the construction exit preventing sediment from being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Non-Compliance

Describe any incidents of non-compliance not described above:

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Certification of No Corrective Actions Needed

After thorough inspection of the entire project site no non-compliance issues were identified nor corrective action required.

☐ Yes ☐ No

If "No," list areas where corrective actions are required.

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name (Main Operator):

Signature (Main Operator): _____

Date: _____

Appendix F – Corrective Action Form

[illegible]

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Appendix G – SWP3 PLAN Amendment Log

[illegible]

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Appendix H –Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWP3 PLAN) for any work that you perform on-site. Any person or group who violates any condition of the SWP3 PLAN may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWP3 PLAN. A copy of the SWP3 PLAN is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction-site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWP3 PLAN for the above designated project and agree to follow the practices described in the SWP3 PLAN.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

Signature: _____

Title: _____

Date: _____

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Appendix I –Grading and Stabilization Activities Log

[illegible]

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Appendix J –SWP3 PLAN Training Log

Stormwater Pollution Prevention Training Log

Project Name:
Project Location:
Instructor's Name(s):
Instructor's Title(s):

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: *(check as appropriate)*

<input type="checkbox"/>	Sediment and Erosion Controls	<input type="checkbox"/>	Emergency Procedures
<input type="checkbox"/>		<input type="checkbox"/>	
<input type="checkbox"/>	Stabilization Controls	<input type="checkbox"/>	Inspections/Corrective Actions
<input type="checkbox"/>		<input type="checkbox"/>	
<input type="checkbox"/>	Pollution Prevention Measures	<input type="checkbox"/>	
<input type="checkbox"/>		<input type="checkbox"/>	

Specific Training Objective: _____

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Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

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Appendix K – Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the _____ construction-site. The designee is authorized to sign any reports, stormwater pollution prevention Plans and all other documents required by the permit.

_____ (name of person or position)

_____ (company)

_____ (address)

_____ (city, state, zip)

_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in the Indiana General Construction Permit INR100000, and that the designee above meets the definition of a "duly authorized representative."

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____

Date: _____

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Appendix L – Endangered Species Documentation

To be added upon completion.

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Appendix M – Historic Properties Documentation

To be added upon completion.

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Appendix N – Indiana Spill Reporting Instructions

QUICK REFERENCE SHEET	
	INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
	Emergency Response Office of Land Quality
(317) 233-7745 • (888) 233-7745 www.idem.IN.gov 100 N. Senate Ave., Indianapolis, IN 46204	

Contact numbers and evaluation techniques for environmental threats

PERSONAL SAFETY, ESPECIALLY YOURS, IS ALWAYS THE FIRST PRIORITY. Do not

endanger yourself by entering hazardous environments. Stay upwind of spills and air releases. Never taste spilled materials. Never inhale smells to identify spills. Never touch unknown materials without proper Personal Protective Equipment. Be aware of highway, water and night-time safety issues. The burden of providing information and performing spill responses ALWAYS falls on the spiller, not you. Please let us know if you need additional guidance or do not feel comfortable being involved in a situation.

CONTACT NUMBERS

State Contacts:

-IDEM Emergency Response, spill reporting (24 hour)	888-233-7745
-IDEM, general information	800-451-6027
-IDEM complaints	800-451-6027 ext 2-4464
-IERC (Indiana Emergency Response Commission)	317-234-6796
-ISFM (Indiana State Fire Marshall)	317-232-2222
-ISDH (Indiana State Dept. of Health)	317-233-1325
-IDNR NRHQ (Indiana Dept. of Natural Resources, North Region)	765-473-9722
-OISC (Office of the Indiana State Chemist)	765-494-1492
-IOSHA (Indiana Occupational Safety and Health)	317-232-2655
-Public Safety Training Institute	317-327-3900
-Illinois Environmental Protection Agency	217-782-2829
-Michigan Department of Environmental Quality	800-662-9278
-Ohio Environmental Protection Agency	614-664-3020
-Kentucky Department of Environmental Protection	502-564-0323

Federal Contacts:

-National Response Center (federal spill reporting)	800-424-8802
-U.S. EPA, Region V (24-hour emergency)	312-353-2318
-Agency for Toxic Substance and Disease Registry	800-232-4636
-U.S. Coast Guard, Marine Safety Office, Louisville, KY	502-969-4006

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-U.S. Coast Guard, Marine Safety Office, Chicago, IL

630-986-2155

Other Contacts:

-Indiana 811 Know what's below. CALL before you dig.

811

-Chemtrec (chemical data information)

800-424-9300

Quick Reference Information Sheet for assessing spills and threats to water

CONTACTS

1. **Spiller information:** name, address, contact numbers
2. **Land owner information** (if different): name, address, contact numbers
3. **Spill location** (if different): facility name, address, directions, contact numbers
4. **Other contacts:** for lease holders, contractors, response agencies

CIRCUMSTANCES

5. **Spilled material/description.** Safety Data Sheet. What is it used for?
6. **Date and time** of spill (when found vs. when spill likely began)
7. **Cause** of spill.
8. Has the spill led to threats of **human** safety? Any evacuations? Any injuries?
9. Has the **release stopped**? Can it be stopped without compromising safety?
10. Was there an immediate or any **spill response**? Many fire and street departments initially dam or absorb spills with kitty litter or sand. Spillers are ultimately responsible for initiating and completing a spill response.

SPILL CHARACTERISTICS

11. Describe **area affected**, estimate square feet or miles of affected water.
12. Describe **amount spilled**, amount contained, and capacity of containers or vessels.
13. **Amount recovered** or why no recovery (very few exceptions).

SPILLS TO WATER

14. Are there **surface waters** nearby or involved? Roadside ditches, streams, ponds?
15. Are the surface waters **standing, flowing, discharging**? To where?
16. Do you see **fish** or other animals in or near the water? Are they alive, stressed, dead?
17. Are there ditches, low areas, storm drains inlets, field tile risers to water?

SPILLS TO SOIL

18. Are there **sandy or gravelly native soils**, backfill areas, dry wells nearby/involved?
19. Are there **water wells, pipelines, phone lines, or utilities** that spills might follow?

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SPILLS TO TILES, SEWERS, STORM DRAINS

20. For impacted **storm drains/storm sewers**, are there signs of the spilled material in **manholes or catchment basins**? Check where the storm drain exits into surface water. Can spilled materials be safely contained and collected from catchment basins or storm drain outlets before entering water?
21. For impacted **combined or sanitary sewer** systems, contact the wastewater utility. Will the material be safely treated? Will it upset or flow through the plant? Can they safely separate and contain it without hurting their plant? Are they experiencing any bypass events where spilled materials may discharge directly to water? Check bypass outfalls for spilled material. **Call IDEM Emergency Response Section at 888-233-7745 immediately for upset plants.** Non-emergency treatment plant questions will be advised during normal business hours by calling IDEM, Office of Water Management, Water Inspection Section, at 317-234-2579.

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Appendix O – Historic Preservation Documentation

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Appendix P – Hazardous Materials Reporting Requirements in Indiana

To be added upon completion.

Project Execution Plan

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South Bend Solar (“the Project”) consists of a solar photovoltaic development in Indiana being developed by Indiana Michigan (I&M) Power Company, the owner (“Owner”) and primary operator. American Electric Power is the contractor and secondary operator that will have day-to-day control over the project construction activities. The major civil works described here will include:

CONTENTS

Civil Implementation	3
General	3
Geotechnical Analysis	3
Geotechnical Report	4
Topographical Survey	4
Site Layout	5
Earthwork	5
Roads and Construction Access	6
Stormwater Management and Site Erosion Control	7
Structural Implementation	9
General	9
Environmental Loading	10
Excavation, Backfill, and Compaction	10
Corrosion Protection	10
Concrete and Grout Work	10
Foundations	12
Buildings	13
Structure and Foundation Stability	13
Fencing	14
Electrical Engineering	14
General	14
Scope	14
Collection System	16
Protection	17
Communication System	17
Solar Equipment Supply	17
PV Panels	18
Combiner/Recombiner Boxes	18
Cables and Connectors	19

Project Execution Plan

PUBLIC VERSION

Inverters	19
Transformers	20
Switchgear	21
Module Support Structure	21
Meteorological Station	22
SCADA	23
Meters	24
Auxiliary Equipment and Accesories	25
Signage, Identification, Numbering, and Labeling Requirements	25
Installation	26
DC System Wiring	26
AC System Wiring (600 V and Below)	26
Boring	26
Medium Voltage AC System Wiring: Inverter Transformer to Interconnection Facilities	27
Security System Wiring	27
Grounding	28
Equipment Enclosures	28
Testing	28
Acceptance Tests	29
Performance Ratio Test	29

The success of the Project will require an experienced EPC team, IEA (“Contractor”) once awarded the Project will have an assigned team that will include a Project Manager, Engineering Manager, and Project Engineer(s). This early works team will be tasked with managing engineering and procurement of major equipment and long lead items for the Project. The early works team will conduct weekly status calls, and detail out an engineering deliverables schedule to Owner showing key dates for deliverables from Owner and to be delivered by Contractor. It is anticipated by Contractor that foundation design verification can be conducted during this time, including test foundation installation and subsequent deflection and pull testing.

Appointments will be made with the various Authorities Having Jurisdiction for purposes of permitting and to ensure a complete permit matrix is developed and no issues will occur to affect the project schedule.

Project Execution Plan

PUBLIC VERSION

CIVIL IMPLEMENTATION

GENERAL

Contractor will design all systems in accordance with applicable codes and standards. Contractor will ensure the design includes road improvements necessary for construction equipment, delivery vehicles and operation and maintenance traffic. The road design will meet any state and local transportation standards, codes, and conditional use permit stipulations and conditions.

Contractor will perform required Site preparation works including earthworks, erosion control, and SWPPP. Contractor will attempt to minimize earthwork and vegetation disruption for the installation of the Plant to the extent it is compliant with the use permits. Until Final Acceptance is achieved, Contractor will be responsible for maintaining dust control in accordance with state and county requirements, and providing Site maintenance as needed.

To ensure long-term cable integrity, Contractor will protect any direct burial cabling with adequate bedding materials. Contractor will account for any land contours that may affect PV electrical generation in the PV system performance estimate. Contractor will take measures to prevent accumulation of standing water

Detailed requirements for the civil and environmental elements of the Plant are included in this section.

GEOTECHNICAL ANALYSIS

All geotechnical investigation will be carried out by personnel with specialized training and experience in soil mechanics and foundation engineering. The geotechnical investigation will be performed in accordance with relevant ASTM Standards. All geotechnical testing, analysis, evaluation, and design methodologies will be published methods that are generally accepted.

At a minimum, the following will be included in the analysis:

- Review of the publicly available geotechnical information and reports (e.g., soils and geologic maps and literature, photographs, hydroelectric reports, groundwater reports, water well data, etc.).
- Review of any owner provided preliminary geotechnical information.
- Coordination and mobilization of the services team for subsurface exploration of the Site including working with the local utilities to identify and mark any existing underground utilities (e.g., cables, gas lines, piping, water, communication, etc.).
- Documentation of the Site study to determine the presence of faults, ground fissures, and other potential geologic hazards that could affect the structural design and construction of the Plant.
- Documentation of methodology and results of laboratory testing performed on collected soil samples from the borings and test pits including an evaluation of the in-place moisture content, dry density, gradation, plasticity, consolidation characteristics, collapse potential, expansivity, shear strength, resistivity, chloride content, sodium sulfate content, and solubility potential will be conducted.
- Analyze the corrosive nature of the soil including a recommendation for the required corrosion protection for underground steel, including rigid metal conduit.

Project Execution Plan

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GEOTECHNICAL REPORT

The Geotechnical Report is subject to the Owner's approval prior to implementation of the design and will include, but is not limited to, the following information;

- Records of all geotechnical investigations and soil tests performed. A brief description will be provided of each test, including the test equipment, laboratory testing methods, and results, along with a reference to the applicable code or standard to which the work was undertaken;
- Plans showing the location of the Plant and locations of all soil sample/tests on and off the Site (i.e., exploratory test pits or bore holes, penetrometer tests, etc.);
- General geological description of region and its formation;
- If filling is required, a description of soil types on the Site and those proposed for the general filling of the Site;
- Schedule of physical and derived engineering properties of in-situ soil, including but not limited to in-place moisture content and dry density, gradation, plasticity, consolidation characteristics, collapse potential, expansivity, shear strength, resistivity, chloride content, sodium sulfate content, and solubility potential (total salts) will be conducted;
- Statement on recent calibration or certification of test equipment used;
- If reclamation is required, then a recommendation on the treatment of the reclaimed Site to meet the performance criteria of the Owner;
- Summary of expected loads (short and long term) from the main structures/buildings;
- Statement on suitability of soil types to support the expected loads;
- Recommended foundation design types for the different structures including the viability of driven piles as the support for the PV racking supports. If piles are a viable option, recommended drive frequency and minimum size and spacing requirements will be provided.
- Susceptibility of soils to liquefaction under earthquake or vibration from rotating machinery;
- Recommended design methods and formulas for determining allowable soil pressures for shallow and deep foundations;
- Recommended allowable soil pressures and appropriate safety factors or load factors to be used for different load cases/combinations. Both limit state stresses and elastic design (allowable stress) stresses will be provided; and
- Assessment of probable settlement of the Site and foundations under short and long-term loading conditions with due reference to the general filling of the Site. This will include a predicted time schedule for the settlements.
- Maximum allowable pile loads (e.g. vertical pull-out capacity test).

TOPOGRAPHICAL SURVEY

Owner will provide the topographical survey to the contractor. If not provided by the Owner, the Contractor will perform a survey suitable for establishing topographic mapping. The optimum Site elevation(s) for the most efficient and economical operation of the Plant will be determined by the Contractor and submitted to the Owner for approval along with detailed calculations on which the Contractor has based its assumptions in determining the optimum level(s) and flood/drainage considerations. The contractor will determine the final Site elevations during the detailed design of the Plant and these will be subject to the approval of the Owner.

Project Execution Plan

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SITE LAYOUT

Contractor will submit Site layout design drawings, data, and documents for review prior to beginning any onsite work or procurement of solar equipment. In general, contractor will define where the project will be constructed, the configuration of materials and equipment, installation of PV modules, installation of electrical systems including inverters, connection to the existing electrical infrastructure, and construction of PV mounting structures and foundations, required buildings and foundations. The design will include a vehicle access road to provide maintenance, cleaning, and public safety access that will comply with state and local county surface requirements.

EARTHWORK

The contractor will plan and execute construction of earthwork methods to control surface drainage and prevent erosion and sedimentation.

Earthwork will include, but is not limited to, the following:

- Preliminary grading, clearing and grubbing
- Trench excavation and backfill for underground utilities
- Excavation and backfill for foundations
- Excavation for roadway cut and fill
- Installation of granular fill and surfacing
- Finish grading

Contractor will provide an estimate of the types and quantities of the various materials to be encountered or required to accomplish the Work. Contractor will utilize sustainable practices where practical, such as establishing a recycling program. All materials that are not recyclable will be disposed of in an approved landfill. Contractor will clean up any spill or contamination in accordance with approved standard procedures.

CLEARING AND GRUBBING

Areas to be graded will be cleared of all brush and trees to within six (6) inches of grade. All stumps and roots will be removed. Waste from clearing will be recycled or disposed of in an offsite disposal area in accordance with all environmental regulations and as directed by the Owner.

STRIPPING

All topsoil and other organic materials will be stripped from the areas to be graded before starting earthwork. Topsoil will be placed in a stockpile for later recovery and use for landscaping the Site (if applicable).

DISPOSAL OF UNUSABLE MATERIALS

All excess excavated materials and all excavated materials unusable for fills will be disposed offsite by Contractor.

PLANT GRADING

Project Execution Plan

PUBLIC VERSION

Plant grading includes the following items:

- Shaping the natural grade as required accommodating permanent facilities and construction facilities while minimizing earthwork
- Obtaining proper cross section, longitudinal slopes, and curvature for roads
- Obtain proper area slopes to provide drainage without ponding
- Construct adequate surface drainage to discharge the twenty (20) year runoff without flooding roads and the two hundred (200) year runoff without flooding any area in the Plant
- Construct stable, erosion-resistant earthen side slopes

ROADS AND CONSTRUCTION ACCESS

GENERAL

The Contractor will submit to the Owner for review and approval all proposed designs and layouts for the roads, roadwork, walkways, parking areas, and drainage provisions for the Plant.

The Contractor will construct permanent Site roads or will improve existing roads such that they meet the design intention. The design of all roads will conform to the requirements of the American Association of State Highway and Transportation Officials (AASHTO) and the Asphalt Institute (AI).

The horizontal and vertical alignments of all roads, vehicle parking areas and walkways will be designed to meet the requirements of anticipated future vehicular traffic, the relevant Local Authority, and Good Industry Practice. All anticipated delivery, operations, and maintenance activities of Plant equipment will be considered in determining the requirements for permanent and temporary construction access.

Permanent parking area or areas will be provided, if needed. The size and arrangement of the parking area will comply with Owner's requirements and this Technical Specification.

ROAD CONSTRUCTION

The roads will be designed to sustain the maximum loads from the vehicles likely to use them during construction and throughout the life of the Plant including articulated vehicles, material handling equipment and transporters used for the removal and replacement of major pieces of equipment. All materials used in the permanent construction will be of good quality, and the total thickness will be designed to support the construction and permanent traffic loads. The design of the thickness of various parts of the roads will conform to the relevant Codes and Standards.

The Contractor will undertake all design and surveying required for the construction of the roads, walkways, car parks, and other roadwork. It will be the responsibility of the Contractor to ensure that the strength of the sub-grade is adequate to carry all traffic loads likely to pass over the roads during the construction and Design Life of the Project.

The Contractor will re-instate the road at the end of the Works before Substantial Completion and will maintain the road during the construction period to the Owner's reasonable satisfaction.

CONSTRUCTION ACCESS

Project Execution Plan

PUBLIC VERSION

Contractor will be responsible for providing, operating, and maintaining appropriate access for equipment, services, and personnel during construction. Contractor will adhere to all applicable rules and regulations established by the state department of transportation (DOT), including road load limits. To allow traffic flow on haul routes and onsite access roads in a safe manner, Contractor will provide traffic control and protective devices in adherence of the Manual on Uniform Traffic Control Devices issued by the Federal Highway Administration. All costs associated with compliance are the responsibility of the Contractor.

ON-SITE ROADS

Contractor will provide all interior service roads as necessary. A minimum road width of 10 feet between PV array blocks must be maintained. Between rows of modules and circuit blocks, the pathways may be narrower, but must allow appropriate access for maintenance and repairs to all modules and array equipment. Roads will have a minimum inside radius of 17 feet. The Owner may provide written approval for smaller turning radius.

Contractor will meet the owners requirements, unless more distance is required by local authorities or instructed by state or local requirements. Road surfacing will meet local fire and emergency vehicle access requirements.

SITE ACCESS ROADS

Contractor will design and install a 20-foot wide Site access road. The Site access road will be gravel with the design based on sufficient soils and subsurface investigation by a qualified professional. The road will be designed to satisfy the loading requirements of equipment vendors and be suitable for access in all weather. The Contractor will restore any temporary roads or staging areas per the permit requirements, if applicable.

PARKING AREAS

Parking areas will be constructed with the additional requirements specified below. A minimum capacity of the car park will be provided in sufficient numbers and location to meet the operational requirements of the Plant.

The surface of the car parks will be laid with falls to the drainage system. No standing water will be permitted in the installation. Care will be taken during the construction that no materials enter the drainage system.

At the junction of the parking areas and roads due to different thickness of foundations, precautions will be taken to ensure that sub-surface drainage from the car parks does not detrimentally affect the road foundations.

ROAD MARKING & SIGNS

Signs will also be provided at strategic positions inside and outside the Plant. Directions and location of Plant areas, buildings, or structure and any other necessary signage will be provided.

STORMWATER MANAGEMENT AND SITE EROSION CONTROL

Storm water discharged to surface waters during construction and operations will not exceed the more stringent of Applicable Law or the Emissions Guarantees.

GENERAL

Project Execution Plan

PUBLIC VERSION

The Plant will be provided with a clean storm water runoff drainage system. The design of the Site drainage system will be based on the requirements from local jurisdiction.

The Site drainage system will be designed to adequately handle the peak rate of run-off resulting from the design storm. The storm water drainage system will be proportioned so that drainage channels and/or pipes run unsurcharged at self-cleansing/non-scouring velocities. Road ditches will be designed to ensure that the maximum width of flow in road channels does not interfere with the usage of any road.

A hydraulic analysis will be made for the storm water collection and conveyance system using established criteria as for open channel gravity sewers having uniform flow.

Stormwater drainage will be through swales and open drains. The drains generally will follow the roads within the property limits and be kept clear of all Plant equipment and buildings. Stormwater runoff will be collected by a series of swales and arterial drains. All drains will be constructed at a gradient. Ponding of stormwater is not allowed. Culverts will be provided where roads cross drainage paths. Erosion and scour protection for culvert inlets and/or outlets will be provided where needed to prevent damage.

TEMPORARY EROSION CONTROL

The Contractor will provide Temporary facilities to control erosion and runoff during earthwork operations and from graded areas until they are surfaced or seeded. Contractor will submit a location-specific erosion control plan for local jurisdiction approval prior to construction. Temporary facilities will include:

- Geotechnical silt fences
- Straw bale dikes
- Straw bale check dams in ditches
- Retention basins

All areas of temporary soil disturbance are to be graded, if necessary, and re-vegetated in a timely manner to limit erosion as required by the local jurisdiction.

SOIL EROSION AND SEDIMENTATION CONTROL

Unless otherwise specified, the Contractor will provide final grading, seeding, and other works to ensure that there is no erosion and that the erosion and sedimentation control is adequate. The Contractor will mitigate impact to the environment by adopting the following key principles to control erosion and sediment transport:

- Keep land disturbance activities to a minimum.
- Schedule the implementation of erosion and sediment controls so that they are timed to match the erosion and sediment needs created by the sequencing in each phase.
- Sequence the construction of storm drainage and sewer systems so that they are operational as soon as possible during construction.
- Divert Site runoff to keep it isolated from wetlands, watercourses, and drainage ways that flow through or near the development until the sediment in that runoff is trapped or detained.
- Utilize the existing topography to the maximum extent practical.
- Align roads on contours wherever possible and use them to divert surface water, thereby reducing slope lengths.
- Concentrate development on flattest area of the Site to avoid excessive slope cuts or fills where possible.

Project Execution Plan

PUBLIC VERSION

- Avoid steep slopes and soils with severe limitations for the intended uses. If there are no feasible alternatives to avoiding steep slopes and/or erodible soils, sound engineering practices will be employed to overcome the Site limitations. Seepage emanating from cut slopes will need provisions for internal drainage to prevent slope failure.
- Avoid flood prone areas, wetlands, beaches, dunes and other sensitive areas. When possible, keep floodplains free of fill or obstructions.
- Keep stockpiles, borrow areas, access roads and other land-disturbing activities away from critical areas that drain directly into wetlands and water bodies.
- Include early stabilization or covering of stockpiled topsoil or other erosive materials when they will not be used within thirty consecutive days.
- Locate detention basins outside of floodplains, wetlands and water courses, and adjacent to steep slopes.
- Utilize the natural drainage system whenever possible. If the natural drainage system of a Site can be preserved instead of being replaced with piped storm sewers, the potential for downstream damages from increased runoff can be minimized, making compliance with storm water management criteria easier.
- Minimize impervious areas and encourage infiltration where appropriate by keeping paved areas such as parking lots and roads to a minimum; increases in runoff may require control measures or drainage improvements.
- Perform runoff calculations to determine the effect of the development on the hydraulic system. Make changes where necessary to avoid downstream damage and to comply with the more stringent of Applicable Law or the Emission Guarantees.
- Perform calculations for the potential of downstream flooding or erosion when diverting one drainage system into another. The Contractor will consider collecting and detaining runoff when there is an increased potential for flooding and resultant damage to downstream facilities.

STRUCTURAL IMPLEMENTATION

GENERAL

Contractor will design the PV arrays' mounting systems, foundations, equipment pads, and buildings required for the Plant. The designs will be based on the requirements of applicable codes, standards, permits, and the design information provided by equipment vendors (e.g., module, inverter, transformer, switchgear, racking/tracking structures).

All structures and all parts thereof will be capable of withstanding code stress and deflection limits within prescribed settlements. The worst practicable combination of all loads including dead and live loads, wind, seismic, erection forces, secondary stresses, impact, temperature, and shrinkage effects will be considered in the design. Temporary loads during maintenance and erection will be considered. Ultimate strength for steelwork either load resistance factor design methods or working stress methods are acceptable. Anticipated deflections at service loading will be considered and will not result in inadequate performance or loss of normal function.

Minimum loads and loading combinations will be consistent with applicable code requirements. Except when applicable Codes and Standards provide otherwise, all loads will be considered to act in the combinations that produces the most unfavorable effect in the building, foundation, or structural member being considered. The Contractor is responsible for reviewing the provisions of the local building code, determining any unique design

Project Execution Plan

PUBLIC VERSION

conditions and applying any appropriate engineering practices that may dictate live loads greater than the minimum loads listed herein. All structures will be designed for loads resulting from construction activities. Loading from construction activities, whether of short or long duration, will be considered as live load. Construction loads and combinations will be rationally combined with all other loads to address the most critical condition. Mixing of load cases/definitions and load combinations of codes of various institutions is not permitted without prior approval.

ENVIRONMENTAL LOADING

All structures at the Plant will be designed using environmental loading as specified in the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures; these include seismic, wind, snow, rain, and ice. Each structure on Site will be grouped in Occupancy Category, as determined by the engineer of record, and the corresponding importance factor will be used for calculating environmental loading. Contractor will take into account a higher environmental loading for the racks on outer perimeter of the Project.

EXCAVATION, BACKFILL, AND COMPACTION

All excavations will be carried out and supported in such a manner as to prevent flooding or ponding of water, damage, or interference to structure services or stored equipment/materials. Contractor is solely responsible for all temporary work as necessary during construction. Contractor will be responsible for making all excavations in a safe manner and consistent with the requirements of the Occupational Safety and Health Administration. This includes, but is not limited to, shoring, cribbing, rock blasting, and dewatering. The Contractor will maintain records of inspection and testing of formations to ensure compliance with design assumptions and will comply with the requirements of the local authority regarding notification and inspection.

Minimum fill compaction will meet the requirements of ASTM D1557.

CORROSION PROTECTION

Corrosion protection will be applied to all structures of the Plant. The type and amount will depend on the selected materials of construction and conditions at the Site. A study of these conditions along with recommendations from the geotechnical report will be used to design the corrosion protection system.

The corrosion protection study will be performed by a qualified corrosion expert and documented with references and calculations showing that the foundations, supports, racking, fasteners, and conduit will meet a 25-year design life in aboveground and belowground conditions. If galvanized materials are used, field-applied zinc coatings will meet American Society for Testing and Materials (ASTM) A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. This standard contains minimum requirements for the material, surface preparation, and application process.

All holes in galvanized structural members will be drilled before the galvanization is applied. If holes are required to be drilled in the field, galvanizing will be applied to the exposed steel as specified in ASTM A780. All field welds will have a field-applied galvanization as specified in ASTM A780. Only steel bolts with pre-applied corrosion inhibitors and/or stainless-steel bolts and fasteners will be allowed in the entire mounting structure.

CONCRETE AND GROUT WORK

GENERAL

Project Execution Plan

PUBLIC VERSION

Concrete work will, as a minimum, be designed, specified, and installed in accordance with applicable ACI requirements. Reinforced concrete structures and foundations will be designed in accordance with the applicable provisions of ACI 318, "Building Code Requirements for Reinforced Concrete."

The design mix will produce a workable concrete that conforms to applicable ACI requirements or those of other international standards approved by Owner. The design mix will be tested for compliance of required strength and characteristics before use in permanent works.

All grout will be flowable, non-shrink and non-metallic natural aggregate, or as required by equipment manufacturers.

EXECUTION OF WORK

In executing the work, the Contractor will conform to all applicable ACI requirements regarding:

- Design and installation of formwork
- Cutting, bending and placing of reinforcing bars
- Mixing, placing, finishing and curing of concrete

Construction joints will be located where the strength and serviceability of the structure is least impaired. Provision will be made for transfer of shear and other forces through the joints as required.

Water stops will be provided in construction joints in walls and slabs where necessary to maintain watertight integrity of the structure. Water stops will be located such that their presence does not affect the performance of shear keys if they are present in construction joints.

Minimum net thickness of concrete cover over reinforcing or embedded steel will be per ACI requirements.

MATERIALS

The minimum twenty-eight (28) day specified compressive strength of structural concrete will be a minimum of 4,000 psi (27.6 MPa). Reinforcing steel bars will be ASTM A615 Grade 60. Welded wire fabric will conform to the requirements of ASTM A185.

The concrete design mix, as well as the type and proportions of all constituent materials and cement type, will be selected to ensure adequate strength and durability for the environmental and exposure conditions. The design mix will produce a workable concrete that conforms to applicable ACI requirements or equivalent international standards approved by Owner. The design mix will be tested for compliance of required strength and characteristics before use in permanent Work. Contractor will conduct material tests and concrete break tests as appropriate during all phases of the work to ensure the quality and consistency of the concrete used. Contractor will ensure strict enforcement of all maximum permissible water-cement ratios for all concrete.

GROUT WORK

All grout will be flowable, non-shrink conforming to ASTM C1107. Grout will not contain metallic aggregate, oxidizing catalysts, gas producing agents no more than 300 ppm chloride. Grout will attain a one (1) day minimum compressive strength of 3500 psi per ASTM C109 and a minimum compressive strength of 5000 psi at 28 days. Grout will conform to ASTM C1107 when mixed to a fluid consistency as prescribed by ASTM C827 at temperature extremes of 7°C (45°F) and 32°C (90°F) with an extended working time of 30 minutes or more.

Project Execution Plan

PUBLIC VERSION

For thickness greater than 3 inches, pea gravel or other approved filler will be added to the grout. Such filler will conform to the grout manufacturer's written requirements or recommendations.

Curing compound will conform to ASTM C309, Type 1-D with fugitive dye. The product will be compatible with and in accordance with the grout manufacturer's recommendations.

Equipment grouting will be performed in accordance with the materials and procedures specified by the equipment manufacturer.

Non-shrink grout will be furnished factory premixed so only water is added at the Site.

FOUNDATIONS

GENERAL

Contractor will design the PV arrays' mounting systems and foundations, as well as any equipment pads and buildings required for the Plant. Contractor is responsible for selection and design of foundation types. Foundations will be as required to accommodate the loadings, tolerable settlement, and soil conditions of the Site. All foundations constructed within the water table and the capillary rise zone will be suitably protected from chemically aggressive ground conditions. All concrete foundations, if required, will be reinforced with no less than ACI minimum temperature and shrinkage reinforcing.

All concrete foundations, if required, will be designed in accordance with ACI 318 or other internationally recognized standard, good industry practices, applicable building codes, and manufacturers' recommendations. The designs will comply with the information provided by the equipment/material vendors (i.e., module, inverter, transformer, switchgear, racking/tracking structures, etc.). If the structural framing or equipment manufacturers' requirements have more stringent geotechnical criteria, the most stringent criteria will be used for design.

The design of foundations for all structures and equipment will be such that differential and total settlements or other movements will not exceed acceptable limits. Settlement limits will be determined by the sensitivity of structures and equipment to settlement.

RACKING/TRACKING SUPPORT FOUNDATIONS

The racking/tracking support foundations and supports will be designed for a minimum 25-year life and will include consideration of all environmental factors and corrosion. The foundations will be designed to withstand the impacts and contact pressure from the chosen installation method. Any Contractor caused damage to corrosion protection coatings will be repaired by Contractor.

EQUIPMENT PADS

Pertinent information about the supported equipment (i.e., footprint, weight, anchorage requirement, nature of equipment, loading criteria, special recommendations by equipment manufacturers, etc.) will be considered in the design of foundations. In general, equipment will be supported on mat or spread footing type foundations; or, piling if required due to the soil conditions.

All equipment foundations will be located such that adequate personnel access is provided; a minimum of 4 feet horizontal clearance from obstructions that would otherwise limit access to the equipment on the pad will be provided on all sides of the equipment foundations. The equipment foundations will be sized sufficiently to allow

Project Execution Plan

PUBLIC VERSION

for safe and adequate working space around the equipment. The slope of the grade around the inverter stations and other equipment will allow for safe and ergonomic personnel access to the equipment.

Critical equipment (i.e., inverter stations, switchgear, and substation (if applicable)) will be located outside of the Federal Emergency Management Agency (FEMA) 100-year flood plain and bolted to equipment pads.

BUILDING FOUNDATIONS

Buildings will be supported on foundations and will have foundations appropriate to the ground conditions. The finished ground floor level within all buildings will be not less than 6 inches above finished grade.

TRANSFORMER FOUNDATIONS

Transformers will be founded on suitable foundations.

The ground in front of the transformers will be suitably treated to facilitate installation, maintenance and replacement of the transformers.

BUILDINGS

Buildings, storage facilities, and enclosures will be provided to the extent that is required; i.e., to provide protection from environmental loads to ensure reliability, availability, and operation of the equipment, by law, or the Interconnection Agreement.

The building architecture, architectural components, and finishing of these buildings will be appropriate for similar facilities and will comply with local culture. The Contractor will prepare the building arrangement to be reviewed and approved by the Owner before detailed design. Pre-engineered building may be used to reduce the overall cost of construction.

Buildings will conform to a common architectural concept to unify the various elements and will be suitable for the operating and climatic conditions at the Site. The design will make selective use of materials to produce a pleasing industrial concept throughout and a working environment that is safe, durable, and functional. The dimensions of all the buildings will be such as to provide adequate space for the safe installation and proper operation and maintenance of Plant and equipment. Adequate space will be provided immediately in front of, behind, and beside all buildings. Appropriate access will be made available for maintenance and operations activities including but not limited to equipment removal by fork truck or crane as required.

The design of all buildings will ensure that noise, vibration, and temperature levels are within acceptable limits.

All buildings and structures will have lightning protection, where required.

The external surface of all buildings will be protected by a system of abrasion resistant color-fast coatings. The color and pattern will be subject to Owner's selection and colors and patterns of all buildings and structures will be the same color scheme. Samples will be submitted to the Owner prior to orders being placed with the manufacturer.

STRUCTURE AND FOUNDATION STABILITY

Every structure and foundation will be designed to resist the overturning, hydrostatic uplift, and sliding effects caused by applied forces. Stability analyses will be performed by superimposing all appropriate loads for each of

Project Execution Plan

PUBLIC VERSION

the conditions being investigated in accordance with standard engineering practice as governed by applicable codes and standards.

FENCING

Contractor will provide fencing for the Plant. Contractor will be responsible for security during construction and utilize temporary fencing whenever an existing fence is removed. Fencing may be required to maintain security and prevent to movement of livestock.

The Contractor will provide chain link fencing around the Site boundary and security fencing to enclose the main power generating Plant, primary construction parking and laydown, construction areas (as needed), and other areas requiring controlled access. Fencing will be a 7-foot-high chain link fence with 1-foot top guard (total 8-foot high) of three strands of nine-gage barbed wire and designed to meet NESC and IEEE standards. Fencing will have posts set in concrete no more than 2 inches above finished grade. Contractor will provide a minimum setback of 20 feet between the perimeter fence line and the PV panels and project substation. The Contractor will ensure that the perimeter fencing does not shade the PV arrays.

Locked gates at the main Plant entrances and exits will be provided. Two slide gates for vehicles with a width of 20 feet and one gate for pedestrians with a width of 4 feet will be included.

Lockable main gates, matching the construction and color of the remainder of the perimeter fencing, will be provided adjacent to all road gates.

ELECTRICAL ENGINEERING

GENERAL

The Contractor's engineering and design will be in accordance with good utility practice, and shall follow typical industry standards regarding engineering, construction and diligence for the design and construction of utility scale, grid-connected solar PV generation projects in the United States. The design shall meet the conditions of all applicable permits and laws and shall follow the standards listed herein.

SCOPE

The Contractor is wholly responsible for all design, engineering and procurement required for the construction of the PV Power Plant that meets all requirements contained herein. This includes all design drawings, calculations and specifications which will be properly certified and stamped in accordance with the requirements of the state where the project is located.

All design drawings, calculations, specifications, data and documents will be submitted to the Owner for review and comment per an agreed upon schedule.

The Contractor is responsible for providing all electrical engineering design services required to show compliance with the applicable codes and standards, and to meeting the requirements of the interconnecting utility, ISO and authority having jurisdiction. The electrical scope includes, but is not limited to, the engineering, design, procurement and construction of the following systems:

Project Execution Plan

PUBLIC VERSION

ELECTRICAL EQUIPMENT AND SYSTEMS

- Furnish Solar Modules
- AC & DC Collection Systems
- Inverters
- Combiner boxes
- Generator step-up (GSU) transformers
- Medium voltage switchgear (if applicable)
- Station auxiliary transformer
- Auxiliary power distribution system
- All power, control, instrumentation, and special cables
- 125 VDC battery system, including battery charger and DC distribution panel
- Cable installation and raceways
- Lightning protection system
- Miscellaneous electrical systems
- Substation instrument transformers
- Grounding mat and equipment grounding
- Indoor and outdoor lighting
- Emergency lighting
- Relay protection systems
- Supervisory Control and Data Acquisition (SCADA)
- Remote Terminal Unit (RTU) panels
- Communication Systems
- Generator for construction power, if applicable
- All performance testing
- Storage equipment, if applicable

ELECTRICAL STUDIES

- Load Flow / Losses
- Reactive Power
- Cable Sizing calculation
- AC auxiliary power system sizing
- DC auxiliary power system sizing
- Grounding calculation
- Insulation coordination

Project Execution Plan

PUBLIC VERSION

- Lighting/Surge protection study
- Protective relay settings
- Short Circuit Study
- Arc Flash Study
- Harmonics Study

COLLECTION SYSTEM

The Contractor will design the collection system using design philosophy typical for utility scale PV projects in the United States. The collection system shall allow the power to be collected from the individual PV modules, combined, and routed to the inverters, stepped-up in voltage and exported to the grid. All proper protection systems will be installed, including fusing, relaying and lightning protection to ensure the safe and reliable operation of the collection system. Collection system grounding shall meet all applicable codes, standards and guidelines and shall ensure the safe and reliable operation of the collection system.

DC SYSTEM

The Contractor is responsible for the engineering and design of the DC system, which includes all equipment and connections required to allow power to reach the inverters from the solar modules. The DC system should be designed to optimize energy yield, and should take into consideration typical design parameters such as voltage ratings, voltage drop, ohmic losses, etc. The Contractor will ensure all cables and equipment are sized appropriately according to the NEC and good utility practice. A cable sizing calculation will be submitted to the Owner for review. The Contractor will design all aspects of the DC system to meet applicable IEC, IEEE, NEC and authority having jurisdiction (AHJ) requirements.

Protective systems and equipment will be used through the DC systems as is dictated by good utility practice and typical design standards of utility-scale PV. At minimum, appropriately sized finger-safe fuses should be used for each DC string at the combiner boxes, and MCBs will be utilized for each inverter input. These protective systems will be sized to reduce possible damage to all components resulting from an electrical fault and will be sized to meet the applicable NEC, NESC and IEEE standards and guidelines.

The DC systems will be designed to facilitate operations, access, troubleshooting, maintenance etc., and to meet the specifications and guidelines contained in this document and all attachments.

For the DC system, all racking needs to be bonded to the inverter via equipment grounding conductor. A local grounding electrode conductor will be installed at each section of UL2703-listed racking.

Combiner box layout should be based on the maximum amperage input of the inverter's MPPT channels. All conductors will be identified via traditional color codes (i.e. red is positive, black is negative in an ungrounded system).

All DC cables must be secured and protected in a way to prevent damage and ensure operational life. Typical methods include UV resistant cable ties, cable loop clamps to modules, UV resistant cables sleeves, cable tray and conduits. Cable management plan and hardware will be described in the design documents and submitted to the Owner for approval. The cable management will ensure damage from sharp edges, water and UV light is prevented, and cables are properly protected and accessible for maintenance.

Project Execution Plan

PUBLIC VERSION

AC SYSTEM

The AC system will be engineered and designed so that all equipment and cabling (above and below ground) is sized adequately to allow power to be exported from the inverters to the grid safely and reliably. The Contractor shall ensure all cables and equipment are sized appropriately and protected as required by good utility practice and all applicable IEC, IEEE, interconnection utility, and authority have jurisdiction (AHJ) requirements.

Protective systems and equipment will be used throughout the AC systems as is dictated by good utility practice and typical design standards of utility scale PV in the United States. These protective systems will be sized to reduce possible damage to all components resulting from an electrical fault and will be designed to meet the applicable NEC, NESC, interconnection utility, ISO, NERC and IEEE standards and guidelines.

The Contractor will design the Site equipment grounding, lightning and surge protection per the applicable standards and guidelines. A comprehensive lightning and surge protection assessment will be performed and submitted to the Owner prior to the start of construction.

The Contractor is responsible for ensuring that the power delivered to the grid meets all interconnection requirements regarding reactive power and power quality.

The AC systems will be designed to facilitate operations, access, troubleshooting, maintenance etc., and to meet the specifications and guidelines contained in this document and all attachments.

PROTECTION

All equipment will be protected from damage occurring during electrical faults with fuses, breakers and protective relaying. The protection system will be designed to good utility practice and to meet all applicable codes and standards including the interconnection agreement and NERC standards. A relay studying and fuse coordination study, along with a protection one-line diagram will be submitted to the Owner for approval.

COMMUNICATION SYSTEM

The Contractor is responsible for the engineering, procurement, installation and testing of a SCADA/Communication systems that meets the requirements of the Owner, Interconnection Utility, ISO, or Offtaker using good utility design practice. These systems will allow for remote monitoring and control by the appropriate stakeholders.

The SCADA system will be composed of utility rated hardware and software designed to integrate and communicate with a wide variety of instrumentation and control systems throughout the Site, and allow for remote monitoring and control. The integration includes, but is not limit to, meteorological stations, transducers, inverter status points, and other miscellaneous alarms, sensors and controllers.

SOLAR EQUIPMENT SUPPLY

The Contractor will be responsible for procurement of all necessary equipment for the completion of an operating PV generation Plant as specified in this document. This includes, but is not limited to the items specified in this section. All equipment shall be subject to inspection by the Owner or their representative at any time during staging, installation, or testing.

Project Execution Plan

PUBLIC VERSION

The Contractor is responsible for the installation of a secured fenced area on-site for receiving and storing equipment and materials during construction. The Contractor will be responsible for maintaining the overall security of the Plant to prevent theft or damage and to securely receive and store all freight and materials.

All installed equipment will be of a quality equal or better to the equipment specified in the design and engineering plans. Utility-grade equipment will be used wherever possible, and any non-utility-grade equipment will be submitted to the Owner for approval prior to construction.

The contractor shall provide a list of all major equipment to be furnished as part of the Plant. This list shall identify both the items and quantities, and shall identify any use of SF6 or hazardous material. Data sheets and vendor drawings of the major equipment will be submitted to the Owner for approval prior to procurement.

PV PANELS

The PV modules will be Owner furnished materials. The PV modules shall meet all applicable aspects of the following standards and requirements:

- IEC 61730: Photovoltaic Module Safety Qualification
- IEC 61701: Salt Mist Corrosion Testing of Photovoltaic Modules; Severity 6
- IEC 61853: Photovoltaic Module Performance Testing and Energy Rating
- UL standard 1703 listed for the voltage specified
- Manufacturer identified as Tier 1
- Manufacturer will have a bankability report from an independent engineer
- Manufacturer will have an established track record of successful installations in the United States
- The manufacturer shall have demonstrated workmanship quality through a third-party factory audit or testing score. The results of these audits or test results will be submitted to the Owner for review.
- All modules shall have electroluminescence testing of every module for defects. Results will be made available to the Owner for review/approval.

Documentation will include flash test results and EL images before and after the tests. The testing procedure will be sent to the Owner for approval.

Flash test data for all modules will be submitted to the Owner upon procurement of the modules.

The snow load capacity of the modules must be specified to match site specific conditions.

The same module make and model will be used throughout the site, and the modules will be corrosion-resistant, resistant to damage from snow, wind, hail and windblown dust and sand. The modules shall include a grounding lug, grounding hole, or some other tested grounding attachment mechanism

COMBINER/RECOMBINER BOXES

Combiner boxes will be of utility grade construction and supplied by a reputable manufacturer.

Combiner boxes will be rated for maximum system voltage and maximum system continuous and short-circuit currents.

Project Execution Plan

PUBLIC VERSION

Terminal blocks will be rated, at minimum, for 1500V and 75°, and with a temperature rating that meets site specific requirements.

Integral fuses shall have blown fuse indicator. Finger-safe fuses will be used for protection and disconnection of each DC string.

Combiner box output shall have a means to be externally isolated.

The combiner box shall have integral surge protection on the inverter side, and the combiner/recombiner box shall have a visual trip indicator.

Combiner/Recombiner boxes will be rated NEMA 4 and will be lockable.

CABLES AND CONNECTORS

The Contractor will document cable and connector selections prior to installation for Owner approval.

PV panel interconnect connectors will be: 1) latching, polarized, and non-interchangeable with receptacles in other systems, and 2) tap branch connectors with multi-contact termination connectors. The grounding connections will be first to make and last to break and will be rated for the interrupting current.

The manufacturer of all connectors will have a proven track record of successful installations in North America.

For the DC feeders and PV panel interconnect cables the Contractor will furnish at least 2-kilovolt 90°C (wet or dry) power cable type USE-2 or RHH/RHW-2 with XLPE jacket and UL 1581, VW-1 rating (or approved equal that is capable of meeting DC collection system design current requirements. Any substitutes must be identified and submitted to the Owner for approval) All exposed cables will be UV rated, direct burial rated, and be in conformance with NEC 300.5 where applicable.

Cables will meet the requirements of PV wire as stated in NEC Article 690.

INVERTERS

The inverters will be manufactured by a reputable manufacturer who has a history of successful inverter installations in North America.

The inverter will be certified to applicable standards by an approved independent third-party inspection agency (e.g., TUV, Intertek, Underwriters Laboratory)

The inverters shall have a minimum design life of ten (10) years.

The inverter will be sized to maximize Plant output and to allow for adequate dynamic reactive compensation support to meet grid requirements. The inverters will be calibrated so that the AC output at the point of interconnection shall not exceed the limit in the generator interconnection agreement. The inverter and associated transformers and wiring will be installed to meet the requirements of the National Electric Code.

The inverters selected for this project must meet the following requirements:

- UL listed to 1741

Project Execution Plan

PUBLIC VERSION

- Comply with IEEE 1547-2003, including testing to IEEE 1547.1 and IEEE C62.45. Regulatory standards compliance shall also include IEEE C62.41.2 and CSA107.1-01.1.
- Equipped with anti-islanding capability.
- The selected inverters in combination with the overall Plant design shall meet all grid code requirements regarding reactive power and power quality. The Contract shall review the MOST recent requirements (NERC, ISO, Utility, etc.) applicable to proposed project and submit documentation showing the selected inverters compliance with these guidelines, including voltage and frequency ride-through.
- The Contractor will provide notice to the Owner at least two weeks prior to factory acceptance tests. The Owner, or its representative, shall have the opportunity to witness factory acceptance tests to ensure all requirements are satisfied.
- The selected inverter will have a maximum harmonic distortion less than 3% of total harmonic distortion at rated power output. The Plant will meet all applicable requirements in IEEE 519.
- Efficiency will be greater than 97.5% (not considering medium voltage step up transformer losses)
- No-load consumption at less than 1% of nominal power and less than 0.1% in standby mode
- Comply with any applicable regulations on noise level
- Equipped with lightning protection
- Inverters located outdoors will be enclosed in lockable enclosures with a minimum rating of National Electrical Manufacturers Association (NEMA) 3R and with coatings in accordance with proper corrosion protection. Any sensitive electronic equipment will be installed in a NEMA 4 rated enclosure.
- Employ a maximum power point tracking scheme which is suitable to optimize inverter efficiency over the entire range of PV panel output for the proposed design
- Equipped with all hardware/software for data collection and control as required by the SCADA sections of this document
- Sufficient AC/DC protection and disconnect means to meet the requirements of the NEC and AHJ
- Integral protective functions for overvoltage, undervoltage, overcurrent, over-frequency and under-frequency, and will meet the low voltage ride through, ramp rate and dynamic response requirements of the interconnection.

The selected Inverter manufacturer shall:

- Be certified to OHSAS 19001, ISO 9001 and ISO 14001 standards
- Have at least 100 MW of inverter capacity installed as part of successful utility-scale PV projects in North America

TRANSFORMERS

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All transformers shall comply with all applicable standards contained within IEEE C57.12 and IEC 60076 and will be rated for continuous operation at any tapping to handle the maximum output of the associated inverters.

Transformers will be oil immersed type and of a low loss design to maximize efficiency of the project. Transformers shall meet transformer efficiency standards set forth in the most recent version of the U.S. Department of Energy "Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule."

Transformers will be specified to meet the requirements of good utility practice and will be sourced from a reputable transformer manufacturer with proven success in North America. Transformer specification, vendor drawings and procurement order will be submitted to the Owner for approval.

The transformer shall include standard accessories including, at minimum, liquid level and pressure vacuum gauges, dial type thermometer with SPDT alarm contacts, pressure relief valve and a drain valve with sampler.

The transformer will be supplied with a fused disconnect switch on the transformer high-voltage side to isolate the transformer in case of an internal fault. The switch/transformer configuration will be designed for loop feed.

The Owner reserves the right to attend factory witness testing of transformer and will be informed when this testing is scheduled. The service life of the transformer will be at least 25 years.

SWITCHGEAR

The switchgear will be designed, manufactured, and tested in accordance with the latest IEC, ANSI, and NEMA standards. The MV and LV switchgear will be of a design that has passed testing for arc-flash resistance according to Standard IEEE C.37.20.7, or will be provided with arc-flash mitigation if required. The switchgear will be adequately rated for the parameters of the Project.

The design of the equipment will be such as to prevent accidental contact with live metal and to avoid the spread of fire or damage from short circuits or other cause. Cubicle type equipment shall include barriers to segregate the equipment for each circuit and main and subsidiary bus bar compartments. Suitable handling equipment will be provided where necessary for the operation and maintenance of the switchgear and breakers.

Circuit breakers utilized in the MV switchgear will be SF6 or vacuum type. A SF6 type circuit breaker shall conform to all requirements in IEC 60376.

All circuit breakers of the same voltage will be fully interchangeable. The operating mechanism will be of the trip free design with an anti-pumping scheme and operation counter.

In general, the switchgear design and components shall meet the requirements of the interconnecting utility and the interconnection agreement and follow good utility practice.

The switchgear specification and vendor drawings will be submitted to the owner for approval prior to procurement. The switchgear will be outdoor rated, NEMA 4. It will be lockable and shall have current and voltage protection, instrument transformers and associated relays included.

MODULE SUPPORT STRUCTURE

FIXED TILT RACKING STRUCTURE

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Contractor will be responsible for the fixed tilt racking system (if applicable), including the racking structure and all module mounting hardware. The racking vendor or a third party may supply the supports. Contractor shall specify the rack's azimuth and tilt angle on the engineering drawings.

Contractor shall design the racking system with a 25-year design lifetime. This includes the racking structures, support attachments, module mounting brackets, fastening hardware, and supports (if applicable). Vendors under consideration for the fixed tilt racking system shall have installed a minimum of 50 MW capacity in utility-scale projects.

SINGLE AXIS TRACKING STRUCTURE

Single axis tracking systems (if applicable) shall include the racking structure, mounting hardware, drive motor(s), and controller system. Any equipment required for the safe operation and wind stow (if applicable) will be included in the bid. The trackers shall automatically track the path of the sun each day. All control equipment enclosures will be rated NEMA 4.

The tracking system will be designed using the environmental loads and the Occupancy Category outlined in contract documents. The torque tubes, support attachments, module mounting brackets, all fastening hardware, and supports (if applicable) shall have a 25-year design lifetime. PV modules will be mounted in landscape orientation. PV modules may be mounted in portrait orientation only if backtracking is employed in the tracker controls.

Single axis trackers feature a "stow" option that operates during high wind conditions, the "stow" feature changes the angle of the tracker's tilt to decrease the wind loads on the racking, supports, and foundations. A backup energy source (i.e., backup emergency battery storage system) will be installed at the Plant if a "stow" is required to meet wind loads in the event of a grid interruption. This is to ensure that the tracker can move into the stow position.

Contractor shall design the PV arrays' mounting systems and foundations. The design shall be based upon standard industry practice, including the requirements of applicable codes, standards, and permits, as well as the information and specifications provided by the module, inverter, transformer, switchgear, racking, and all other vendors.

Single axis tracking vendors under consideration shall have installed a minimum of 50 MW of capacity in utility-scale projects.

METEOROLOGICAL STATION

Contractor will provide at least two (2) Meteorological Stations to provide adequate meteorological data to evaluate Plant performance. For sites with greater than 50MWp, a minimum of three (3) Meteorological stations are required. The Meteorological Station shall include at a minimum, the ability to measure:

- Reference cell temperature
- Reference cell irradiance at plane of array
- Ambient air temperature having an accuracy of $\pm 0.2^{\circ}\text{C}$ or better – two temperature stations are required for Plants with a single Meteorological Station

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- Wind speed having an accuracy of ± 1.5 percent or better
- Wind direction having an accuracy of $\pm 5^\circ$ or better
- Global horizontal irradiation (GHI) – two pyranometers are required for GHI measurement
- In-plane of array (POA) irradiation – one pyranometer is required for POA irradiation measurement
- Rain measurement
- Back of module temperature having an accuracy of $\pm 0.5^\circ\text{C}$ or better, attached to modules in such a way as to reflect temperatures representative of the average of the array and adhered to middle of back of module using conductive epoxy and/or Kapton tape to avoid the creation of a hot spot

The irradiance meters shall have an accuracy of better than ± 2 percent.

The station shall have capability of recording and storing environmental conditions without AC power for a minimum of 1 day.

Installation, calibration, maintenance and operation of the meteorological station shall conform to standard industry practices. NIST calibration certificates will be provided for meteorological instruments listed above. The reference cells or modules will be calibrated by the National Renewable Energy Laboratory (NREL) or an Owner-approved equivalent.

SCADA

The Contractor will furnish and install an Owner-approved monitoring hardware and software package from a reputable vendor. The monitoring system shall provide energy generation data, historical data, solar insolation attributes, and meteorological data. In addition, it must provide all the necessary status and alarm monitoring and Site control points.

The SCADA system will utilize microprocessor based process controllers to monitor and control Plant areas and auxiliaries (inverters, relays, meteorological stations etc.). A suitable data network will be designed (typically TCP/IP on fiber optic network) to allow centralized monitoring and control at operator and engineering workstations.

The monitoring system will be designed to instantly alert the operations manager of alarm status.

The system will be designed so that metering complies with the standards in IEC 61724.

The metering scheme will be designed to read bi-directional energy flow at the point of interconnection, and will be capable of metering both the maximum (daytime) and minimum (standby) power flows.

All metering, status, alarm, analog and control points will be made available for remote control and monitoring to the Owner, Utility, ISO and Offtaker as required. The Contractor shall propose a method for accomplishing this which will be submitted for approval by the Owner. Typical industry security measures will be taken to ensure there is no unauthorized access to the system. This includes firewalls and routers as dictated by good utility practice.

Points to be monitored and made available shall include at minimum the following:

- Meteorological parameters

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- Inverter Shelter environmental conditions
- Inverter Shelter HVAC/climate control status
- Inverter Shelter door position switch
- Inverter performance points: To include real time AC and DC electrical characteristics, including power, energy generated, inverter status and diagnostics, and all data available from inverter system (including every inverter fused input monitoring).
- Met Station PV module surface temperature (quantity of 2 sensors per PV module, and 2 such monitored PV modules per weather station)
- PV String current, all
- Inverter Transformer oil temperature
- Inverter Transformer pressure/vacuum
- Inverter Transformer oil level
- Medium & High Voltage Circuit Breakers Status
- Medium & High Voltage Circuit Breakers Loss of DC Voltage Loss of AC Control Power
- Medium & High Voltage Circuit Breakers Low SF6
- Medium & High Voltage Circuit Breakers General Fault
- Control Room Interior Temp
- Control Room Door Status
- Control Room HVAC Status
- Revenue Meter Voltage, VARS, MVARs, MWh, Amps, Frequency

A final points list will be submitted to the owner for approval.

METERS

A bi-directional revenue grade meter will be installed to measure the total Plant output at a point specified in generator interconnection agreement (POI). The revenue grade meter will be American National Standards Institute C12.20 0.2% Class UL listed, ISO9001 certified. The instrument transformers utilized by this meter will be metering class accuracy.

The meter shall have a local visible display and interface, and shall also provide data to the SCADA system for remote monitoring.

This revenue meter shall match the one specified by the interconnection utility which shall act as the billing meter. Contractor shall coordinate with the interconnection utility for the installation of same.

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AUXILIARY EQUIPMENT AND ACCESORIES

The battery system will be sized: to provide DC power to trip, close, and recharge the switchyard 8 hours after a loss of power; recharge within 12 hours; and supply sufficient power to the SCADA and communications systems for 12 hours minimum. The battery sizing will be compliant with IEEE 484 and the battery sizing calculation will be provided by Contractor to Owner. If the PV trackers have “stow” functionality, back-up will be provided to allow them to return to the stow position in the case of power loss.

The contractor will design permanent lighting installations, comprehensive emergency lighting systems, and road lighting systems per typical industry practice. The lighting installation will be designed to last the operational life of the Plant; providing recommended minimum levels of illumination in accordance with BS EN 12464. Illumination will be provided in such a manner as to ensure evenness and to avoid glare.

To facilitate operations and maintenance, the contractor will install power socket outlets at convenient areas throughout the Plant. Socket outlets shall comply with IEC 60309 and will be installed to give adequate coverage of all buildings and areas of the solar PV installation.

SIGNAGE, IDENTIFICATION, NUMBERING, AND LABELING REQUIREMENTS

Contractor will include within its scope of supply a Plant-universal designation numbering system utilizing the Owner’s based system. The designations will be included on all drawings, schedules, descriptions, and other documents as well as on all nameplates, tags, and on equipment and components itself (wherever applicable). Except for cable and wire identification, the identification designation will be engraved or stamped on stainless steel nameplates. Each piece of equipment and associated apparatus will be provided with signage (tag plates) indicating tag number and description. All major equipment – including inverters, combiner boxes, transformers, etc. – will be provided with the data plates, indicating the name of the vendor, type, model number, serial number, year of fabrication, main characteristics, and all further information necessary for a complete identification of the equipment.

Instruction plates, nameplates and labels will be provided for all items of the Plant giving particulars about rating, duty, size, model number, serial number and full information for identification and operation. The Contractor shall pay attention to the name tags, nameplates and labels during painting operations to ensure that such identifiers are not painted over. Labels will be of sufficient size to carry a full description of the Plant item and its complete identifier.

Tags will be fitted by stainless steel self-tapping screws, stainless steel banding such that they are not readily lost or broken during routine operations and maintenance.

Cable markers which indicate the presence of underground electrical facilities will be installed at all road crossing locations.

Arc flash labels will be placed prior to energization of equipment.

Any labels damaged or defaced during installation of Plant will be replaced by the Contractor prior to Substantial Completion.

All Plant signage must meet current industry standards and shall have a life span of 25 years.

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INSTALLATION

DC SYSTEM WIRING

- Any cable or connector that will be exposed to sunlight is required to be UV resistant and outdoor rated.
- For series string connections between solar modules, the factory supplied quick connectors will be utilized.
- Series string circuits will be combined in parallel and ran as a single circuit back to a combiner box. A minimum of 12 AWG cable will be used to connect these series string circuits and the cable shall utilize quick connect ends.
- The DC cabling running between the modules and the combiner box will be buried in conduit, at least 24" below grade in a clean fill material. For cables that are direct buried, a detectable marker tape will be placed 12" below grade over the entire length of the conductor run. Backfill will be compacted to 95% modified proctor density.
- The DC cabling from the combiner boxes to the inverters will be buried conduit at least 18" below grade in a clean fill material free of aggregate. If the cable is run underground, a detectable marker tape will be placed 12" below grade over the entire length of the cable run. Trench bedding will be adequate to prevent damage to the cable from any oversized material.
- For transitions between above and below grade, DC cabling will be protected from damage by utilizing mechanical protection (e.g. conduit).

AC SYSTEM WIRING (600 V AND BELOW)

- All conductors and cable accessories will be UL/IEC listed.
- All exposed cables and connectors will be outdoor rated and UV resistant.
- All conductors will be stranded copper or aluminum. Any connectors used with aluminum conductors must be compression type and suitable for use with aluminum cable.
- Oxide inhibit will be used when terminating aluminum conductors.
- AC conductors shall not be spliced.

BORING

- At the start of boring operations required SWPP will be setup to protect the area.
- HDPE pipe will be fuse (if required) for the length of the bore.

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- Receiving pit will be dug at the end location of the bore.
- Using a directional drill temporary piping will be installed from the beginning to the end of the bore location.
- Reamer will be attached to temporary piping and HDPE pipe will be pulled back through the drilled hole.
- Cable installation will be able to continue through bored location.

MEDIUM VOLTAGE AC SYSTEM WIRING: INVERTER TRANSFORMER TO INTERCONNECTION FACILITIES

- Medium voltage AC conductors will be aluminum with copper concentric neutrals. Selected cable must be rated for the intended use and meet applicable IEEE, NEC and ICEA standards.
- The Contractor shall select one of the installation methods listed below for each cable:
 - Direct bury rated, single conductor with jacket: Conductors are placed in a single trench and separated per NEC table 310-82. Trench shall have a bed of clean fill material free from aggregate.
 - Direct bury rated, single conductor with jacket: Conductors are placed in a single trench in a triplex arrangement as per NEC table 310-82. Trench shall have a bed of clean fill material free from aggregate.
 - Three conductor cables, with an interlocked metallic armor and with an overall jacket, suitable for direct burial.
- All conductors will be buried at a minimum depth of 36" below grade unless otherwise specified in the contract documents. All cables will have a marker tap placed 12" below grade over the entire length of the cable run.
- The Contractor will install a bare copper equipment grounding conductor with each feeder with a calculation supporting its size.
- The Contractor will size the conductors so that no single conductor has more than a 2% voltage drop across it at full generation.
- For medium voltage terminations the contractor will install cold shrink terminations, rated for outdoor use and live front applications. The terminations will be of IEEE-386 class for non-load break, dead front applications.
- For transitioning into and out of the transformers, conduits sleeve will be provided.
- For transitions between above and below grade, AC cabling will be protected from damage by utilizing mechanical protection (e.g. conduit).

SECURITY SYSTEM WIRING

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The contractor will install all security system components in accordance with the manufacturer's specifications, and all applicable codes. The contractor is responsible for all interconnections, additions and adjustments required to commission and complete an operable and satisfactory system.

The Contractor will install security system wiring in dedicated conduit throughout. All low-voltage wiring outside enclosures will be plenum rated where required by code.

The Contractor will identify each conductor by its wire code as shown on the construction drawings.

GROUNDING

- Grounding system installation will be compliant IEEE 80, 81, 142, 665 837, and 1050 as well as the NEC and NESC.
- Ground conductors will be stranded copper.
- PV Modules, mounting equipment, combiner/recombiner boxes and inverters will be grounded per NEC requirements.
- All below grade connections will be compressed or exothermic and UL listed for direct burial applications.
- The Contractor will present calculations to show that the proposed system complies with applicable IEEE standards and is safe in terms of touch, step, and transferred potential.
- Ground rods will be placed at all junction boxes
- Surge arrestors will be installed on the DC side of the system (e.g. DC side of inverter, array junction box, etc.)
- All module racking needs to be bonded to the inverter via equipment grounding conductor. A local grounding electrode conductor will be installed at each section of UL2703-listed racking.

EQUIPMENT ENCLOSURES

Electrical equipment enclosures (junction boxes, control cabinets, etc.) will be in accordance with NEMA Standards and will be suitable for the location conditions. All enclosures will be provided with provisions for pad locking. Base design will be:

- Indoor: NEMA 1
- Outdoor: NEMA 4

TESTING

The purpose of the performance testing is to ensure that the solar installation is operating as intended and meets the system requirements. All testing will be in accordance to the Interconnection Agreement. The Contractor shall

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conduct a capacity test and performance ratio test. The Owner must authorize all tests in advance and the Owner must be notified at least 5 business days in advance of testing to be able to witness the tests if desired.

Contractor shall develop a procedure that includes at a minimum, a listing of test instrumentation, calibration procedures, test duration, type of data collected and collection frequency, test data collection procedures, and test reporting to complete the required tests. Contractor shall provide preliminary test results to the Owner five days after conclusion of each test and provide Final Test Report 10 business days once all tests have concluded. The test report shall consist of the following:

- Any agreed upon deviations to the test procedures
- Instrument calibration sheets/certificates
- Test data (manual and from the data acquisition system)
- Corrected test data
- Field notes
- Calculations
- Post-test uncertainty analysis
- Conclusions

ACCEPTANCE TESTS

The Contractor shall prepare a testing plan and perform tests to verify system functionality of the following equipment:

- DC Cable
- LV Cable
- MV Cable
- Ground Loop
- Pad-mount Transformers
- Fiber loops and Communication
- PV Strings (i.e. module string, string circuits, and string combiner box)
- Inverters
- MV switchgear and relays
- Meteorological Stations
- Ground Grid
- SCADA

Testing plan, procedures, and documentation of results will be submitted to the Owner for approval.

PERFORMANCE RATIO TEST

Project Execution Plan

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The purpose to the Performance Ratio test is to prove the Plant can continuously produce the energy in line with the contracted Performance Ratio. All incidents shall be recorded in 15-minute increments when the Plant is in operation. Unsatisfactory results will be recorded as well. The PR will be measured at the AC utility meter and will be weather corrected. The test will be conducted over a period of at least five consecutive days and meet the minimum requirements below:

- At least five days with irradiance measured on the plane of the array greater than 600 W/m² for 3 contiguous hours.
- Data will be excluded when the Plant is not fully available. The test period will be extended to obtain a full set of data for an equivalent of five days with 100% availability.

Acceptance of the test will be achieved if the Plant meets the minimum PR for the corresponding month the test was conducted in.

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Construction Waste Management Implementation Plan

Overview:

On-site construction waste implementation plan will incorporate the removal of waste from the jobsite according to the following items:

- Disposing of non-hazardous construction waste/material
- Recycling non-hazardous construction waste/material
- Salvaging non-hazardous demolition waste/material

Site Materials:

Excess/unusable onsite material will be sorted into dumpsters labeled either 1) construction waste or 2) Salvageable/Recyclable material. Multiple dumpsters may be used for each depending upon the variance of material expected to be delivered to the site. The overall goal will be to divert as much material as possible from a landfill.

Expected waste material to be produced by the site:

- Aggregate
- Concrete
- Geotextile
- Spare parts such as wiring, conduit, harnesses, tracker/rack material other accessories
- Lumber
- Metals
- SWPPP materials
- Packaging materials such as paper, cardboard, boxes, plastic, crates

Site Implementation Plan:

Site execution will include the following steps:

- Plan implementation with site team.
- An on-site employee will be named waste management coordinator; this employee will also have other responsibilities.
- Training will occur in order to make sure the entire site staff understands waste management for the project.
- Site waste controls will be implemented to assure the plan will be followed and the site is kept as clean and as organized as possible.
- Hazardous wastes, if encountered, will be handled according to local regulations.

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Material Tracking:

Site supervision will provide a report for materials based upon the following:

- Whether the material is recycled, salvaged, or landfill bound material
- Hauler/location for disposal
- Quantity of materials hauled

Disposal Site:

Disposal site will be determined prior to construction but will be use one of the following locations:

- Waste Management
- Republic Services
- Michiana Recycling & Dispose

Licenses


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The state of Indiana does not require a contractor license. Indiana contractor license is not at the state level. Rather, they are required to register or obtain a license by the various municipal governments throughout the state.

St Joseph County, Indiana does require permits, but no licenses are required.

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	MANPOWER LOADING CHART																																				
6325 Digital Way, Suite 460 Indianapolis, IN 46278	South Bend Solar																																				
	12/14/2018																																				
Site Activity	April				May				June				July				Aug				Sept				Oct				Nov				Dec				
	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	
Survey/Stake																																					
Fencing																																					
Civil																																					
Foundation																																					
Underground DC Wiring																																					
Trackers																																					
PV Modules																																					
PV Array Wiring																																					
Combiner Boxes																																					
Inverters																																					
AC Collection																																					
Site Restoration																																					
Testing/Commissioning																																					
Manpower Crew Size	0	6	12	18	12	12	20	22	34	50	54	54	54	54	54	54	46	34	34	34	34	34	22	10	10	16	12	12	12	12	12	12	12	6	6	0	0

South Bend Clay Version
High Level Schedule

BIBLIOGRAPHY

[illegible]

 Critical Remaining Work
  Actual Work
  Milestone

 Remaining Level of Effort
  Remaining Work
  Critical Milestones

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Site Quality Control Plan



ISO 9001:2008 Compliant Quality Management System

SAMPLE
Site Quality Control Plan

*For The
Installation of
Solar Photovoltaic (PV) Modules
Revision 0*

THIS DOCUMENT WHETHER CONTAINING PATENTABLE OR NON-PATENTABLE SUBJECT MATTER, EMBODIES THE PROPRIETARY AND CONFIDENTIAL INFORMATION OF WCI. THIS INFORMATION IS LOANED IN CONFIDENCE WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED, USED OR DISCLOSED FOR ANY PURPOSE EXCEPT THE LIMITED PURPOSE FOR WHICH IT WAS LOANED. THIS DOCUMENT SHALL BE RETURNED TO WCI UPON DEMAND.

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Site Quality Control Plan

1.0 Table of Contents

Site Quality Manual Contents

2.0	Introduction and Statement of Authority and Responsibility	5
2.1	Conformance and Compliance Standards.....	5
2.2	Other Relevant Standards	5
2.3	Services Offered	6
2.4	Subcontracted Supplied Services and Materials.....	6
2.5	Purpose of This Manual.....	6
2.6	QMS Scope and Exclusions.....	7
2.7	Distribution and Review	7
3.0	Terms and Definitions	8
4.0	Quality Management System.....	8
4.1	General Requirements	8
4.2	Documentation Requirements.....	9
4.2.1	General	9
4.2.2	Quality Manual.....	9
4.2.3	Control of Documents	10
4.2.3.1	Document Approval and Issue:	10
4.2.3.2	Document and Data Changes:.....	10
4.2.3.3	Obsolete Documents:.....	10
4.2.3.4	Documents of External Origin:	11
4.2.4	Control of Quality Records.....	11
5.0	Management Responsibility	11
5.1	Management Commitment.....	11
5.2	Customer Focus.....	11
5.3	Quality Policy.....	12
5.4	Planning.....	12
5.4.1	Quality Objectives	12
5.4.2	Quality Management System Planning	13
5.5	Responsibility, Authority and Communication	14
5.5.1	Responsibility and Authority	14
5.5.2	Management Representative.....	14
5.5.3	Internal Communications.....	15
5.6	Management Review	15

PUBLIC VERSION

Site Quality Control Plan

5.6.1	General	15
5.6.2	Review Input.....	15
5.6.3	Review Output.....	15
6.0	Resource Management	16
6.1	Provision of Resources	16
6.2	Human Resources.....	16
6.2.1	Assignment of Personnel.....	16
6.2.2	Competence, Awareness and Training.....	16
6.3	Infrastructure	17
6.4	Work Environment	17
7.0	Service Realization.....	17
7.1	Planning of Service Realization	17
7.2	Customer-Related Processes.....	17
7.2.1	Determining of Requirements to the Product	17
7.2.2	Review of the Requirements Related to the Product	18
7.3	Design and Development	18
7.3.1	Design and Development Planning	18
7.3.2	Design and Development Inputs	18
7.3.3	Design and Development Outputs	18
7.3.4	Design and Development Review	18
7.3.5	Design and Development Verification	19
7.3.6	Design and Development Validation.....	19
7.3.7	Control of Design and Development Changes	19
7.4	Purchasing	19
7.4.1	Purchasing Process.....	19
7.4.2	Purchasing Information.....	20
7.4.3	Verification of Purchased Product	20
7.5	Production and Service	20
7.5.1	Control of Production of Service Provision	20
7.5.2	Validation of Processes	20
7.5.3	Identification and Traceability	20
7.5.4	Customer Property.....	20
7.5.5	Preservation of Product	21
7.6	Control of Monitoring and Test Equipment.....	21
7.6.1	Site Monitoring.....	21

PUBLIC VERSION

Site Quality Control Plan

8.0	Measurement, Analysis & Improvement	22
8.1	General	22
8.2	Monitoring and Measurement	22
8.2.1	Customer Satisfaction	22
8.2.2	Internal Audit	22
8.2.3	Monitoring and Measurement of Processes	22
8.2.4	Monitoring and Measurement of Product	23
8.3	Control of Nonconforming Product	23
8.4	Analysis of Data	23
8.5	Improvement	23
8.5.1	Continual Improvement	23
8.5.2	Corrective Action	24
8.5.3	Preventative Action	24
9.0	Site Specific Addenda	24

PUBLIC VERSION

Site Quality Control Plan

2.0 Introduction and Statement of Authority and Responsibility

This Site Quality Manual demonstrates and documents Infrastructure & Energy Alternatives (IEA) commitment to maintaining a high-level of quality and strong customer service within an environment that has safety as a first priority, and is devoted to delivering services and projects that constantly meet or exceed the customer requirements and fosters continual improvement.

The Company endorses the concept that total quality services and products are based on principles where quality is a functional responsibility of each individual and segment of the IEA organization. Managers and key personnel at all levels are responsible for giving full attention to quality in managing and performing their respective activities. All employees have the ability to stop work, the responsibility and authority to identify quality problems, to initiate and provide solutions to quality problems, to verify implementation, and to resolve deficiencies that affect quality.

Each Project Manager, Construction Manager, Project Engineer / Superintendent, Site Quality Control Manager, Craft Foreman, as well as all other company employees as assigned, will be responsible for implementing the requirements of this plan in their area of assigned responsibility.

Any issues, differences or nonconformance that cannot be resolved in accordance with this plan shall be brought to the attention of the Senior Quality Control Manager for resolution and/or the Corporate Quality Control Director for resolution.

2.1 Conformance and Compliance Standards

This Site Quality Manual is intended to demonstrate conformance to the ISO 9001:2008 international standard. The Site Quality Manual is a reference guide (G-4220-02) and supplements IEA's ISO 9001:2008 Compliant Lean QMS Map® (Manual—QM-4220). The Site Quality Manual is limited to its intended application and design scope and does not control the ISO 9001:2008 quality requirements of WCI nor IEA.

This plan does not control the installation, alignment, and performance of Solar Equipment and software. This specific information is contained within vendor manuals, documents and programs. Commissioning is outside the scope of this manual and is under the direction of Others.

2.2 Other Relevant Standards

In addition to the conformance and compliance standards, IEA may from time to time use other standards documents as guidance in its operations and Quality Management System. These may include but are not limited to current editions of the following:

American Concrete Institute (ACI): the leading authority and resource worldwide for the development and distribution of consensus-based standards, technical resources, educational and training programs, certification programs and proven expertise for individuals and organizations involved in concrete design, construction and materials.

American Society of the International Association for Testing and Materials (ASTM): is an international standards organization that develops and publishes voluntary consensus technical

PUBLIC VERSION

Site Quality Control Plan

standards for a wide range of materials, products, systems, and services.

With the exception of ISO 9001:2008 these are not auditable standards and are used solely for guidance.

2.3 Services Offered

Infrastructure & Energy Alternatives, LLC (IEA) was formed back in 2011 and chartered with building an integrated portfolio of energy and water infrastructure service companies. The product of IEA is the service of providing contracting, engineering, installation, and plant maintenance for various construction projects ranging from heavy highway, biomass, solar, along with other projects in the renewable energy marketplace.

2.4 Subcontracted Supplied Services and Materials

2.4.1 This section is not applicable.

2.4.2 Before being considered for an invitation to bid, critical subcontractors and suppliers go through a prequalification process to review availability, Quality Control, Safety, Financial Capacity Eligibility, and previous work history.

2.4.3 Subcontractors and Suppliers are required to implement their own respective Quality Plan commensurate to this plan with the work to be performed and the materials provided. Each subcontractor is responsible for the distribution and control of their respective plan and program manual as stated in their controlling document.

2.4.4 Critical Suppliers and Subcontractors are monitored for performance during construction activities through the use of Surveillance Reports and/or field audits to help assure compliance to contract, drawings, and specifications/code.

2.4.5 The Project Manager has the responsibility for the controlled distribution of project documents to the subcontractor(s)/supplier(s) and the Subcontractor's/Supplier's Site Manager is responsible for issuance within the Subcontractor's/Supplier's Company.

2.4.6 Testing agencies will submit appropriate certifications and credentials to the Site Quality Manager for review and filing prior to performing any testing on site.

2.4.7 All subcontractors and suppliers are required to provide records of calibration for their equipment (if applicable). The Site Quality Manager shall review these records and ensure compliance with project requirements.

2.5 Purpose of This Manual

IEA's overall commitment to quality in work practice and customer service is defined through its Core and Support Business Processes. Through each of these business processes, the Quality Management System is aligned with the goals and strategic direction of the organization. The Quality Management System as described in the Quality Manual defines IEA's commitment:

PUBLIC VERSION

Site Quality Control Plan

- a. by demonstrating its ability to consistently provide quality service that meets customer and applicable regulatory requirements,
- b. by addressing customer satisfaction through the effective application of the system, including processes for continual improvement and the prevention of nonconformity,
- c. through employee empowerment, especially for innovative action to improve the company's performance, and
- d. through orderly change management that will maintain a high level of service in schedule-driven complex and fast-paced projects.

The Lean Quality Management System Map® (QM-4220) provides an overview of the quality policies and key requirements for the organization. The Lean QMS Map® is the source of reference for all matters dealing with quality. It is available for inspection by our customers, potential customers, and third party quality auditors.

2.6 QMS Scope and Exclusions

Scope: Civil and commercial construction, project management and construction project design.

Exclusions: ISO 9001 clause 7.5.2 Validation of processes for production and service provision.

Outsourced Process: ISO 9001 clause 7.3 Design and Development.

2.7 Distribution and Review

2.7.1 Circulation List

The Quality Manual System is maintained on the IEA SharePoint network as a read-only document that is available to all employees and to other interested and authorized parties. All copies printed from the network are uncontrolled reference copies need not be labeled as such.

2.7.2 Procedures for Updating the Quality Management System

The Quality Management System will be reviewed by IEA Management and revised as required. After management review, the Quality Management System is updated (if needed) by incorporating all approved changes. The Management Representative may approve minor changes and updates to the Quality Management System. The revision date is updated, and the document is re-approved and released as a new issue in its entirety. The revision date on the cover refers to the entire document.

2.7.3 Procedures for Updating the Site Quality Manual (G-4220-02)

- 2.7.3.1 This site quality manual serves as an informative guide to explain the Lean QMS Map® (Manual). It is the responsibility of WCI to provide and maintain an effective Quality Plan throughout the duration of the contract. To accomplish our overall goal of completing the timely construction of these facilities in compliance with the contract documents while providing a safe work environment for our employees and subcontractors. WCI shall provide and ensure the performance of sufficient inspection and testing of all work performed incident to this construction effort. These tests and inspections include subcontracted as well as self-performed work. All tests and inspections will be performed to provide the quality of

PUBLIC VERSION

Site Quality Control Plan

materials, workmanship, and functional performance requirements mandated by the contract documents.

- 2.7.3.2 The Site Quality Manual describes the program used by IEA to control the quality of field activities performed in the installation of solar modules.
- 2.7.3.3 The Site Quality Manual does not control the installation, alignment, and performance of Equipment and software that is controlled by other vendor manuals, documents and programs.
- 2.7.3.4 The Corporate Quality Control Director is responsible for the contents of the site quality control manual and revisions there in. The Corporate Quality Control Director will review the site manual as required to assure compliance with QMS requirements.
- 2.7.3.5 At the request of the customer, site plan adjustments that are unique to a project may be made in the site quality manual as required by contract, specifications, and applicable code. These changes will be considered plan addenda. When such changes are made, they will be added to this plan as addenda and not revisions. *Any field changes are prohibited.*
- 2.7.3.6 Changes in titles, document forms and material that do not change the intent of the site quality plan are not considered to be a revision. In addition, special addenda can be issued to address governmental, site and/or customer/contract specific requirements.
- 2.7.3.7 The forms referenced in this plan are controlled inspection records and cannot be substituted.

3.0 Terms and Definitions

For the purpose of this document, the terms and definitions given in ISO 9001 apply. Throughout this document, whenever the term “product” occurs, it can also mean “service”. The following have been defined as:

Quality: is defined as a product’s compliance with its design specifications. These specifications include the customer’s requirements and local statutory and regulatory legislation (ISO 9001:2005).

Quality Management System (QMS): is defined as a system established to ensure achievement of the quality objectives by the quality policy adopted by top management in accordance to the requirements of the standard (ISO 9001:2008).

4.0 Quality Management System

4.1 General Requirements

IEA has established, documented and implements and effective QMS as a means of ensuring that the services provided conform to specified requirements, to foster an environment of continual improvement, and to identify its position as a leading EPC contractor in the renewable energy marketplace. The Site Quality Manual is intended to be a reference guide (G-4220-02) and supplements IEA’s ISO 9001:2008 Compliant Lean QMS Map® (Manual—QM-4220).

PUBLIC VERSION

Site Quality Control Plan

This site Quality Manual is limited to its intended application and design scope and does not control the ISO 9001:2008 quality requirements of IEA.

- 4.1.1 The Core Processes describe all the processes that are necessary for the organization to realize and deliver the desired service to its Customers. QM-4220 is an overview of the processes and their interactions within the system.
- 4.1.2 The support processes describe all other business requirements that are necessary to manage and control resources and to conduct business in an orderly manner. The support processes are implemented and managed in accordance with the applicable requirements of the International Standard.
- 4.1.3 The sequence and interaction of the Core and Support Business Processes are described in Section 5.4.2 QMS Planning of QM-4220 where the criteria and methods required to ensure the effective operation and control of these processes are defined and documented.
- 4.1.4 The entire QMS documentation and other key information necessary to support the operation and monitoring of the organization's business processes are available to all employees and other parties requiring access on the SharePoint network.
- 4.1.5 Appropriate levels and types of monitoring and measurement of core and support processes have been determined and are documented in relevant policies and procedures.
- 4.1.6 The Lean QMS Map® (Manual) includes policies and procedures for implementation of actions required to achieve planned results and for continual improvement of the business processes.
- 4.2 Documentation Requirements
 - 4.2.1 General
 - 4.2.1.1 IEA has defined and documented quality procedures consistent with the requirements of the standard. The quality procedures further describe criteria, methods, detail activities, responsibilities, and the quality assurance measures that are required to ensure the effective operation and control of the business processes. The QMS also includes other documents and records required by the organization to ensure the effective operation and control of the business process. The degree of documentation is consistent with: the methods used, the complexity and interaction of the business processes, and the skills needed and training required by the personnel involved in carrying out these activities.
 - 4.2.1.2 The Documentation Hierarchy consists of three levels. Level 1: Lean QMS Map® (Manual). Level 2: Policies and Procedures including this Site Quality Manual (guide). Level 3: Work Instructions.
 - 4.2.1.3 The QMS is maintained, updated and continually improved as the organization seeks better business practices.
 - 4.2.2 Quality Manual

PUBLIC VERSION

Site Quality Control Plan

4.2.2.1 A Lean QMS Map® (Manual) has been established and maintained. This includes the scope of the QMS, including details of and justification for any exclusions; documented procedures or reference to them; a description of the sequence and interaction of the processes included in the QMS.

4.2.2.2 The QMS Map® (Manual) is a controlled document subject to the requirements of section 4.2.3 Control of Documents.

4.2.3 Control of Documents

IEA ensures that pertinent issues of documents and data that relate to the requirements of the QMS are controlled. This control also extends to documents of external origin that are maintained solely by WCI, such as customer drawings or requirements, performance standards, and other industry specifications. This policy is implemented by SP-4230.

Any document that is kept controlled in an electronic folder is designated uncontrolled when downloaded from the folder of origin.

4.2.3.1 Document Approval and Issue:

All documents and data that relate to the requirements of the QMS and the Standard are reviewed and approved for suitability by authorized personnel prior to use or release. Where use is made of computer-based files, special attention is paid to appropriate approval, access, distribution, and archiving procedures.

All electronic QMS documents are stored in protected folders. Update access privileges to these folders are limited to the designated document control administrator.

A list of documents, identifying the current revision status of each, is established and is readily available. Appropriate documents are available at all locations where operations essential to the effective functioning of the Lean QMS Map® (Manual) are performed, or they may be readily obtained.

4.2.3.2 Document and Data Changes:

Personnel are required to identify required changes in documents and are encouraged to suggest improvements. Changes to documents are reviewed and approved by the same function/organization that performed the original review and approval, unless specifically designated otherwise. Access to appropriate background is provided. The nature of the changes are recorded.

4.2.3.3 Obsolete Documents:

Electronically maintained documents are promptly removed from active files when they become obsolete. They may be maintained for the document retention period in file areas not accessible to general users.

PUBLIC VERSION

Site Quality Control Plan

After a revision issue, obsolete documents are promptly removed from points of issue and use. The obsolete master document is archived and may be retained for legal and/or knowledge preservation purposes.

4.2.3.4 Documents of External Origin:

IEA is subject to various government regulations. When there is a need to refer to any of these regulations, access is gained through the regulatory agency system. Our presumption is that the link on that site goes to the most current edition of the regulation. Any other copies of these regulations are not authorized for use. These and other situations are further documented in SP-4230.

Customer Documents: The Customer will furnish applicable documents as defined in the contract. The Project Manager is responsible for conducting a review of all Customer provided documents. All Customer documents will be maintained and controlled the same as IEA documents unless otherwise stated in the contract.

4.2.4 Control of Quality Records

Quality Records are a special case of quality documents. For example, a blank form is a document. A completed form is a record.

IEA maintains quality records to demonstrate conformance to specified requirements and the effective operation of the Lean QMS Map® (Manual). Record control provides for the identification, collection, indexing, filing, access, storage, maintenance, and disposition of quality records. Pertinent customer and supplier records are an element of this data.

Quality records are legible and are stored and retained in such a manner that they are readily retrievable. Storage facilities provide an environment that minimized damage, deterioration and prevents loss. Retention times of quality records are established and recorded. A records control matrix is documented to aid control. SP-4240 has been established to implement the above policies and to control Lean QMS Map® records.

5.0 Management Responsibility

5.1 Management Commitment

The top management of IEA is committed to the development and improvement of an effective Quality Management System. This commitment is demonstrated by communicating to the organization the importance of meeting all customer, regulatory, and legal requirements; establishing an IEA quality policy for total commitment to excellence and the associated quality objectives; conducting management reviews; identifying and acquisition of controls, processes, equipment, fixtures, resources, and skills needed to achieve the required quality. The associated quality management activities are described in Section 6—Resource Management.

5.2 Customer Focus

Top management of IEA ensures that customer needs and expectations are determined, converted into requirements, and fulfilled with the aim of meeting or exceeding those

PUBLIC VERSION

Site Quality Control Plan

expectations. The specific needs of our customers are determined through continual verbal and written communication as well as periodic visits to their facilities to better understand their individual needs and/or expectations. It is the responsibility of all personnel that interface with customers to access stated or implied needs and bring them to the attention of top management so that they may be addressed. To continually improve, the organization also monitors, measures, and analyzes customer satisfaction throughout the business cycle.

5.3 Quality Policy

The top management of IEA has defined and documented the Quality Policy. This policy includes the organization's commitment for meeting customer requirements and continual improvement.

The top management of IEA ensures that the Quality Policy is understood. This is accomplished through training, communication, and displays. The Policy is implemented by means of documentation and training about the Quality Management System to meet the requirements of the Standard. The Policy is maintained through QMS audits and corrective and preventative action and reviewed for continuing suitability through Management Reviews. Further, this Quality Policy is supported by the quality objectives listed in the Lean QMS Map® (Section 5.4.1 Quality Objectives).

Quality Policy Statement: IEA is committed to operate every aspect of the business to those standards that offer the highest possible quality of service to all customers. This is supported by a progressive management style that encourages the Quality culture throughout the Company.

The Quality Policy is communicated and implemented throughout all operations of IEA and embodies Management's mandate to achieve:

- To consistently meet our customers ever changing expectations by understanding their needs, requirements and delivering projects that they and us can be proud of.
- By nurturing the experience and skills of our people to ensure the highest standards of workmanship and professionalism in everything we do.
- Compliance to respective standards and guidelines (ISO 9001:2008), regulatory and statutory legislation, and IEA's corporate defined requirements.
- Customer satisfaction by compliance & fulfillment of customer requirements.
- Employee empowerment, through the education and training of employees.
- Continual improvement of processes and systems.
- A safe and healthful work environment, with minimized risk to employees.
- Satisfactory response to the needs of interested parties.

5.4 Planning

5.4.1 Quality Objectives

Top management of IEA establishes quality objectives at all relevant functions and levels within the organization. The objectives are derived from IEA's Quality Policy and corporate policies. The quality objectives are documented (Annual Quality Objectives) and are reviewed by top management.

PUBLIC VERSION

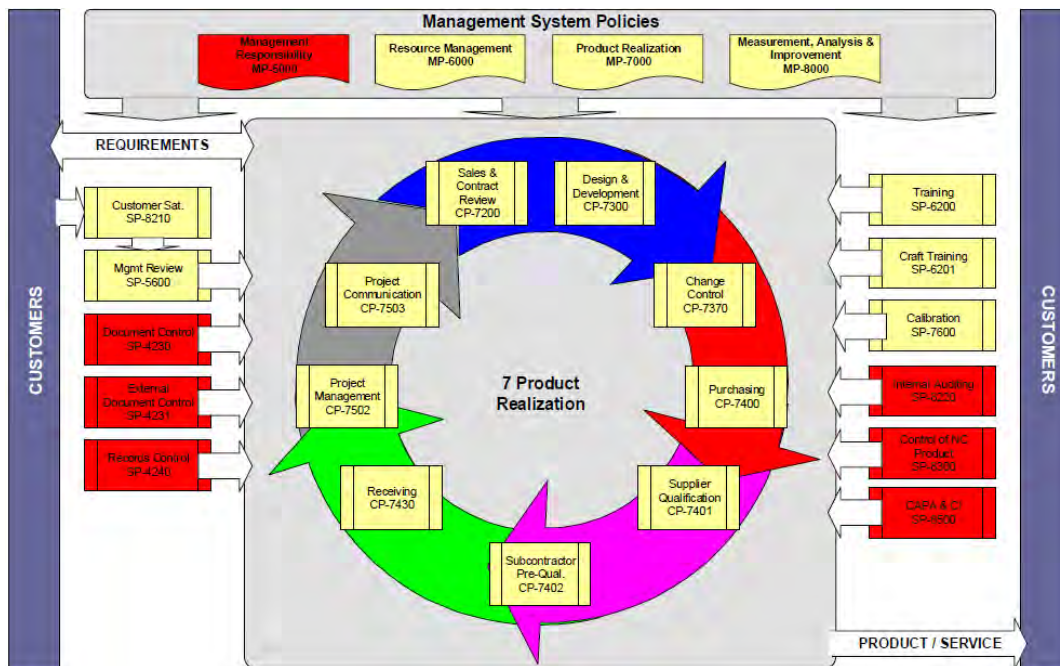
Site Quality Control Plan

The quality objectives are measureable and consistent with the quality policy, including commitment to continual improvement. Quality objectives include those needed to meet all contracted requirements.

5.4.2 Quality Management System Planning

Top management of IEA has identified and planned the resources needed to achieve its quality objectives. The results are documented in management reviews. Quality planning addresses continual improvement of the QMS and assures that change is conducted in a controlled manner so that the integrity of the QMS is maintained during this change.

The Quality Plan identifies the core and support processes of the QMS, and is documented in the form of references to associated Quality Procedures. The Core Processes (CP-) represent how opportunity is turned into profitable outcomes. Its effectiveness is maintained and enhanced by Support Processes (SP-). The identified Core and Support Processes are indicated in Figure 1.



Lean QMS MAP® Figure 1

Each Core and Support Process has a process owner who has the prime responsibility for ensuring that the process achieves its objectives and is under continual review for improvement.

The Quality Plan describes the overall plan for quality assurance. The quality plan consists of: the core business processes and their interactions, the support processes and their interactions, the Project Management Process and Responsibility matrix, and appropriate outputs of management review, such as supporting resources.

PUBLIC VERSION

Site Quality Control Plan

The Quality Plan is assessed for on-going suitability and effectiveness during management review meetings.

5.5 Responsibility, Authority and Communication

5.5.1 Responsibility and Authority

5.5.1.1 Top management of IEA has defined business functions and their interrelations with the organization, including responsibilities and authorities; and those are communicated in order to facilitate effective quality management.

5.5.1.2 IEA ensures the responsibility, authority and interrelationship of personnel who manage, perform, and verify work affecting quality have the organizational freedom and authority to: initiate action to prevent the occurrence of any nonconformance relating to service, process, and Quality Management System; Identify and record any problems relating to the service, process and QMS; Initiate, recommend, or provide solutions through designated channels; Verify the implementation of solutions; Control further processing, delivery or installation on nonconforming product until the deficiency or unsatisfactory condition has been corrected.

5.5.1.3 The IEA organizational chart (Figure 2) for solar projects shows the organization of the company and the relationships to IEA corporate management. Relationships to other parts of IEA corporate structure are documented by IEA and are available on the SharePoint network.

5.5.1.4 The Project Manager is responsible for overseeing the construction of the project, as well as all other related contract work. The Project Manager reports to the designated Project Director.

5.5.1.5 The Construction Manager is responsible for directing all construction activities, which includes: supervision of all Project Superintendents, as well as the administration of the Equipment/Logistics Manager(s), and Site Administrative Assistant. The Construction Manager is responsible, along with the Site Quality Control Manager, to implement the Quality Program and Plan, and interfaces with the Project Superintendents to implement all work activities of the Craft Labor.

5.5.1.6 The Site Quality Control Manager reports to the Senior QA/QC Manager. The Corporate Quality Control Director is responsible for supervision of IEA Site Quality Assurance/Control, implementation of this or any subcontractor's plan, technical direction in Quality Control to IEA personnel, controlling contents, revisions, and reviewing quality plans.

5.5.1.7 Other than Discipline Engineers, The Site Quality Control Manager may appoint a Site Quality Specialist, NDE Technician, Civil Specialist, Mechanical Specialist, or other technically specialized personnel to the project commensurate with the scope of work to be performed. These technical specialists report functionally to the Site Quality Control Manager and administratively to the Project Manager and are responsible for providing direction in their specific area of authority for the project. The Site Quality Control Manager can assign field technical responsibility to a Site Quality Specialist.

5.5.2 Management Representative

PUBLIC VERSION

Site Quality Control Plan

The top management of IEA has appointed the Corporate Quality Director as its Management Representative. This individual, irrespective of other responsibilities, has the defined authority to: Ensure that the processes of the QMS are defined; Ensure that the Quality Management System requirements are established, implemented and maintained in accordance to the Standard; Report to top management of the performance of the QMS, including needs for improvement; Promote awareness of customer requirements throughout the organization.

The Management Representative also acts as the liaison between the company and other third parties on matters concerning the Quality Management System.

5.5.3 Internal Communications

Top management of IEA ensures that communication is maintained between its various levels and functions regarding the processes of the QMS and their effectiveness. This is accomplished via various quality meetings, lessons learned opportunities, and internal publications.

5.6 Management Review

5.6.1 General

Top management of WCI reviews the QMS at planned intervals to ensure its continuing suitability, adequacy and effectiveness. The review evaluates the need for changes to the organization's QMS, including its quality policy and quality objectives. Results of management reviews are documented.

5.6.2 Review Input

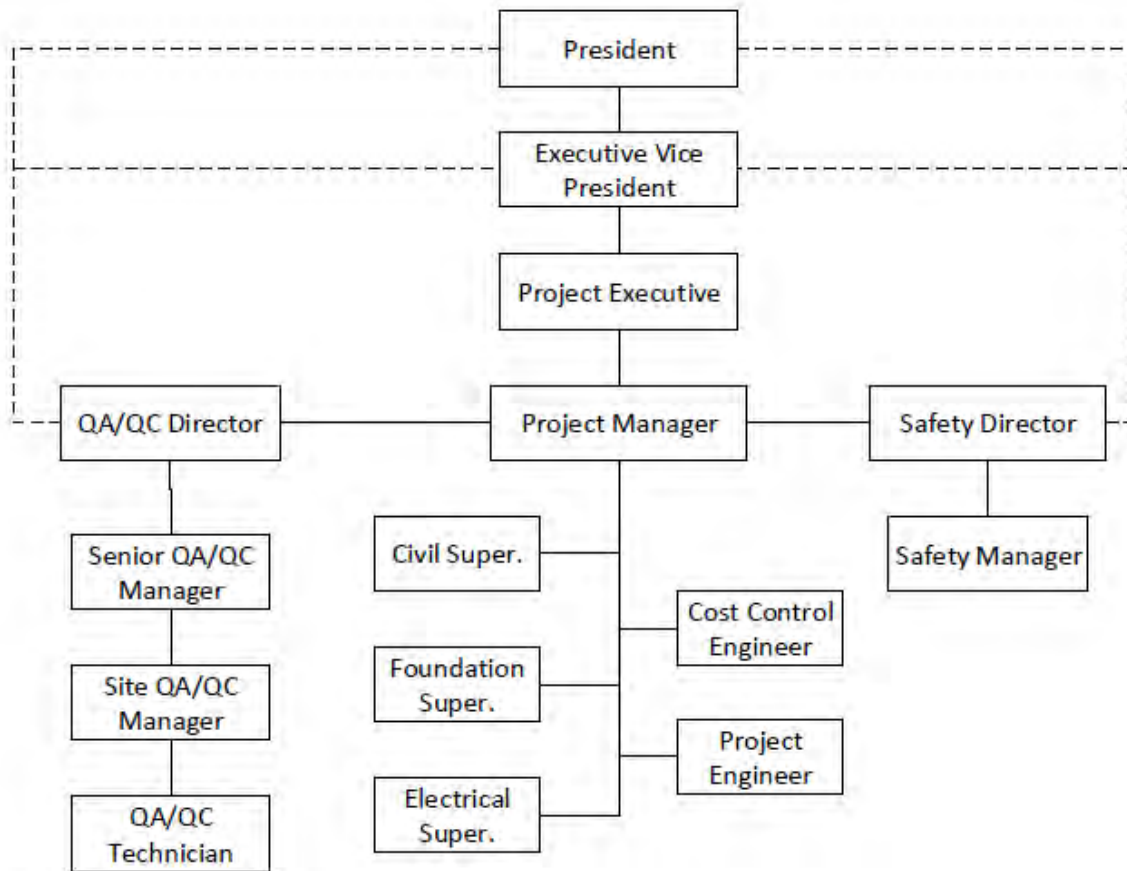
Inputs to management review include but are not limited to current performance and improvement opportunities related to: results of audits, customer feedback, process performance and product performance, status of preventative and corrective actions, follow-up actions from earlier management reviews, changes that could affect the QMS, and recommendations for improvement of the system.

5.6.3 Review Output

The outputs from the management review include but are not limited to decisions and actions related to: improvement of effectiveness of the QMS and its processes; improvement of product related to customer requirements; and resource needs.

PUBLIC VERSION

Site Quality Control Plan



Organization Figure 2

6.0 Resource Management

6.1 Provision of Resources

Top management of IEA determines and provides, in a timely manner, the resources needed: to implement, maintain and improve the effective operations of the QMS processes, and to enhance customer satisfaction by meeting requirements. These resources are assessed and reviewed on a periodic basis consistent with annual and strategic business planning activities.

6.2 Human Resources

6.2.1 Assignment of Personnel

Personnel who are assigned responsibilities directly or indirectly affecting conformity to service (product) requirements are determined to be qualified and competent based on education, training, skills, and experience.

6.2.2 Competence, Awareness and Training

PUBLIC VERSION

Site Quality Control Plan

IEA identifies training needs and provides for the training of all personnel performing activities affecting quality. Personnel performing specific assigned tasks are qualified on the basis of appropriate education, training, observed skills, and experience as required. A training plan is prepared by department with periodic updates.

Training is provided either on or off the job, internally or externally as appropriate. The ongoing effectiveness of training is periodically assessed by observation, proficiency testing or other appropriate means. IEA ensures that personnel are aware of the relevance and importance of their jobs and how they contribute to the achievement of the quality objectives.

SP-6220 in the Lean QMS Map® (Manual) implement the above policies.

6.3 Infrastructure

Top management of IEA identifies, provides and maintains the facilities and infrastructure it needs to achieve quality including: workspace and associated facilities, including utilities, process equipment, hardware and software; supporting services such as telephone, computer networks, etc. MP-6000 on the Lean QMS Map® has been established to further describe and implement this policy.

6.4 Work Environment

Top management of IEA identifies and manages the human and physical factors of the work environment needed to achieve conformity of service of quality. MP-6000 on the Lean QMS® Map has been established to further describe and manage this policy as well as to define the physical environmental requirements.

7.0 Service Realization

7.1 Planning of Service Realization

7.1.1 This section describes the document control process (SP-4230) for review and distribution of management policies, process forms, specifications, drawings, procedures, instructions and other documents.

7.1.2 The purpose, scope and responsibility for controlling each type of document is defined on the document record master list (F-4220-01).

7.2 Customer-Related Processes

7.2.1 Determining of Requirements to the Product

IEA determines customer requirements including service and/or product requirements specified by the customer. These customer requirements include, but are not limited to: specific project requirements and specifications, the requirements for availability and delivery with associated costs, contract requirements not specified by the customer but necessary for project construction, and obligations related to the contract, including regulatory and legal

PUBLIC VERSION

Site Quality Control Plan

requirements. CP-7200 on the Lean QMS Map® is established to implement and provide further guidance regarding customer-related processes.

7.2.2 Review of the Requirements Related to the Product

IEA ensures that the customer requirements are fully understood and the company has the capability to meet them. Before acceptance of a project, a thorough review is conducted to ensure that the requirements are adequately defined and documented, contract requirements differing from those previously expressed are resolved, and the organization has the ability to meet the defined requirements.

Where the customer provides no documented statement of the expected requirements, the customer requirement is confirmed by the organization before acceptance. Where the customer requirements have changed, the organization ensures that relevant documents are amended and the relevant personnel are made aware of the changed requirements.

7.3 Design and Development

IEA is not a design firm and currently outsources the design and development of a project to qualified outside parties. Where applicable, drawings, specifications, etc. will be uploaded, stored and issued to the subcontractors through email or via paper copy.

7.3.1 Design and Development Planning

Through CP-7300 IEA manages the interfaces between the different groups involved in the design and development process to ensure effective communication and clear assignment of responsibility. During the design and development planning, IEA reviews, verifies, and validates what is appropriate to each design and development stage, and the responsibilities and authorities for design and development.

7.3.2 Design and Development Inputs

Inputs relating to the project requirements are determined in accordance with CP-7300. These inputs include, but are not limited to: functional and performance requirements, applicable statutory and regulatory requirements, information derived from previous similar designs (when applicable), and other requirements essential for design and development.

7.3.3 Design and Development Outputs

Outputs of design and development shall be in accordance with CP-7300 where the design outputs shall: meet the input requirements for design and development; provide appropriate information for purchasing, production and service provision; contain and/or reference product acceptance criteria, and specify the characteristics of the product that are essential for its safe and proper use.

7.3.4 Design and Development Review

During suitable stages, systematic reviews of design and development are performed in accordance with CP-7300. These reviews evaluate the ability of the results of design and

PUBLIC VERSION

Site Quality Control Plan

development to meet project requirements, and identify any problems and propose necessary actions. Participants in these reviews include representatives of the functions concerned with the design and development stages being reviewed.

7.3.5 Design and Development Verification

Verification of the design is performed in accordance with CP-7300 to ensure that the design and development outputs have met the design and development input requirements.

7.3.6 Design and Development Validation

Design and development validation is performed in accordance to CP-7300 to ensure that the resulting product is capable of meeting the requirements for the specified application or intended use, where known. Wherever practical, validation shall be completed prior to the delivery of implementation of the product.

7.3.7 Control of Design and Development Changes

Design and development changes shall be identified and records maintained in accordance with CP-7300. Changes are reviewed, verified and validated, as appropriate, and approved before implementation. The review of design and development changes shall include evaluation of the effect of the changes on constituent parts and product already delivered.

7.4 Purchasing

7.4.1 Purchasing Process

Purchasing is controlled and maintained through CP-7400 in the Lean QMS Map® for outside materials, suppliers and services not provided by the customer/manufacturer/supplier that may affect the quality of the installed system and components.

The Project Manager has total responsibility for site procurement. The Project Manager initiates purchase requests and then reviews the subsequent purchase order to assure that provisions for traceability, identification and quality requirements are specified for items and materials as applicable. Purchase Orders clearly define the specified technical requirements to ensure the quality of the products.

Critical Suppliers and Subcontractors are assessed according to CP-7401 (Supplier Qualification) and CP-7402 (Subcontractor Qualification). Purchases are made from approved sources only and are selected from a critical supplier/subcontractor list (F-7401-03).

Critical Suppliers and Subcontractors are monitored for performance during construction activities through the use of QA/QC Activity Surveillance Reports (F-7502-05) and field audits. Critical Suppliers and Subcontractors are evaluated based upon quality, performance, and service provided.

The customer may verify for themselves that the purchased products or service conform to the relevant requirements.

PUBLIC VERSION

Site Quality Control Plan

7.4.2 Purchasing Information

The Purchase Order contains information describing the product or service ordered, including: identifying reference codes, appropriate drawings, inspection instructions, the requirements for qualification of personnel, and the quality standard to be applied.

All appropriate and relevant contract issues have been supplied to the IEA purchasing department. All purchasing documents are reviewed by the Project Manager and/or site team and approved to ensure the adequacy of specified requirements contained in the purchasing documents prior to their release.

7.4.3 Verification of Purchased Product

IEA identifies and implements the activities necessarily for verification of purchased products and/or services to ensure that purchase specifications are met. Through CP-7430 (Receiving) on the Lean QMS Map® this ensures that incoming material is not used or processed until it has been inspected or otherwise verified to specified requirements. Verification of conformance is in accordance with the contract requirements, project specifications, quality requirements, and material certification.

7.5 Production and Service

7.5.1 Control of Production of Service Provision

IEA carries out its defined production and service activities under the following controlled conditions: availability of product information, availability of process instructions, use of suitable process equipment, use of measuring and monitoring devices, implementation of process monitoring and measurements, and product inspection and acceptance criteria.

7.5.2 Validation of Processes

IEA has excluded clause 7.5.2 of the ISO Standard. All processes of the QMS can be validated by subsequent monitoring and measurement. Therefore, this sub-clause has been excluded from the scope of the QMS.

7.5.3 Identification and Traceability

IEA ensures appropriate identification and traceability of product at all stages of product realization: e.g. during receiving, inventory, work in progress, inspection, testing, finished goods, shipping and delivery. This system includes the following at a minimum: part numbers, lot numbers, job numbers, work order numbers, sales order numbers, project numbers, etc.

7.5.4 Customer Property

IEA exercises care with customer property while it is under our control or being used by the organization. Customer property, including products, tooling, equipment, returnable packaging, and intellectual property (information provided in confidence), proprietary information, is normally identified, verified, stored, used, and controlled in the same manner as company-

PUBLIC VERSION

Site Quality Control Plan

owned property, unless there are other specific requirements. Any loss, damaged, or deterioration of customer property is promptly reported to the customer.

Solar Modules: will remain packaged until the time of installation so as not to expose the module to sunlight. The packaging material will be inspected visually for damage. Any on site measurements required to verify proper manufacturing tolerances of any specific Manufacturer/Supplier/Customer supplied materials will be the sole responsibility of the Manufacturer/Supplier/Customer. *IEA will not accept responsibility, take possession of, or be responsible for the purchase of any special tooling required to check the Manufacturer's/Supplier's/Customer's original manufacturing requirements or tolerances outlined in the component manufacturing specifications or fabrication process.*

7.5.5 Preservation of Product

Products (including purchased materials and components, customer-owned products, parts and subassemblies, and the finished products) are protected and preserved during all stages of construction.

7.6 Control of Monitoring and Test Equipment

The calibration process SP-7600 ensures that adequately calibrated measuring and monitoring devices for tools, gauges and other inspection, measuring and testing equipment used in the activities affecting quality assures proper range, type and accuracy are controlled to provide consistent measurement requirements, and that these measurement results are traceable to National Standards.

This section does not intend to imply the need for special calibration and control on rulers, tape measures, levels and other devices when commercial practices provide adequate accuracy for the application.

This section does not intend to imply the need for special calibration and control of test hardware consisting of jigs, fixtures and templates.

7.6.1 Site Monitoring

7.6.1.1 The Site Quality Manager and the Project Manager are responsible for the site calibration program, including maintaining a list of all measuring and test equipment requiring periodic calibration. The Site Quality Manager is assigned the responsibility to assure that calibration records are maintained and current and a calibration tag is affixed to calibrated equipment. When it is impractical to use a tag, an alternative method may be used.

7.6.1.2 The Site Quality Manager will determine the required corrective action when a tool, gage or measurement instrument is found out of calibration as per SP-7600. Items measured by the tool, gauge or instrument in question since the last valid calibration, shall be considered unacceptable and treated as a nonconformance, until the Site Quality Control Manager has determined that the applicable requirements have been met. Tooling suspected being out of Tolerance will be listed on the "Out of Tolerance Evaluation of Tooling" (F-7502-99) and inspected or evaluated for site use. If the evaluation deems that the tool is out of tolerance, the tool will be removed, sent to a Calibration Laboratory for recalibration and issuance back to

PUBLIC VERSION

Site Quality Control Plan

the site. All work performed with the out of tolerance tool will be inspected for compliance with a calibrated tool.

7.6.1.3 Equipment furnished by the Customer requiring calibration and control will be calibrated and controlled by the Customer.

7.6.1.4 Equipment furnished by the Manufacturer/Supplier or its representatives requiring calibration and control will be calibrated and controlled by the Manufacturer/Supplier.

7.6.1.5 All subcontractors and suppliers are required to provide records of calibration for their equipment.

8.0 Measurement, Analysis & Improvement

8.1 General

IEA's methodology for planning and implementing measurement, analysis and improvement is stated on page 3 of the Lean QMS® Map (QM-4220). This methodology effectively integrates the DMAIC (Define, Measure, Analyze, Improve, Control) approach into the fabric of the QMS.

Process owners and process users are familiar with basic statistical concepts, such as variation, stability, process capability, and over-adjustment, as appropriate. Where applicable, explanation and discussion of these concepts are included in individual training.

8.2 Monitoring and Measurement

8.2.1 Customer Satisfaction

IEA monitors information on customer satisfaction and/or dissatisfaction as one of the measurements of performance of the QMS. The Quality Manager determines the methods for obtaining and using this information.

8.2.2 Internal Audit

IEA conducts periodic internal audits at planned intervals to determine whether quality management system conforms to the requirements of the Standard and is being effectively implemented and maintained. Audits are conducted by Independent third-party organizations, such as a qualified consultant or consulting firm.

The results of the internal audits are documented and brought to the attention of the personnel having responsibility for the area audited. Management personnel responsible for the area take timely corrective action of the deficiencies found during the audit. Follow-up activities verify and record the implementation of the corrective action, report the verification results, and close out the audit. Subsequent audits verify the effectiveness of the corrective actions taken. Results of internal audits and the corrective action are submitted for management review.

8.2.3 Monitoring and Measurement of Processes

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Site Quality Control Plan

IEA has defined process measureable (in the form of quality objectives and metrics) within each process of the QMS. Furthermore, QMS processes are monitored by a variety of approaches and techniques as appropriate for a particular process and its importance. These include: Internal Audits (SP-8220); Monitoring trends in corrective and preventive action requests; Measuring product conformity and monitoring quality performance data and trends (quality objectives and associated metrics); and Measuring and monitoring customer satisfaction.

8.2.4 Monitoring and Measurement of Product

IEA has defined and depicted in-process and final inspection criteria for product measurement at specific points within each core process map. All product that does not meet the defined inspection criteria is processed through the Non-conforming Product Process (SP-8300).

8.3 Control of Nonconforming Product

IEA ensures that the service or materials provided that do not meet project requirements are identified, controlled, where possible to prevent unintended use and is corrected if required. This policy is implemented in SP-8300. This procedure includes provisions for: Identification, documentation, evaluation, segregation (where practical), disposition of nonconforming service/material, and for notification of the functions concerned; Assigning responsibility for the review and the authority for disposition of nonconforming service; Correction of nonconforming service/material and re-installation or replacement of the affected area after correction to demonstrate conformity (if necessary); Handling of nonconforming service/material when detected after installation.

- 8.3.1 Where applicable, a preventative maintenance program will be initiated to perform the mechanical, electrical and lubrication requirements on equipment prior to start up. All preventative maintenance will be documented concerning when, what, and by whom the maintenance was performed. If the Solar manufacturer has a specific formatted document to record the long-term storage of equipment, this document will be used to record the preventive maintenance program.

8.4 Analysis of Data

IEA determines, collects and analyzes appropriate data to demonstrate the suitability and effectiveness of the QMS and to evaluate where continual improvement can be made. The main areas of focus are: suppliers, internal process metrics, and customers. This data is used to determine: trends, customer satisfaction, interested party feedback, process effectiveness and efficiency, supplier contribution, quality objective performance, economics of quality, benchmarking, and competitiveness.

8.5 Improvement

8.5.1 Continual Improvement

WCI seeks to continually improve the effectiveness and efficiency of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventative actions and management review. Internal audit results and quality performance data are analyzed by management to assess the effectiveness of the QMS and current

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Site Quality Control Plan

organizational performance. Opportunities and priorities for improvement are identified by comparing present quality performance to goals and aspirations defined in the quality policy. Improvement projects are defined either as corrective or preventive actions or as quality objectives.

8.5.2 Corrective Action

IEA takes corrective action to eliminate the cause of the identified nonconformities in order to prevent recurrence. Correction actions are appropriate to the impact of the problems encountered.

SP-8500 defines the requirements for: identifying nonconformities (including customer complaints); determining the cause of the nonconformity; evaluating the need for actions to ensure that nonconformities do not recur; determining and implementing the corrective actions needed; recording the results of action taken; review and evaluation of corrective action taken to assess its effectiveness.

8.5.3 Preventative Action

IEA identifies preventative actions to eliminate the causes of identified potential nonconformities to prevent initial occurrence. Appropriate sources of information such as processes and work operations results that affect product quality, concessions, audit results, quality records, and customer complaints are analyzed to detect preventive action possibilities. Preventative actions that are appropriate to the impact of the potential problems.

9.0 **Site Specific Addenda**

END OF DOCUMENT

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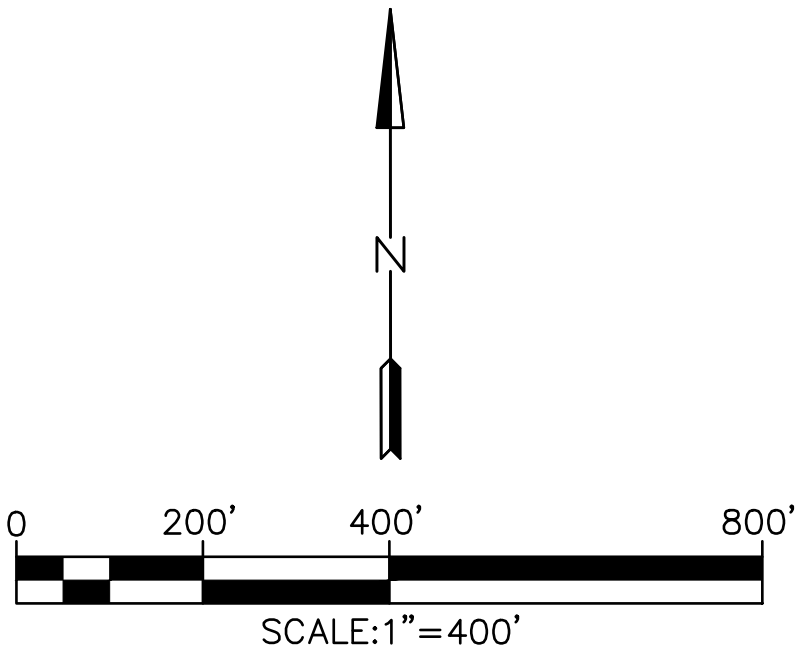


INFORMATION

25,356.24 kWDC
20,000 kWAC
1.267812
1 SINGLE AXIS TRACKER, 33% GCR,
78 MODULE TABLE
N/A
3,968) x 430W FIRST SOLAR FS-6430
6
1461.8 VDC
TMEIC NINJA 4200 kVA INVERTERS
(6) 4200 kVA
9,828
~205 ACRES
-22 °C
105 MPH (ASCE 7-10)
30 LB/SQFT

LEGEND:

- 78 MODULE TRACKER TABLE
- WETLANDS
- PROJECT BOUNDARY
- 400A DC COMBINER BLOCK
- ROAD
- FENCE



**SOUTH BEND SOLAR
PROJECT**
ST. JOSEPH COUNTY
INDIANA

Rev.	Date	Description	By
A	11/27/18	FOR REVIEW	UEI
B	12/11/18	FOR REVIEW	UEI

IEA
6325 DIGITAL WAY,
SUITE 460
INDIANAPOLIS, IN 46278



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5575 DTC Parkway, Suite 200
Greenwood Village, CO. 80111
Phone: 720.873.5841
www.ulteig.com

Ulteig *Ulteig* **Ulteig**
Bismarck - Denver - Detroit Lakes - Fargo - Sioux Falls - St. Paul
Design By: K. DEAN
Drawn By: K. DEAN
Approved By: A. MELVIN
Project Number: 18.01712

**ELECTRICAL SITE PLAN
SINGLE AXIS TRACKER
FIRST SOLAR FS-6
MODULES**

REVISION:
A
DWG #:
SBS-PVP-E101

SYSTEM DESCRIPTION	
SYSTEM SIZE (DC)	25,356 kW
SYSTEM SIZE (AC)	20,000 kW
PV MODULE SPECIFICATIONS	
MANUFACTURER	FIRST SOLAR
MODEL NUMBER	FS-6430
MODULES PER STRING	6
I_{MP} OPERATING CURRENT	2.38A
I_{SC} SHORT CIRCUIT CURRENT	2.64A
V_{MP} OPERATING VOLTAGE	180.3
V_{OC} OPEN CIRCUIT VOLTAGE	215.3
MAX SERIES FUSE (OCPD)	6A
V_{OC} TEMP COEFFICIENT	-0.28% / °C

MAXIMUM VOLTAGE (NEC 690.7)	
MODULES PER STRING	6
MODULE V_{OC}	215.3 VDC
TEMPERATURE COEFFICIENT	-0.28 %/°C
LOW TEMP (ASHRAE)	-22°C
*MAX VOLTAGE	1461.8 VDC
*MODULES X (V_{OC} + $TCOE \times V_{OC} \times (T_{LOW}-25)$)	

Rev.	Date	Description	By
A	11/27/18	FOR REVIEW	UEI



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Design By: K. DEAN
Drawn By: K. DEAN
Approved By: A. MELVIN
Project Number: 18.01712

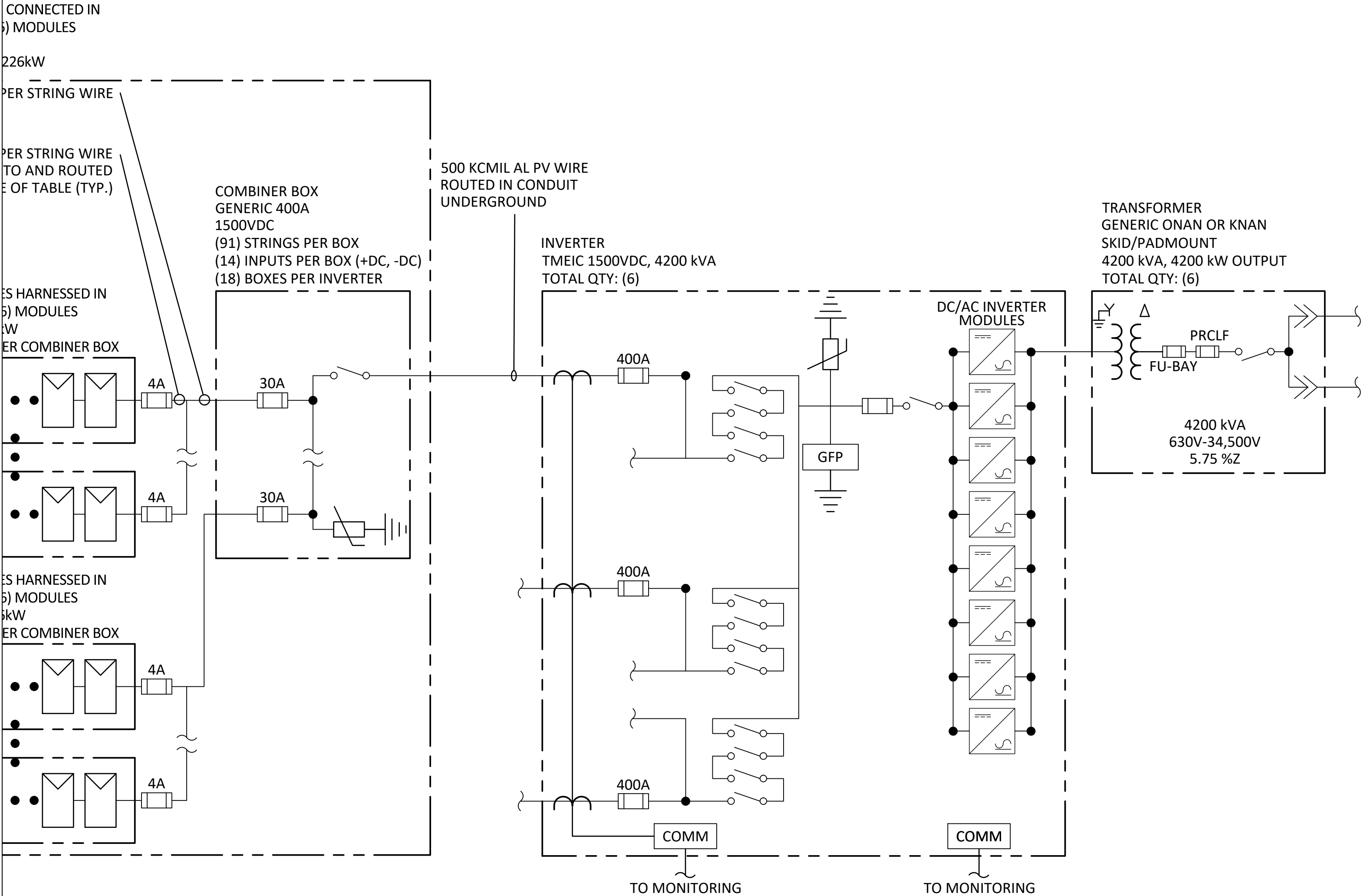
DC SINGLE LINE
SINGLE AXIS TRACKER
FIRST SOLAR FS-6
MODULES

REVISION:

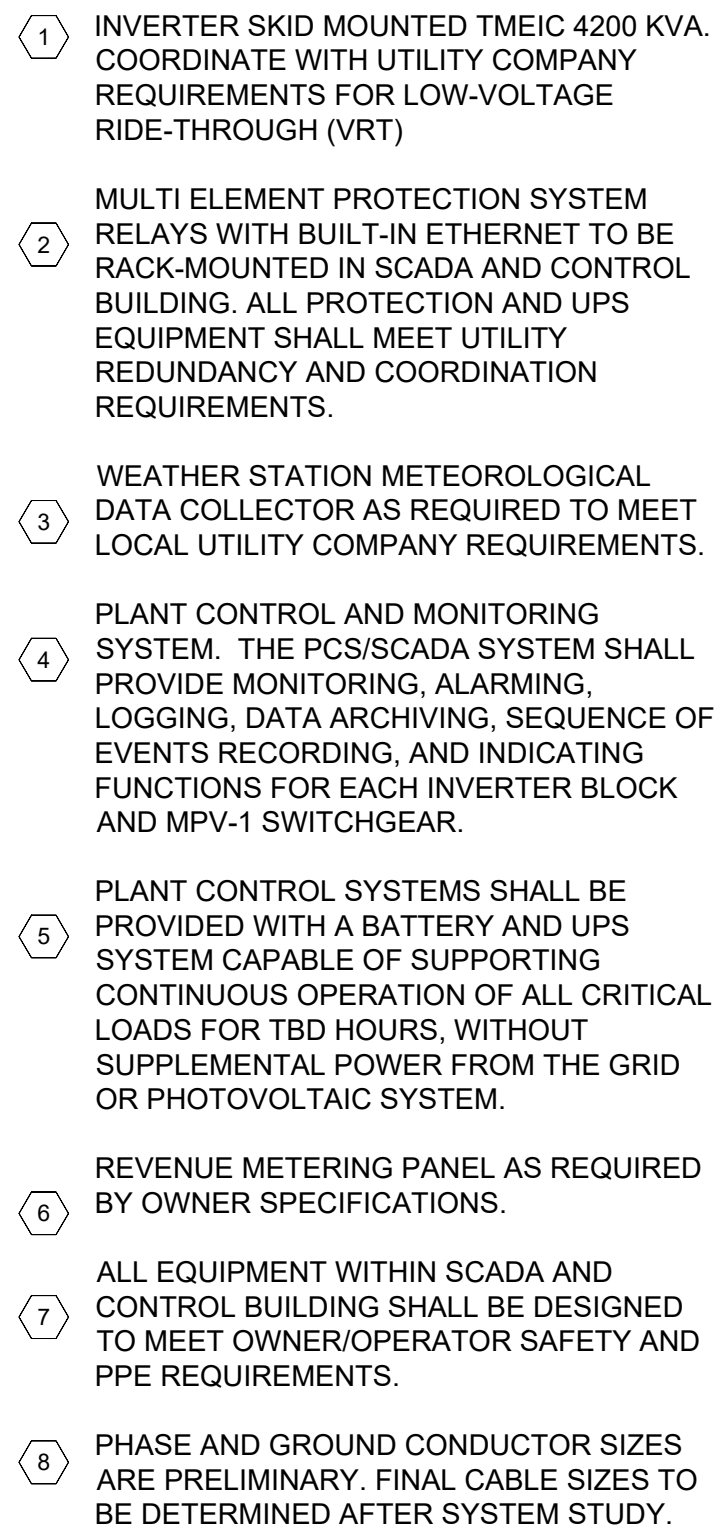
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DWG #:

SBS-PVP-E201



KEYED NOTES



K	KIR-KEY INTERLOCK AND#
M	METER
27	UNDER VOLTAGE
50 51	OVERCURRENT/TIME OVERCURRENT
59	OVERVOLTAGE
67	DIRECTIONAL OVERCURRENT
81O	OVER FREQUENCY
81U	UNDER FREQUENCY
86	LOCKOUT RELAY
52	MV CIRCUIT BREAKER



IEA
6325 DIGITAL WAY,
SUITE 460
INDIANAPOLIS, IN 46278



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Design By: K. DEAN
Drawn By: K. DEAN
Approved By: A. MELVIN
Project Number: 18.01712

AC SINGLE LINE
SINGLE-AXIS TRACKER
FIRST SOLAR FS-6
MODULES

A

SBS-PVP-E202



PROJECT NUMBER
PROJECT NAME
IE Engineer
Notes:

For:
18.01712
IEA_IN_South Bend Solar
TBD
Clean Power Research-Unit size of 4200 kWAC

Project Characteristics	
Date of Estimate	12/11/18
Source of Estimate	Ulteig Engineering
Estimator	ANDREW.MELVIN
Latitude	41.73 °
Longitude	-86.10 °
Module	First Solar FS-6430
Module Wattage	430 W
Inverter	TMEIC Solar Ware 840 - PV-PCS
Inverter Capacity	840 kW
DC/AC (@Inv)	1.01
DC/AC (@POI)	1.27
Net Inverter Quantity	26
Total Strings	9828
Installed DC Capacity (kWdc)	25,356 kW
Installed AC Capacity (kWac)	21,840 kW
POI Limitation	20,000 kW
Structure Type	Single Axis Tracker
Tilt Angle	n/a
Azimuth Angle	0.00 °
Ground Coverage Ratio	33.0%
Tracker Range of Motion	+/-52
First Year Net Energy	36,787.7 MWh/yr
Specific Yield	1,450.8 kWh/kWp
DC Net Capacity Factor	16.56%
AC Net Capacity Factor - Inv Rating	16.66%
AC Net Capacity Factor - POI Rating	21.00%
Modeled Degradation	0.50%/Year
System Availability Loss	1%

Soiling Loss	0
January Soiling	6.9%
February Soiling	6.0%
March Soiling	5.0%
April Soiling	3.8%
May Soiling	2.0%
June Soiling	1.2%
July Soiling	0.0%
August Soiling	0.1%
September Soiling	1.5%
October Soiling	3.2%
November Soiling	4.9%
December Soiling	6.7%
Snow Loss	
January Snow	25.6%
February Snow	16.8%
March Snow	6.8%
April Snow	2.3%
May Snow	0.3%
June Snow	0.0%
July Snow	0.0%
August Snow	0.0%
September Snow	0.0%
October Snow	1.1%
November Snow	4.3%
December Snow	17.2%

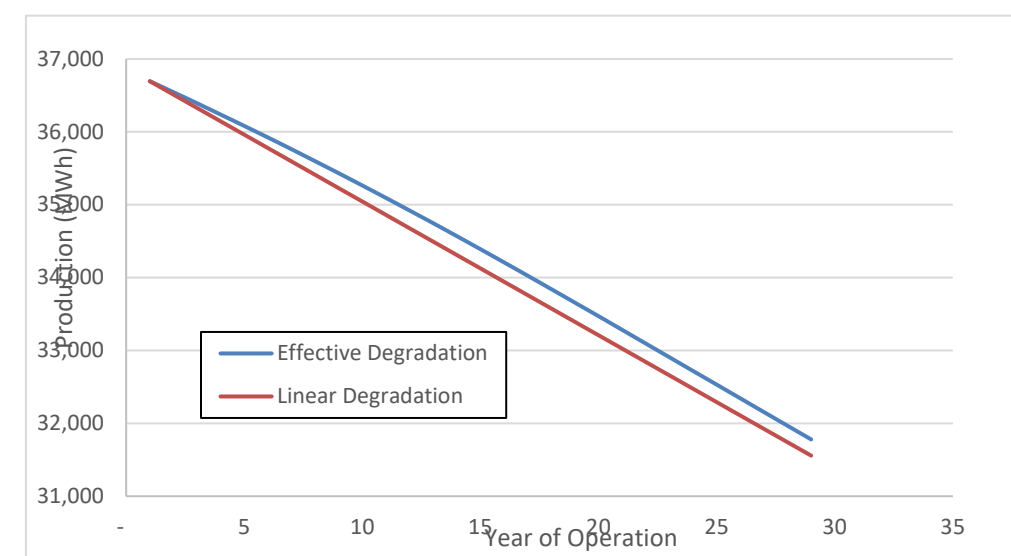
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While module power degrades at a constant rate, there are often losses associated with clipping or the available dc power being higher than the inverters can output.

Because of this, production often does not degrade linearly. This is referred to as Effective degradation and is shown in the table and graph below.

Year	Annual Production	% Inverter Clipping	% POI Clipping	Effective Degredation	Annual Prod_Linear	Degredation (%)
1	36,695	0.0%	0.9%	0.00%	36,695	0.00%
2	36,545	0.0%	0.8%	-0.41%	36,511	-0.50%
3	36,392	0.0%	0.7%	-0.42%	36,328	-0.50%
4	36,237	0.0%	0.6%	-0.42%	36,145	-0.50%
5	36,081	0.0%	0.6%	-0.43%	35,961	-0.50%
6	35,923	0.0%	0.5%	-0.43%	35,778	-0.50%
7	35,762	0.0%	0.4%	-0.44%	35,594	-0.50%
8	35,597	0.0%	0.4%	-0.45%	35,411	-0.50%
9	35,432	0.0%	0.3%	-0.45%	35,227	-0.50%
10	35,264	0.0%	0.2%	-0.46%	35,044	-0.50%
11	35,093	0.0%	0.2%	-0.46%	34,860	-0.50%
12	34,921	0.0%	0.2%	-0.47%	34,677	-0.50%
13	34,746	0.0%	0.1%	-0.47%	34,493	-0.50%
14	34,569	0.0%	0.1%	-0.48%	34,310	-0.50%
15	34,390	0.0%	0.1%	-0.49%	34,126	-0.50%
16	34,209	0.0%	0.0%	-0.49%	33,943	-0.50%
17	34,026	0.0%	0.0%	-0.50%	33,759	-0.50%
18	33,842	0.0%	0.0%	-0.50%	33,576	-0.50%
19	33,656	0.0%	0.0%	-0.51%	33,392	-0.50%
20	33,471	0.0%	0.0%	-0.51%	33,209	-0.50%
21	33,283	0.0%	0.0%	-0.51%	33,025	-0.50%
22	33,095	0.0%	0.0%	-0.51%	32,842	-0.50%
23	32,907	0.0%	0.0%	-0.51%	32,658	-0.50%
24	32,719	0.0%	0.0%	-0.51%	32,475	-0.50%
25	32,532	0.0%	0.0%	-0.51%	32,292	-0.50%
26	32,344	0.0%	0.0%	-0.51%	32,108	-0.50%
27	32,155	0.0%	0.0%	-0.51%	31,925	-0.50%
28	31,967	0.0%	0.0%	-0.51%	31,741	-0.50%
29	31,779	0.0%	0.0%	-0.51%	31,558	-0.50%
30	31,591	0.0%	0.0%	-0.51%	31,374	-0.50%
31	31,402	0.0%	0.0%	-0.51%	31,191	-0.50%
32	31,214	0.0%	0.0%	-0.51%	31,007	-0.50%
33	31,025	0.0%	0.0%	-0.51%	30,824	-0.50%
34	30,837	0.0%	0.0%	-0.51%	30,640	-0.50%
35	30,647	0.0%	0.0%	-0.52%	30,457	-0.50%



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Ambient Temperature	11	°C
Global Horizontal Irradiation	1,397	kWh/m²
Increase in GHI on the tilted plane	29.4%	%
Far Shadings/Horizon	0.0%	%
Near Shadings: Irradiance Loss	-4.6%	%
IAM Losses	-1.5%	%
Array Soiling Loss	-2.5%	%
Effective Irradiance on collectors	1,657	kWh/m²
Efficiency at STC	17.44%	%
Collector Area	145,424	m ²
Array nominal energy (STC effic)	42,018	MWh
PV Loss Due to Irradiance	-1.6%	%
PV Loss Due to Temperature	-2.8%	%
Module Quality Loss	2.1%	%
LID - Light Induced Degradation	0.0%	%
Module array mismatch loss	-1.1%	%
DC Ohmic wiring loss	-0.8%	%
Array virtual energy at MPP	40,287	MWh
Inverter Loss During Operation	-1.7%	%
Inver Loss over nominal inv. Power	0.0%	%
Inverter Loss due to voltage threshold	0.0%	%
Available Energy at Inverter Output	39,617	MWh
Nighttime Inverter Losses	7	MWh
AC ohmic loss to Xfmr/POC	0.0%	%
ISU/Net transformer loss	-1.6%	%
ISU to GSU/POC AC ohmic loss	-0.3%	%
GSU transformer loss	0.0%	%
GenTie AC ohmic loss	0.0%	%
Station Load Loss	-0.2%	%
POI Clipping	-0.9%	%
Snow Loss	-3.3%	%
Net Excluding Availability	37,159	MWh
Installed Capacity	25,356	kWp DC
Yield Factor Excluding Availability	1,465	kWh/kWp
Availability	-1.0%	%
Net With Availability	36,788	MWh

Hour ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7	0.0%	0.0%	0.0%	2.7%	15.5%	16.1%	16.7%	5.0%	0.1%	0.0%	0.0%	0.0%
8	0.0%	0.0%	8.1%	27.9%	47.3%	39.1%	51.2%	35.0%	24.5%	7.0%	0.1%	0.0%
9	1.9%	9.6%	34.3%	54.0%	63.6%	53.1%	66.2%	61.6%	57.6%	33.9%	14.3%	1.5%
10	14.5%	21.5%	52.6%	60.1%	65.3%	61.3%	71.7%	69.0%	66.1%	46.2%	26.1%	14.1%
11	18.5%	30.0%	53.9%	60.3%	70.2%	69.2%	71.6%	69.5%	70.2%	46.4%	33.1%	18.5%
12	21.3%	36.7%	54.2%	67.1%	72.3%	77.0%	77.5%	73.1%	67.2%	45.3%	32.4%	20.7%
13	24.0%	37.9%	54.8%	65.6%	69.9%	82.8%	79.3%	77.4%	64.3%	46.5%	30.7%	22.2%
14	23.6%	35.8%	56.4%	64.8%	72.1%	80.4%	80.7%	73.7%	63.2%	44.0%	31.1%	21.2%
15	22.5%	34.1%	50.5%	62.4%	68.2%	80.0%	81.9%	69.2%	59.7%	45.7%	29.6%	19.7%
16	21.0%	30.7%	49.3%	62.2%	60.5%	77.8%	81.9%	69.9%	64.6%	42.9%	24.5%	17.7%
17	13.7%	26.1%	45.7%	57.3%	54.4%	67.3%	70.8%	63.7%	56.3%	32.3%	10.2%	8.3%
18	0.8%	11.2%	26.5%	46.0%	44.1%	51.8%	58.7%	50.7%	34.2%	7.9%	0.0%	0.0%
19	0.0%	0.0%	2.8%	13.3%	21.1%	30.4%	34.4%	20.0%	4.8%	0.0%	0.0%	0.0%
20	0.0%	0.0%	0.0%	0.0%	1.6%	5.8%	5.4%	0.2%	0.0%	0.0%	0.0%	0.0%
21	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
23	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Avg. Monthly CF%	6.7%	11.4%	20.4%	26.8%	30.2%	33.0%	35.3%	30.7%	26.4%	16.6%	9.7%	6.0%
Avg. Annual CF%	21.2%											

INDIANA MICHIGAN POWER COMPANY
INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
DATA REQUEST SET NO. OUCC DR 3
IURC CAUSE NO. 45245

DATA REQUEST NO OUCC 3-02

REQUEST

Mr. Toby Thomas

Please refer to page 13 of Mr. Thomas' direct testimony:
Are the naming rights to the SBSP exclusive to Notre Dame?

RESPONSE

No. Additional stakeholders can be included in the project.

INDIANA MICHIGAN POWER COMPANY
INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
DATA REQUEST SET NO. OUCC DR 3
IURC CAUSE NO. 45245

DATA REQUEST NO OUCC 3-03

REQUEST

Will the naming rights conferred to Notre Dame for the SBSP include site signage?

RESPONSE

Yes.

Request 1-11: Refer to Haselden testimony page 20, line 19 to page 21, line 2. “Naming the facility as an extension of Notre Dame implies Notre Dame is the recipient of all environmental attributes, and perhaps power generated from the facility, unless there is a clear expression this is not the case. This arrangement could be considered a violation pursuant to the Federal Trade Commission’s Green Guides.”

- (a) Which provision(s), specifically, of the Federal Trade Commission’s Green Guides does the witness believe would be violated? For each such provision, please explain why the witness believes the provision would be violated.
- (b) Did the witness reach this conclusion concerning the Federal Trade Commission’s Green Guides by himself, or was the witness’s opinion informed by OUCC counsel? Please explain fully.
- (c) What are the witness’s qualifications to interpret and apply the Federal Trade Commission’s Green Guides? Please explain fully.

Response:

- (a) Mr. Haselden states in his testimony there “could” be an issue regarding violation of the Green Guide. As stated on pages 20-21 of his testimony, the term “naming rights” is only mentioned by I&M Witness Toby Thomas and does not appear in the Purchase and Sale Agreement for Renewable Energy Credits. Without further specification of how the naming rights will be applied or the specific language in any materials indicating Norte Dame’s support for the SBSP, the OUCC is only able to indicate there may be potential issues regarding compliance with the Green Guide rules. Mr. Haselden refers to the following provisions of the Green Guides: 10 CFR §§260.4(b) and 260.15(b) and (d).
- (b) The OUCC objects to this request on the grounds that the request seeks information subject to attorney-client privilege and the mental impression of OUCC counsel. Notwithstanding this objection, the OUCC provides the following response:
Mr. Haselden reached this conclusion by himself.
- (c) Mr. Haselden has over 28 years of experience in the electric utility industry. Mr. Haselden has worked with this specific topic of renewable energy over the past eight years. Prior to working at the OUCC starting in 2018, he worked on these issues while employed by Indianapolis Power & Light Company, which included discussions with their advisor, The Center for Resource Solutions, in 2011-2017.

Request 1-3: Has Mr. Haselden ever visited a solar facility? If yes, please identify each such solar facility and when Mr. Haselden visited the facility.

Response: Mr. Haselden has visited many solar facilities but has not kept records of the dates he visited each solar facility. Mr. Haselden recalls visiting the sites listed below between 2011 and 2019. Some of the sites listed were visited on multiple occasions. Projects visited include:

Indianapolis Airport I
Indianapolis Airport II
Indianapolis Airport III
Major General Emmett J. Bean Federal Center
Indianapolis Motor Speedway Solar Farm
A-Pallett Company
Rexnord
Equity Industrial A
IUPUI
Lifeline Data Systems
Vertellus
Johnson-Melloh
Melloh Enterprises
Laurelwood Apartments
Schaefer Technologies
Town of Speedway Sewage Treatment Plant
Maple Creek Apartments
Evansville Urban Project
Pastime Solar Project

INDIANA MICHIGAN POWER COMPANY
INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
DATA REQUEST SET NO. OUCC DR 3
IURC CAUSE NO. 45245

Attachment DAL-6R

DATA REQUEST NO OUCC 3-22

REQUEST

As a follow-up to I&M's answer to OUCC DR 1-21, I&M states: "the Project also has value in economic development, customer education, and can be a source of pride for the South Bend and the Michiana region..."

- a. Please provide any and all documentation I&M relied upon to determine that these characteristics provide a value.
- b. What is the monetary amount assigned to this claimed "value"?
- c. Does I&M have any documentation to show I&M customers have requested this type of project in this area? If yes, please provide the documentation.

RESPONSE

I&M objects to the request on the grounds and to the extent the request is overly broad and unduly burdensome, particularly to the extent the request seeks "any and all documentation". I&M further objects to the request on the grounds and to the extent the request seeks an analysis, compilation, calculation or study that I&M has not performed and to which I&M objects to performing. Subject to and without waiver of the foregoing objections, I&M provides the following response.

a. Over the past few years, I&M has been engaged in many different conversations with site selectors, companies, customers, economic development organizations and industry groups on the value of renewables and the growing trend of sustainability commitments from many different companies. According to the Corporate Renewable Energy Buyers' Principles, "As of 2017, 63% of the Fortune 100 had set targets to reduce greenhouse gas emissions and buy clean energy." (buyersprinciples.org.)

The US EPA supports I&M's perspective relative to the value of renewable energy. Under the benefits section of the US EPA's Green Power Partnership program (epa.gov/greenpower/benefits-using-green-power) it states the following benefits for organizational users (i.e. customers participating in green energy):

- Potential to serve as a brand differentiator
- Generate customer, investor, or stakeholder loyalty and employee pride
- Create positive publicity and enhance your organization's public image
- Demonstrate civic leadership

The SBSP provides the opportunity for the Michiana area to bring these benefits to existing businesses in the area as well as attract new businesses.

The economic development benefit of a renewable energy project has previously been recognized by the Commission. For example, in March 2019, the Commission stated as follows in its decision in *Southern Indiana Gas & Electric*, Cause No. 45086 (IURC 3/20/2019) (pp. 24-25, 26):

In addition to the foregoing statutory provisions, we previously have recognized the importance of fuel diversity generally, with respect to generation portfolios, and

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recognized the benefits of local renewable solar resources, in particular. For example, in approving a long-term purchase of power by Duke Energy Indiana from a wind provider, we stated:

Not only does the environment benefit from such emissions free electric generation but also Indiana benefits through the development of another "home grown" energy resource. The price volatility of foreign energy and carbon fuels and the historically increasing costs and stringency of environmental emissions compliance make the potential Indiana savings from reasonably-priced Indiana renewable energy sources more economically beneficial than ever before. In addition, as the record substantiates here, this renewable energy project offers the traditional economic benefits of local Indiana business investment, revenue generation, and job creation.

Verified Petition of PSI Energy, Inc. d/b/a Duke Energy Indiana, Inc. for Approval of a Renewable Wind Energy Project Purchased Power Agreement, Cause No. 43097 (IURC; Dec. 6, 2006) at 16-17.

* * *

In addition to the benefits of fuel diversification, Petitioner presented substantial evidence that renewable resources are beneficial in efforts to retain and attract industrial and commercial customers seeking to meet renewable energy goals .. Petitioner presented evidence that within its service territory alone, approximately twenty corporations have publicly created sustainability goals and/or support efforts taken by Petitioner to construct the Solar Project. Petitioner has had discussions with Toyota regarding Toyota potentially purchasing energy produced by the Solar Project and has entered into a letter of intent with AstraZeneca to enter into a contract for AstraZeneca to purchase power generated by the Solar Project. Petitioner also has had site selectors inquire as part of their RPI process whether the utility has solar assets and is willing to allow a prospective customer to enter into an agreement to purchase renewable energy generated by those assets. Petitioner's residential customers also have indicated that they want Petitioner to add renewable resources to its portfolio.

b. No monetary value has been assigned. The ability to have a visible solar facility in the area will provide a significant benefit to economic development efforts in the region, however it is one of a number of different factors that ultimately determine the location of the new companies to the region.

c. Yes. As a part of normal business and customer service, I&M has had dialogue with a number of customers in the Michiana area that have inquired about renewables, sustainability, and future plans around solar. I&M provides the following as examples of the types of input I&M has received. At the South Bend field hearing conducted in this proceeding on July 11, 2019, several speakers voiced an interest in additional renewable

INDIANA MICHIGAN POWER COMPANY Attachment DAL-6R
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energy, including local clean energy projects. As part of I&M's 2018-2019 IRP stakeholder process, I&M received many comments from South Bend residents requesting I&M invest in renewable energy. Please see "OUCC DR 3-22c Customer Requests.pdf" for a sampling of requests received from residents in South Bend, Indiana requesting renewable projects in the South Bend area. In addition, in I&M's last rate case (Cause No. 44967), South Bend Witness Therese Dorau encouraged I&M to invest in "Indiana-based renewable energy generation". See Dorau direct testimony, pages 9-10.

Regiana M Sistevaris

From: anne.beerhorst@gmail.com
Sent: Tuesday, April 2, 2019 11:08 AM
To: Regiana M Sistevaris
Cc: Thomas R Zelina; Scott Fisher
Subject: Integrated Resource Plan Questions and Comments

Integrated Resource Plan Questions and Comments

First Name: Anne
Last Name: Beasley
Organization: Customer
Email: anne.beerhorst@gmail.com
Phone: 616-886-4822

Comments/Questions: My letter to the editor of the South Bend Tribune:

As a former student of ecology and a mother, I worry constantly about the world I will leave to my two little boys.

My husband and I have spent the last decade learning and making incremental changes to reduce our impact on the environment. We have adopted a more plant-based diet, joined a food co-op and begun raising backyard chickens. But without systemic change, our individual actions are meaningless.

Our utility Indiana Michigan Power can turn the tide on climate change by releasing a 20-year energy plan that moves us away from fossil fuels to 100 percent renewable energy in upcoming decades. It is crucial that this plan create environmentally friendly investments that will benefit our local community both now and over the long term.

Customers benefit when utility companies move to renewable energy. In October 2018 NIPSCO announced plans to retire all of its coal plants by 2028 and replace that power exclusively with efficient renewable energy sources. The company projects this move will save their customers \$4 billion.

Moving away from coal and gas power is the best way for us to have a healthier community that is prepared for the future.

Dear Toby Thomas, President and COO, Indiana Michigan Power,

I urge you to move towards a 100% renewable future, with no outdated (and unprofitable) fossil fuel generation. Build many smaller wind farms and solar farms distributed throughout Indiana and you'll have a system less subject to the whims of weather. Buy what you can't produce locally from other renewable generation systems.

As Indiana Michigan Power engages in its 20-year planning process, I am asking that Indiana Michigan Power (I&M) collaborate with the communities it serves to create plans to replace energy generated by the AEP-Rockport coal plant with clean, renewable energy and energy efficiency.

I ask that I&M:

- Replace Rockport generation with with solar, wind, battery storage, and energy efficiency in a cost-effective manner.
- Invest in energy efficiency programs that serve low-income residents. Ensure I&M meets or exceeds energy savings goals established under the former statewide Energizing Indiana program.
- Invest in renewable energy projects that will transform abandoned spaces while bringing good jobs to our communities and improving the local tax base.
- Ensure that this current and future 20-year planning processes are transparent and accessible to all interested customers, especially the people most impacted by I&M's decisions.

Dean Alvis

1411 Sunnymede Avenue

South Bend, IN 46115

Pledge to Repower Indiana - Support for a Transition to Renewable Energy for Indiana Michigan Power Customers



To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission

As Indiana Michigan Power engages in its 20-year planning process, I am asking that Indiana Michigan Power (I&M) collaborate with the communities it serves to create plans to replace energy generated by the AEP-Rockport coal plant with clean, renewable energy and energy efficiency.

According to company statements, I&M plans to end its lease on Rockport Unit 2 in 2022 and will phase out Rockport Unit 1 by 2028. I support the company's decision to transition away from coal. In developing plans for replacement power, I ask that I&M:

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- Invest in renewable energy projects that will transform abandoned spaces while bringing good jobs to our communities and improving the local tax base.
- Ensure that this current and future 20-year planning processes are transparent and accessible to all interested customers, especially the people most impacted by I&M's decisions.

We the undersigned look forward to working with Indiana Michigan Power on these objectives in a collaborative, transparent and accessible manner.

Sincerely,

People for the Common Good, Fort Wayne

Executive Committee Members: Sarah Hyndman, Shane Sullivan, Jain Young, Amanda Vance, Cortney Robbins, Meg Bloom



Dear Toby Thomas, President and COO, Indiana Michigan Power,

CLEAN RENEWABLE ENERGY AND ENERGY EFFICIENCY ARE THE FUTURE !

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Kris Whitman

61444 Ironwood Rd

South Bend, IN 46614

Dear Toby Thomas, President and COO, Indiana Michigan Power,

I am appalled that I&M still is relying on and expanding coal-fired energy. Stop!

As Indiana Michigan Power engages in its 20-year planning process, I am asking that Indiana Michigan Power (I&M) collaborate with the communities it serves to create plans to replace energy generated by the AEP-Rockport coal plant with clean, renewable energy and energy efficiency.

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Joanne Detlef

1129 Belmont Ave

South Bend, IN 46615

Dear Toby Thomas, President and COO, Indiana Michigan Power,

We must begin now to create a future of clean renewable energy. It is efficient, it creates jobs and it will save our planet.

As Indiana Michigan Power engages in its 20-year planning process, I am asking that Indiana Michigan Power (I&M) collaborate with the communities it serves to create plans to replace energy generated by the AEP-Rockport coal plant with clean, renewable energy and energy efficiency.

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Rev Barbara Jung

2826 Rockne Dr

South Bend, IN 46615

**Pledge to Repower Indiana - Support for a Transition to Renewable Energy for
Indiana Michigan Power Customers**

To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission



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- Ensure that this current and future 20-year planning processes are transparent and accessible to all interested customers, especially the people most impacted by I&M's decisions.

We the undersigned look forward to working with Indiana Michigan Power on these objectives in a collaborative, transparent and accessible manner.

Signature:

A handwritten signature in blue ink, appearing to read "Pete Buttigieg", is written over a white rectangular background.

Name (printed):

Pete Buttigieg

Title:

Mayor

City:

South Bend, Indiana

Personalized Message (Optional):

July 23, 2018

To:

Toby Thomas, President, Indiana Michigan Power

William Fine, Indiana Utility Consumer Counselor Indiana Utility Regulatory Commission

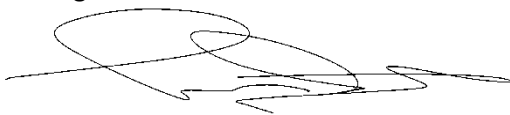
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We the undersigned look forward to working with Indiana Michigan Power on these objectives in a collaborative, transparent and accessible manner.

Best Regards

A handwritten signature in black ink, appearing to read 'Tim Scott', with a stylized, flowing script.

Tim Scott
1st District Representative
South Bend Common Council

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We the undersigned look forward to working with Indiana Michigan Power on these objectives in a collaborative, transparent and accessible manner.

Signature: *Regina Williams-Preston*

Name (printed): *Regina Williams-Preston*

Title: *South Bend Common Council, District 2*

City: *South Bend*

Personalized Message (Optional):

Pledge to Repower Indiana - Support for a Transition to Renewable Energy for Indiana Michigan Power Customers



To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission

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Signature: 

Name (printed): Sharon McBride

Title: South Bend Common Council

City: South Bend

Personalized Message (Optional):

Pledge to Repower Indiana - Support for a Transition to Renewable Energy for
Indiana Michigan Power Customers

Attachment DAL-6R

To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission



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Signature: *Jo M. Broden*

Name (printed): Jo M. Broden

Title: South Bend Common Council Member, 4th District

City: South Bend

Personalized Message (Optional):



To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission

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Signature:

Name (printed):

JAKE TESKA

Title:

COMMON COUNCILMAN, DISTRICT 5

City:

SOUTH BEND

Personalized Message (Optional):

**Pledge to Repower Indiana - Support for a Transition to
Renewable Energy for Indiana Michigan Power Customers**



To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission

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Signature:

Karen L White

Name (printed):

KAREN L WHITE

Title:

Common Council AT Large Member

City:

South Bend, IN 46601

Personalized Message (Optional):

Pledge to Repower Indiana - Support for a Transition to Renewable Energy for Indiana Michigan Power Customers

Indiana Michigan Power Company

Cause No.: 45245

QUCC Set 3, Q22c

Attachment DAL-6R



To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
Indiana Utility Regulatory Commission

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We the undersigned look forward to working with Indiana Michigan Power on these objectives in a collaborative, transparent and accessible manner.

Signature: 

Name (printed): Gavin Ferlic

Title: City Council, At-Large

City: South Bend

Personalized Message (Optional): Please include nuclear as an

Pledge to Repower Indiana - Support for a Transition to Renewable Energy for Indiana Michigan Power Customers

Indiana Michigan Power Company

Cause No.: 45245

QUCC Set 3, Q22c

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To: Toby Thomas, President, Indiana Michigan Power
William Fine, Indiana Utility Consumer Counselor
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Signature: 

Name (printed): 

Title: 

City:

Personalized Message (Optional):

INDIANA MICHIGAN POWER COMPANY
INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
DATA REQUEST SET NO. OUCC DR 05
IURC CAUSE NO. 45245

DATA REQUEST NO OUCC DR 05-02

REQUEST

Please refer to the direct testimony of Toby Thomas, page 6, lines 17-19. Please provide any documentation to support the statement that “[s]ome of our communities want to differentiate themselves and include electric supply alternatives in their sustainability and climate action plans.”

RESPONSE

Please see Company's response to OUCC 3-22.

Additionally the Company offers the following examples.

The City of South Bend Mayor Pete Buttigieg has committed to the Global Covenant of Mayors for Climate & Energy, a global coalition of city leaders dedicated to reducing greenhouse gas emissions, enhancing community resilience to the unavoidable impacts of climate change, and increasing access to sustainable energy. In the article below, Mayor Buttigieg states, “We joined the Covenant because we are serious about ensuring South Bend is a healthy, prosperous place for the next several generations, and because we want South Bend to contribute to the global effort to protect the climate.” Source: <https://southbendin.gov/2018/04/25/city-joins-global-covenant-of-mayors-for-climate-energy/>

Consistent with the South Bend's commitment to climate and energy, it has established a Municipal Energy Office that is focused on sustainability issues. From the City's website, it states “Communities that commit to sustainability have stronger economies, bounce back more easily after disasters, are inclusive of all types of people, and are enjoyable places to live and work. Working together towards sustainability will promote investment in our community, celebrate and preserve our local assets, and cultivate parks and open spaces.” Source: <https://southbendin.gov/departments/public-works/sustainability/>

I&M has met with representatives of the City of South Bend concerning the SBSP project and have agreed that the SBSP project is a great opportunity for I&M and the City of South Bend to work collaboratively to achieve a common goal of a sustainable energy future.

Additionally, in March 2019 a group of citizens presented 1,000 petitions asking Fort Wayne Mayor Tom Henry to sign a letter endorsing more investment in renewable energy. According to an article in the Fort Wayne Journal Gazette,

INDIANA MICHIGAN POWER COMPANY
INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
DATA REQUEST SET NO. OUCC DR 05
IURC CAUSE NO. 45245

the petitions were aimed to urge I&M to include more energy from renewable sources such as solar and wind. Members of the group that presented the petition pointed out that South Bend Mayor Pete Buttigieg and Muncie Mayor Dennis Tyler had signed on to increase the renewable energy in I&M's generation portfolio.

Source: <http://www.journalgazette.net/news/local/20190320/mayor-pushed-to-ask-im-for-renewable-energy>

The SBSP project is consistent with I&M's plans to continue to transition its generation fleet to more diverse energy resources and to support I&M's local communities and customers that value a sustainable energy future.

Request 1-14: Refer to Aguilar testimony page 6-7. Are there any provisions in the EPC contract provided in response to the Commission's July 3, 2019 docket that the OUCC contends are unreasonable?

- (a) If yes, please identify each such provision and explain why the OUCC contends that provision is unreasonable.

Response: In the current unexecuted draft form, provided in the response to the Commission's July 3, 2019 docket entry, the OUCC does not find any of the provisions unreasonable. However, the OUCC reserves the right to reevaluate this position upon execution of the draft EPC contract.