AES Indiana

Petersburg BESS Project

Issue: Revision 2

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Exhibit A

Scope of Work and Technical Requirements

TABLE OF CONTENTS

ATTACHMENTS

AES INDIANA REFERENCE DOCUMENTS

1.0 ACRONYMS AND ABBREVIATIONS

Abbreviation and Acronym	Term
A	Ampere
AA	Aluminum Association
AC	Alternating Current
ACI	American Concrete Institute
AEIC	Association of Edison Illuminating Companies
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANCO	American Nut Company
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
ATS	Automatic Transfer Switch
ATS	Acceptance Testing Specifications
AWG	American Wire Gauge
AWS	American Welding Society
BES	Bulk Electric System
BESS	Battery Energy Storage System
BIL	Basic Lightning Impulse Level
BMP	Best Management Practices
BOS	Balance of System
CFR	Code of Federal Regulations
CMTR	Certified Material Test Reports
COD	Commercial Operation Date
COMTRADE	Common Format for Transient Data Exchange
CPE	Chlorinated Polyethylene
CT	Current Transformer
DBPC	Ditertiary Butyl Paracresol
DC	Direct Current
DIR	Dispatchable Intermittent Resource
DOT	Department of Transportation
ECS	Electrical Commissioning Specifications
EIA	Electronic Industries Alliance
EMT	Electrical Metallic Tubing
EOR	Engineer of Record
EPR	Ethylene Propylene Rubber
ERAC	Electrical Aluminum Rigid Conduit
ERN	Equipment Ratings Notification

Abbreviation and Acronym	Term
ERSC	Electric Rigid Steel Conduit
FM	Factory Mutual
FS	Factor of Safety
GE	General Electric
GRS	Galvanized Rigid Steel
GSU	Generator Step-up Transformers
HAZ-FLEX	Hazardous Location Flexible Coupling
HSS	Hollow Structural Sections
HVAC	Heating, Ventilation, and Air Conditioning
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEC	International Electric Code
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IMT	Intermediate Grade Metallic Tubing
ISA	International Society for Measurement and Control
ISO	International Organization for Standardization
kV	kilovolt
KVA	Kilovolt-ampere
KW	Kilowatt
LV	Low Voltage
MISO	Midcontinent Independent System Operator
MSDS	Material Safety Data Sheet
MSS	Manufacturers Standardization Society
MTBF	Mean Time Between Failure
MV	Medium Voltage
MVA	Megavolt-ampere
MW	Megawatt
MWh	Megawatt-hour
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Agency
NIST	National Institute of Standards and Technology
OCF	Overload Capacity Factors
ODAF	Oil Directed Air Forced
OEM	Original Equipment Manufacturer
OFAF	Oil Forced Air Forced
OHGW	Overhead Ground Wires
OLTC	On-Load Tap Changer

Abbreviation and Acronym	Term
ONAF	Oil Natural Air Forced
ONAN	Oil Natural Air Natural
OSHA	Occupational Safety and Health Administration
pC	picocoulombs
PCB	Polychlorinated Biphenyls
PD	Partial Discharge
PLC	Programmable Logic Controller
POI	Point of Interconnect
PT	Potential Transformer
PTC	Power Test Codes
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RAC	Rigid Aluminum Conduit
RGS	Rigid Galvanized Steel
RTRC	Reinforced Thermosetting Resin Conduit
RTU	Remote Terminal Unit
RUS	Rural Utilities Service
SC	Short-Circuit current
SCADA	Supervisory Control and Data Acquisition
SEL	Schweitzer Engineering Laboratory
SFRA	Sweep Frequency Response Analysis
SPCC	Spill Prevention Countermeasures and Control
SSPC	Steel Structures Painting Council
SSVT	Station Service Voltage Transformer
SU&C	Start-up & Commissioning
SWC	Surge Withstand Capability
SWPPP	Storm Water Pollution Prevention Plan
TIA	Telecommunications Industry
TRF	Thermal Rating Factor
TSP	Twisted Shielded Pair
TST	Twisted Shielded Triad
UL	Underwriters Laboratories
UPS	Uninterruptible Power Supply
UV	Ultraviolet
V	Voltage
XLPE	Cross-linked Polyethylene

2.0 PROJECT DESCRIPTION

AES Indiana (Previously Indianapolis Power and Light) ("Owner") is requesting proposals from qualified firms for the complete delivery of a collector substations and transmission tie lines. The Petersburg BESS Project ("Project") consists of two (2) – 100 MW/400 MWh batteries. The Project will be located on the grounds of the 2146 MW coal-fired Petersburg Generation Station ("Petersburg Generating Station", or "Facility") which is currently owned by AES Indiana.

The Project is anticipated to be interconnected to the nearby AES Indiana transmission line through the new Project substation Point of Interconnect (POI) which will tie-in to the new interconnection switching station and gen-tie line. Additional details on Project ratings and substation and interconnect voltages are provided in Table 1.1.

The Project Scope of Work and Work requirements are defined in the following sections of this Exhibit A – Scope of Work, its referenced Attachments, and referenced Contract Exhibits.

Table 1.1 – Project Size and Voltage Ratings

Project Parameter	Unit	Value
Project Name / Location		Petersburg Generation Station Petersburg 6925 IN-57 (Petersburg, IN)
Project Substation Voltage	kV	34.5
Interconnect Voltage	kV	345
[1]: The specific values shown are taken from Owner's initial conceptual site layouts contained in Exhibit A Attachment 1, and may change based on Contractor's final design which shall meet the requirements listed herein and with the Contract exhibits referenced herein. Final inverter ratings shall be selected to facilitate Nominal Project Rating at POI.		

Figure 1.1 – Project Site Location

3.0 SCOPE OF WORK

The Work to be provided by Contractor shall include all work (except for those items specifically excluded) required to deliver a Project capable of operating in accordance with, Applicable Laws, Applicable Permits, GIA, and the Project Schedule. Contractor's Scope of Work shall include the engineering, design, procurement, delivery, installation, construction, commissioning, start-up and testing, as necessary to deliver the commercially operational Project, in accordance with Table 2.1 - Scope of Work Matrix below, Table 2.2 – Owner Supplied Equipment, and the associated requirements of this Exhibit A. Contractor shall design and construct the Project in accordance with this Exhibit A, Scope of Work, and all of the appendices attached hereto. The following Equipment, material and services, at a minimum, shall be included in the Work:

Table 2.1 – Scope of Work Matrix

Item No.	Description	Engineer and Design / Technical Selection	Procure /Supply	Construct / Install / Implement	Commission, Start-up and Test
1.	**Equipment, Components, and Materials**				
1.1.	Site collector substation[1]	Contractor	Contractor	Contractor	Contractor

[1] AES Indiana to furnish GSUs, 345 kV breakers, and control house in order to meet project timeline.

Item No.	Description	Engineer and Design / Technical Selection	Procure /Supply	Construct / Install / Implement	Commission, Start-up and Test
1.1.1.	Site collector substation GSUs[2]	Owner	Owner	Contractor	Contractor
1.2.	Transmission interconnection facilities[3]	Owner	Owner	Owner	Owner
1.3.	Substation/Interconnection SCADA control systems[4]	Owner / Contractor	Owner / Contractor	Contractor	Owner / Contractor
1.4.	Communications Infrastructure[4]	Owner / Contractor	Contractor	Contractor	Contractor
1.5.	Backup Substation Auxiliary Service Power Supply	Contractor	Contractor	Contractor	Contractor
1.6.	Essential Power Supply System	Contractor	Contractor	Contractor	Contractor
1.7.	Labels - NEC, OSHA and other code required labels for equipment and areas	Contractor	Contractor	Contractor	Contractor
1.8.	Labels – Equipment, Panels, Cabling	Contractor	Contractor	Contractor	Contractor
1.9.	Structural foundations for all equipment, panels, and enclosures	Contractor	Contractor	Contractor	Contractor
1.10.	Mechanical Systems and Equipment	Contractor	Contractor	Contractor	Contractor
1.11.	Raceway and Miscellaneous Services	Contractor	Contractor	Contractor	-
1.12.	Power and Instrument Cable	Contractor	Contractor	Contractor	Contractor
1.13.	Instrument Cabinets and Local Control Panels	Contractor	Contractor	Contractor	Contractor
1.14.	Local Instrument Cabinets / Racks	Contractor	Contractor	Contractor	Contractor
1.15.	Site storage building(s)/enclosure(s)	Contractor	Contractor	Contractor	-
1.16.	Site grounding and lightning protection systems	Contractor	Contractor	Contractor	Contractor
1.17.	Protective Corrosion Coating Systems	Contractor	Contractor	Contractor	-
1.18.	Site Security Fence and Gate System	Contractor	Contractor	Contractor	-
1.19.	Substation Security Fence and Gate System	Contractor	Contractor	Contractor	-
1.20.	Site and Substation Video Surveillance System	Owner	Owner	Owner	Owner
2.	**Site Work and Services**				
2.1.	Site Development - General	Contractor	Contractor	Contractor	-
2.2.	Site Clearing	Owner / Contractor	Owner / Contractor	Contractor	-
2.3.	Site Storm Water and Erosion Control	Contractor	Contractor	Contractor	-
2.4.	Site Restoration	Contractor	Contractor	Contractor	-
2.5.	Roads and Work Pads	Contractor	Contractor	Contractor	-
2.6.	Environmental Control Plan	Contractor	Contractor	Contractor	-
2.7.	Construction Power	Contractor	Contractor	Contractor	Contractor
2.8.	Construction Support Facilities	Contractor	Contractor	Contractor	Contractor
2.9.	Construction Security	Contractor	Contractor	Contractor	Contractor
3.	**Engineering, Design, and Project Implementation Services**				
3.1.	Project Administration and Management	Contractor	Contractor	Contractor	Contractor
3.2.	Project Equipment and Material Management	Contractor	Contractor	Contractor	Contractor
3.3.	Site Management	Contractor	Contractor	Contractor	Contractor

[2] Owner to contract with an engineering firm to create 60 percent electrical drawings in order to procure GSUs, 345 kV breakers, and control house due to long-lead times.

[3] Owner to furnish transmission line up to the dead end structure inside the substation fence.

[4] Owner to furnish OPGW to substation dead end; Owner to furnish Emerson DCS server; Owner to furnish control house enclosure and associated relays.

Item No.	Description	Engineer and Design / Technical Selection	Procure /Supply	Construct / Install / Implement	Commission, Start-up and Test
3.4.	Procurement	Contractor	Contractor	-	-
3.5.	Construction and Contractor permits	Contractor	Contractor	Contractor	-
3.6.	Owner Permits	Owner	Owner	Contractor	-
3.7.	Landowner Coordination	Owner	Owner	Owner	
3.8.	Contractor proposed schedule and list of submittals for each of the Preliminary and Final Design Submittal phases.	Contractor	Contractor	Contractor	-
3.9.	Engineering and Design of the complete Project including As-Builts[5]	Owner / Contractor	Contractor	Contractor	Contractor
3.10.	Project Document Preparation and Submittal	Contractor	Contractor	Contractor	-
3.11.	Electrical Studies	Contractor	Contractor	Contractor	As Applicable
3.12.	Fire Protection and Detection Studies and Design	Contractor	Contractor	Contractor	As Applicable
3.13.	NERC compliance and reports	Contractor	Contractor	Contractor	As Applicable
3.14.	Geotechnical Engineering Investigation Report	Contractor	Contractor	Contractor	-
3.15.	Surface Survey Reports	Contractor	Contractor	Contractor	-
3.16.	Quality Program	Contractor	Contractor	Contractor	-
3.17.	Operation & Maintenance Manuals	Contractor	Contractor	Contractor	-
3.18.	Training	Contractor	Contractor	Contractor	-
3.19.	Start-up & Commissioning and Testing Program	Contractor	Contractor	Contractor	Contractor
3.20.	Coordinate the interconnection and back feed power from the transmission system	Contractor	Contractor	Contractor	Contractor

4.0 PROJECT DESIGN CRITERIA

4.1 General Requirements

4.1.1 This Section specifies the requirements for a fully functioning colletor substation that meets or exceeds all requirements delineated herein.

4.1.2 The Project shall be designed for a minimum life of thirty (30) years.

4.1.3 The systems and equipment supplied by Contractor shall be suitable for the environment in which they will be located.

4.1.4 The specifications provided herein are intended to identify overall system requirements and certain specific hardware requirements to ensure that the Project provided by Contractor shall operate reliably and safely during the Project's design life, and that the Project shall be able to be operated and maintained in a cost-effective manner. The adequacy of the overall system design to meet these requirements is the responsibility of Contractor.

4.1.5 The general system performance criteria are defined in this Scope of Work, its referenced Attachments, and referenced Exhibits. Contractor is responsible for ensuring that all system performance criteria included in this specification are met by the final Project design.

[5] Owner to provide 60% electrical design package for substation.

4.1.6 Design and implementation of the Project shall comply with all interconnection requirements in the Generator Interconnection Agreement.

4.1.7 Project design and implementation shall incorporate performance and adherence to all studies and system design required to ensure that the transmission system interconnecting with the Project is capable of receiving the full Project output.

4.1.8 Supplemental site design criteria are provided in the Exhibit A Attachments.

4.1.9 Provide all reports and documentation for compliance with applicable NERC reliability standards. Report shall be developed in conjunction with the substation engineer.

4.2 Site Location

4.2.1 The Project will be located on a new greenfield site. See Exhibit A – Attachment 1 for the preliminary site layout of the Project.

4.3 Boundary and Interface Limits

4.3.1 Contractor's work shall be on lands under control by Owner. Initial project limits are shown on drawings in [Exhibit A - Attachment 1 to the EPC Agreement]. Contractor shall confirm the project limits with Owner prior to the start of services under this Agreement.

4.3.2 Owner has procured a quantity of land expected to be sufficient to support the final project design and layout as well as construction related space requirements such as laydown and parking.

4.3.2.1 If additional space is required to support construction activities Contractor shall procure such land and include in their bid the cost for such additional land.

4.3.2.2 If Contractor expects or determines that additional land will be required to meet the Project rating and design requirements, Contractor shall notify Owner as soon as this is known to Contractor. Owner will coordinate procurement of additional land dependent upon final agreement of land necessity.

4.4 Site Design Data

4.4.1 Project shall be capable of continuous operation for the full range of operational ambient conditions at the respective project location and as shown in Table 3.1.

4.4.2 All equipment and materials shall be rated to withstand the full range of site ambient conditions shown in Table 3.1.

4.4.3 All equipment heating and cooling systems, where required, shall be designed for the full Ambient Temperature Rating range, and account for ambient conditions which will be experienced such as direct sunlight exposure and windchill factored heat loss, and shall maintain equipment within manufacturer's recommended conditions for operation and stand-by / storage.

Table 3.1 – Site Ambient Design Criteria

Project Bid Name	Reference		Design Conditions			
	Site Ambient Temperature Range [1]		Ambient Operating Temperature Range [2]		Ambient Temperature Rating Range [3]	
	Minimum (deg C)	Maximum (deg C)	Minimum (deg C)	Maximum (deg C)	Minimum (deg C)	Maximum (deg C)
Petersburg Substation	-18.8/ -25.8	36.5 / 42.1	-25	40	-40	60

[1] – Based on ASHRAE climatic data – Extreme Annual Mean DB / 50 Yr Extreme DB Temperatures

[2] - Equipment / components / materials can withstand this range while operating at nameplate capacity without accelerating degradation of equipment beyond design rate or suffering damage or degradation to performance such that repair, or replacement is required to restore performance. Range Based on typical equipment operating range capabilities. Where discrepancies between this table and any other specified temperatures exist, the more stringent requirement shall apply.

[3] - Equipment / components / materials can withstand this range while not in operation, or at reduced operational performance, without suffering damage or degradation to performance such that repair, or replacement is required to restore performance. Range based on ASHRAE climatic data - 50-year extreme temperature (absolute value + 3-degree F) vs. typical equipment operating range of -13°F to 104°F whichever is more extreme. . Where discrepancies between this table and any other specified temperatures exist, the more stringent requirement shall apply.

Table 3.2 – Site Loading Design Criteria

Project Bid Name	Design Condition				
	Wind	Seismic [1]	Snow	Ice	Frost
	- 3 Sec Gust - Exposure Category - Importance Factor	- Soil Class - Spectral Accelerations (SS / S1) - Importance Factor	- Ground Snow Load - Importance Factor	- Equivalent Uniform Radial Thickness - Importance Factor	- Frost / Adfreeze
Petersburg Substation	• 90 mph • Category III • Iw: 1.0	• Soil Class C • SS=0.419/S1=0.156 • Ie= 1.25	• GSL= 20 lb/sqft • Is= 1.10	EURT = 0.75” Ii = 1.25	[2]

[1] - Seismic design criteria are currently based on ASCE 7-10, these values shall be adjusted by the Contractor based on Contractor’s geotechnical investigation and report.

[2] - Contractor shall determine frost and adfreeze depths based on recommendations of geotechnical study and geotechnical engineer’s recommendations to account for frost jacking and adfreeze design pressures and forces in the design.

[3] – Wind, snow, and ice design criteria are currently based on ASCE 7-10.

4.5 Site Layout

4.5.1 The bid basis site layout for the Project shall be based on the Contractor’s proposed layout within the available project limits. A preliminary site layout is provided in Exhibit A for reference. Contractor shall be responsible for the final site layout and overall facility design to meet Contract performance requirements and optimize Project efficiencies, solar energy harvesting and site energy production.

4.6 Operational Criteria

4.6.1 The Project shall be designed for fully automatic, unmanned operation. This shall include startup, shutdown, abnormal operating condition (i.e. voltage, frequency excursions), etc. Transmission interconnection shall meet all requirements of transmission owner Interconnect Requirements as well as applicable MISO DIR requirements and NERC requirements at project Commercial Operation Date (COD).

4.7 Reliability and Maintainability

4.7.1 Reliability and availability of the Project are prime requirements of the Project. Project design philosophy shall be used to attain high reliability; providing no less than a 99.7% availability rate.

4.7.2 Project design philosophy and equipment and material selections shall provide a dependable, reliable, and durable final installation which reduces ongoing maintenance, extends equipment mean time between failure (MTBF) and equipment life. Contractor shall utilize the project design and equipment and material selections activities as tools to attain maintainability, at minimum, which is consistent with industry standards. Design features that offer long term O&M cost reductions shall be offered, specifically those which in the Contractor's experience offer beneficial value to cost ratios.

4.7.3 Project design and equipment and material selections shall be based on proven design concepts which have been utilized successfully and have met performance expectations under commercial operation for similar applications.

4.7.4 Contractor shall provide all-inclusive operations and maintenance manual, the typical daily, monthly, and annual maintenance activities list for the expected long-term operation of the Project. This shall include inspection and testing activities, preventative/periodic maintenance activities, and recommended equipment replacement intervals for the Project; these listed activities shall be inclusive of the recommended and required activities provided in the NETA Maintenance Testing Specification. The Contractor shall provide a catalog listing the names, part numbers, typical lead times and other identification and planning information for all unique components (Asset Register) requiring preventative maintenance.

4.8 Site Specific (AES Indiana) Technical Requirements

4.8.1 The Project shall meet all AES Indiana technical requirements unless otherwise agreed to in writing.

4.8.2 The project shall meet the following AES Indiana additional clearances on top of those required by NESC:

4.8.2.1 2 feet additional clearance over any crossings (railroads, road, other circuits)

4.8.2.2 1 foot additional clearance over all other areas not designated as crossings

4.8.2.3 Using 10% over-voltage when determining clearances (instead of NESC 5%)

4.8.2.4 Substation drive path shall be large enough to allow a 140' truck drive through access to the main power transformers.

4.9 Miscellaneous Technical Requirements

4.9.1 Contractor shall acquaint itself with the Project Site and applicable permit conditions and shall design the balance of system (BOS) to be suitable for the site environmental conditions, including elevation, temperatures, corrosion potential, etc.

4.9.1.1 The Contractor shall be responsible for coordinating with all utility owners whose facilities pass through the site, above or below grade, to determine all aspects of the project which will be impacted by the utility and to provide a compliant design and final installation. Such factors may include road crossings, collector line crossings, and easement/setback requirements for any work and permanently installed portions of the project.

4.9.2 The Project shall meet all applicable federal, state, and local noise requirements.

4.9.3 If the noise level is above OSHA linear field threshold then appropriate signage shall be installed.

4.9.4 The Contractor shall be responsible for providing signs for high noise areas requiring hearing protection, arc flash hazards and other items needed to meet OSHA regulations and otherwise ensure minimal risk to personnel health and safety while at the Project.

4.9.5 Arrangements shall provide a minimum vertical clearance of 18 feet at all roads under any structures, wires, and equipment, platforms and pipe bridges, etc. Where code requirements call for additional overhead clearance, this additional clearance shall be provided.

4.9.6 All equipment shall be provided with permanent engraved labels.

4.10 Codes, Regulations and Standards

4.10.1 Contractor shall design the Project in accordance with all applicable federal, state and local laws and codes, regulations and standards listed below. The codes and standards utilized shall be the latest editions in effect on the effective date of this Agreement. Where these codes do not govern specific features of the equipment or system, Contractor and Original Equipment Manufacturer (OEM) standards shall be applied. Where local codes or ordinances will have an impact on the design (e.g. building height restrictions) or equipment selection, Contractor shall jointly address these with the local authorities having jurisdiction (AHJ). Contractor shall review all applicable laws, codes and standards throughout the project duration. Any change in requirements which become applicable to the Work prior to final turnover shall be identified and presented to Owner with recommended implementation options for Owner's consideration and final approval.

4.10.2 Federal Regulations

4.10.2.1 US Environmental Protection Agency Regulations

4.10.2.1.1 Resource Conservation and Recovery Act Regulations

4.10.2.1.2 Clean Water Act

4.10.2.1.3 Clean Air Act

4.10.2.1.4 Oil Pollution Act

4.10.2.1.5 Comprehensive Environmental Response, Compensation and Liability Act

4.10.2.1.6 Emergency Planning and Right-to-Know Act

4.10.2.1.7 Toxic Substances Control Act

4.10.2.2 National Environmental Policy Act

4.10.2.3 US Fish and Wildlife Regulations (e.g. Endangered Species Act)

4.10.2.4 US Army Corps of Engineers Regulations

4.10.2.5 Occupational Safety and Health Act (OSHA)

4.10.2.5.1 29 CFR 1910 Occupational Safety and Health Standards

4.10.2.5.2 29 CFR 1926 Safety and Health Regulations for Construction

4.10.2.6 US Department of Transportation Regulations

4.10.2.7 Code of Federal Regulations

4.10.3 Applicable State, County and Local Codes and Regulations

4.10.3.1 County Regulations

4.10.3.2 Department of Transportation Regulations

4.10.3.3 Local Codes and Ordinances

4.10.4 Applicable Industry Codes and Standards from the following list as applicable for a utility scale BESS plant. Alternative standards may be used with written justification on how compliance is to be achieved.

4.10.4.1 Mechanical

4.10.4.1.1 ANSI - American National Standards Institute,

4.10.4.1.2 PTC - Power Test Codes - Applicable Test Codes

4.10.4.1.3 ASNT - American Society for Nondestructive Testing

4.10.4.1.4 ASTM - American Society for Testing and Materials

4.10.4.1.5 AWS - American Welding Society

4.10.4.1.6 SSPC - Steel Structures Painting Council

4.10.4.1.7 MSS – Manufacturers Standardization Society

4.10.4.2 Electrical

4.10.4.2.1 ANSI - American National Standards Institute

4.10.4.2.2 FM - Factory Mutual

4.10.4.2.3 ICEA - Insulated Cable Engineers Association

4.10.4.2.4 IEEE - Institute of Electrical and Electronics Engineers

4.10.4.2.5 IESNA - Illuminating Engineering Society of North America

4.10.4.2.6 ISA - International Society for Measurement and Control

4.10.4.2.7 NEC - National Electrical Code, latest version adopted by Authority Having Jurisdiction

4.10.4.2.8 NEMA - National Electrical Manufacturers Association

4.10.4.2.9 NESC - National Electrical Safety Code

4.10.4.2.10 UL Underwriters Laboratories

4.10.4.2.11 NFPA – National Fire Protection Agency

4.10.4.2.12 IEC – International Electric Code

4.10.4.2.13 Other local codes as required

4.10.4.3 Civil/Structural/Architectural

4.10.4.3.1 ACI - American Concrete Institute

A. ACI 318 - Building Code Requirements for Reinforced Concrete

B. ACI Manual of Standard Practice

C. ACI 350R – Environmental Engineering Concrete Structures

4.10.4.3.2 ASCE 7 – Minimum Design Loads for Buildings and Other Structures

4.10.4.3.3 ASCE 113- Substation Structure Design Guide

4.10.4.3.4 AISC - American Institute of Steel Construction

4.10.4.3.5 AISI - American Iron and Steel Institute "Specification for Design of Cold-Formed Steel Structural Members," Parts 1 and 2

4.10.4.3.6 AWS - American Welding Society

4.10.4.3.7 State Building Code and any State and local amendments and codes

4.10.4.3.8 SSPC - Steel Structures Painting Council

5.0 MECHANICAL SYSTEMS AND EQUIPMENT

5.1 General Utilities

5.1.1 Contractor shall supply and install all process and potable water, compressed and dried air, HVAC and other utilities as required to support their design and equipment.

5.2 FIRE PROTECTION SYSTEM

5.2.1 Introduction

5.2.2 The site control house, located in the Project substation, shall be provided with fire detection systems and outfitted with appropriate fire extinguishers at a minimum. The fire detection systems shall be designed and constructed in accordance with the latest version of fire protection codes and standards for stationary energy storage systems, inclusive of applicable NFPA Standards and those required by the AHJ. If required by AHJ, fire protection systems shall be installed.

5.2.3 All fire protection materials or services that require approval in accordance with the applicable local or national codes and standards for fire protection and shall be FM or UL approved.

5.2.4 The "Authority Having Jurisdiction" shall be the local fire marshal or equivalent. Contractor shall be responsible for contacting the AHJ and determining if any local codes or rules apply to the Project.

5.2.5 All applicable recommendations of the applicable local or national code for fire prevention and fire protection for electric generating plants and high voltage direct current converter stations. If no applicable code is available, then NFPA 850 shall be considered as required in the design of the Project. All applicable requirements of NFPA 855 shall be considered as required in the design of the BESS enclosure fire detection and suppression.

5.2.6 Contractor shall prepare a fire protection design basis document (DBD) and submit to Owner. The approved DBD shall be periodically updated during the design phase of the Project and resubmitted to Owner.

5.2.7 Fire Alarm and Detection

5.2.7.1 A fire alarm and detection system shall be provided. The fire alarm system shall be an intelligent addressable type using FlashScan™ signaling line or equivalent circuits. Provide a main annunciator fire control panel located in the central control room. All local fire panels shall be connected to the main panel.

5.2.7.2 Alarm control panels shall accept signals from the detecting devices and alarm in the central control room and initiate release of the protection systems where they are provided. Local alarms and indication shall also be provided.

5.2.7.3 A proprietary fire alarm system shall be provided for the Project with local structure fire alarms, automatic fire detectors, and fire signaling panels.

5.2.7.4 Aspirating smoke detectors for electronics and electrical rooms shall take samples from each electrical room to allow alarm indication down to the individual room level.

5.2.8 Fire Water Supply

5.2.8.1 The Project fire water supply shall be derived by the Contractor.

5.2.9 The table below outlines the minimum fire detection and suppression systems to be provided for the Project's buildings, structures, and equipment:

Area or Equipment	Suppression System	Detection	Actuation
BESS Enclosure	Per NFPA 855 for specific battery chemistry.	Per NFPA 855 for specific battery chemistry.	Automatic; Contractor to provide complete details with proposal.
Site / Switchyard Control House	Portable extinguishers	Aspirating smoke detector	Manual
Electrical Rooms	Portable extinguishers	Aspirating smoke detector	Manual
Oil filled Transformers	Fire Walls or separation	None	None
Cable spreading rooms or manholes	Dry pipe sprinkler	Aspirating smoke detector	Automatic
Battery rooms (UPS)	Portable extinguishers	Smoke detection	Manual
All areas not identified above	Dry pipe sprinkler	Smoke detection	Automatic
Fire pump enclosure	Dry pipe sprinkler	Frangible bulb	Automatic

6.0 CIVIL AND STRUCTURAL FEATURES

6.1 Civil / Structural Design Basis

6.1.1 The following preliminary documents are provided for information only. The design for new facilities shall be based on final investigations and surveys as defined below. Any additional investigation or survey work which Contractor requires or desires to complete their work shall be the responsibility of the Contractor.

Design Basis Document	Preliminary		Final	
	Provided By	Exhibit F Location	Provided By	Exhibit F Location
Site Plan	Contractor	Bid Response	Contractor	Contract Deliverable
Site Topological Survey	Owner	Attachment 7	Contractor	Contract Deliverable
Site ALTA Survey	Owner	Attachment 7	Owner	Attachment 7 (Future)
Site Geotechnical Investigation	Owner	Attachment 7	Owner	Attachment 1 (Future)

6.1.2 Surface Surveys and Investigations

6.1.2.1 The Contractor shall be solely responsible for furnishing all labor, materials, tools and equipment to perform all surveying work, inclusive of final topographic and ALTA surveys, as determined necessary by Contractor, and geotechnical investigations, and provide all services necessary for, or incidental to construction of the Project; and to establish and maintain benchmarks, to make measurements to verify location of completed construction, and to survey alignment to existing property boundaries. Underground utilities and surface penetrations shall be identified on the Contractors drawings.

6.1.3 Easement and Setbacks

6.1.3.1 The Contractor shall observe all easements and setbacks described herein and in Exhibit A – Attachment 1 as reference. Final easements shall be identified on the Site Plan Drawings to be developed by the Contractor. Minimum setback requirements shall be in accordance with local zoning codes and ordinances and the Contract requirements.

6.1.4 Geotechnical Investigation

6.1.4.1 Contractor shall provide the following services in regard to geotechnical investigations, studies, analysis and associated engineering:

6.1.4.1.1 Review available geotechnical and geological data related to the project and available from the Owner's preliminary and final Geotechnical Investigation documentation. Owner provided documentation will include:

6.1.4.1.1.1 Laboratory testing on undisturbed and disturbed soil samples to determine soil properties for use in design.

6.1.4.1.1.2 Evaluation of in-situ dry density and moisture content, shear-strength, Atterberg limits, grain size distribution, compaction, consolidation, specific gravity and expansion characteristics of the soil conditions encountered.

6.1.4.1.1.3 Electrical resistivity (4-pin Wenner) testing results per ASTM G57.

6.1.4.1.1.4 Thermal resistivity testing per ASTM D5334-08. Results provided with a dry out curve (Thermal Resistivity versus Water Content).

6.1.4.1.1.5 Soil corrosion study to determine the potential to concrete chemical attack and resistivity testing for verification of corrosion risk to buried ferrous metals.

6.1.4.1.1.6 Recommended type of concrete that is appropriate for the site.

6.1.4.1.2 Contractor shall conduct pile lateral, compression and uplift load testing and provide pile lateral, compression and uplift load testing results. Owner performed Pile load testing will be in general conformance with ASTM D 3689-07, Standard Test Method for Deep Foundations under Static Axial Tensile Load and ASTM D 3966-07, Standard Test Method for Deep Foundations under Lateral Load, as modified for the small piles being tested. The number of pile tests will be in accordance with the recommendations of the geotechnical engineer and corresponding to the variability of encountered soils and the size of the site

6.1.4.1.3 Contractor shall determine excavation and backfill requirements for site structures, such as inverter stations and/or substation equipment. These shall be designed by a Civil Engineer and in conformance with the recommendations of the Geotechnical Engineering Report. Where compaction cannot be achieved by mechanical methods, controlled low strength material shall be used for backfill.

6.1.4.1.4 Contractor shall determine excavation and backfill requirements for site utility trenching, including electrical trenches. These shall be designed by a Civil Engineer and in conformance with the recommendations of the Geotechnical Engineering Report. Perform quality assurance testing in conformance with the recommendations of the Geotechnical Engineering Report. At a minimum, perform 1 compaction test per lift at all locations where utility trenches cross a roadway.

6.1.5 Load Combinations

6.1.5.1 All substation equipment support structures shall be designed using the provisions and load combinations of ASCE 113. Wire-supporting structures shall additionally be designed per the National Electric Safety Code (NESC), Construction Grade B.

6.1.6 Structural Analysis

6.1.6.1 Computer aided analysis and design shall include secondary moments from non-linear effects (p-delta) for structure stresses. Analysis procedures shall be based on the applicable design document (AISC 360 for steel structural shapes, ASCE 48 for tubular steel structures, ACI 318 for concrete structures, ASCE 10 for lattice structures, the Aluminum Design Manual for aluminum structures, etc.).

6.1.7 Equipment Support Structure Design

6.1.7.1 Transmission line dead ends shall be located outside the substation, with a slack span inside the substation.

6.1.7.2 Structural supports for bus work, switches, and all other equipment shall be designed in compliance with ASCE MOP 113, and IEEE 605.

6.1.7.3 All substation structures, except dead-end structures, shall be designed and constructed using hot-rolled, structural steel square, rectangular, or tapered polygonal tubes. The dead-end structures shall be designed using tapered tubular polygonal shapes.

6.1.7.4 Per ASCE 113, polygonal tube structures shall be designed in accordance with ASCE 48. Per ASCE 113, structures designed with other structural shapes shall be designed in accordance with AISC 360.

6.1.8 Structure Deflection

6.1.8.1 For deflection Load Combinations, the deflection extreme wind shall not be determined by using a reduced return period per ASCE 113, Table 3-14. For the Ice with Wind load Combination, the deflection ice thickness shall not be determined by reducing the ice thickness per ASCE 113, Table 3-15.

6.1.8.2 Structure deflections shall be checked for loading combinations with all load factors equal to 1.1.

6.1.8.3 The calculated deflections shall not exceed the values listed below.

6.1.8.3.1 Wire-Supporting Structures and Shield Poles:

6.1.8.3.1.1 Horizontal deflection of vertical members: 1/100 of height

Horizontal deflection of horizontal members: 1/200 of span
Vertical deflection of horizontal members: 1/200 of span

6.1.8.3.2 All other Equipment Support Structures:

6.1.8.3.2.1 Horizontal deflection of vertical members: 1/200 of height

Horizontal deflection of horizontal members: 1/300 of span
Vertical deflection of horizontal members: 1/300 of span

6.1.9 Control House Structural Design

6.1.9.1 The control house shall be designed using the applicable building code as required by the Authority Having Jurisdiction (AHJ). If no AHJ oversight is required, the International Building Code 2015 edition shall be used for design.

Design, fabrication, and erection of structural steel shall meet the requirements of the IBC, AISC Steel Construction Manual (AISC specification and AISC code of standard practice). Structural design shall comply with seismic design and detailing requirements of the IBC, ASCE 7, and AISC 341. It is preferred to have an Engineered/prefabricated and delivered to site precast concrete building. Steel, concrete, and CMU buildings are all acceptable options.

6.1.9.2 Design Loads

6.1.9.2.1 Design Loads shall be determined in accordance with IBC assuming a Risk Category III.

6.1.9.2.1.1 Roof dead load: Weight of built-up roof, roof joists, insulation, structural members, permanent equipment, cable tray fully loaded with cables, lighting, and any other items supported by the roof.

Floor dead load: Weight of AC/DC panels, control/relay panels, batteries, cable termination cabinets, and other electrical equipment supported on the floor.
Roof live load: 40 psf (minimum)

Snow load: Per the applicable building code. 10 psf ground snow load minimum.
Floor live load: 250 psf or a 1,300-pound load concentrated in any 2½ square foot area.
Wind load: Per the applicable building code. 120 mph (minimum)
Seismic: Per the applicable building code.

6.2 Site Development

6.2.1 General

6.2.1.1 The Project design shall take into account existing site conditions with respect to site undergrounds and utilities, soil characteristics, site clearing, grading and drainage. Contractor shall be responsible for all needed site preparation and soil stabilization. In addition to the site development work required to support Project construction, overall Project Site development shall also include permanent grading, drainage, roadways, and fencing and gate systems.

6.2.1.2 Site elevation shall be established during the design process. Grading around foundations and exposed concrete slabs shall be sloped to assure proper drainage away from foundation structures.

6.2.1.3 All graded slopes must be 3:1 or flatter to allow mowing of the site. In areas that must be steeper and cannot be mowed, proper measures must be taken to minimize weed growth in an effort to reduce the need for string trimming and/or the use of herbicides.

6.2.1.4 The final grade for the substation shall be above the 100-year floodplain elevation. The substation shall be elevated above surrounding grade such that no upstream sheet-flow shall flow over the pad.

6.2.1.5 Contractor will be responsible for preparing, submitting and securing of all required construction-related permits including dewatering, demolition, clearing, burning or other permits. Contractor will also be required to prepare and submit any and all site compliance certifications regarding work completion to applicable agencies (e.g. as-built certification of storm water management system, if required).

6.2.2 Site Clearing

6.2.2.1 Tree and stump removal, clearing and grubbing, along with demolition of any obstructions or facilities, necessary for the Project shall be completed by Contractor.

6.2.2.2 All non-organic construction-related debris and material removed shall become the immediate property of Contractor and shall be removed from the premises and disposed of by Contractor in accordance with permits, federal, State and local regulations. Contractor shall minimize landfill waste by recycling materials where possible.

6.2.2.3 On-site open burning will not be permitted unless approved by appropriate local authorities.

6.2.3 Site Storm Water and Erosion Control Management

6.2.3.1 Contractor shall develop the Storm Water Pollution Prevention Plan (SWPPP. The Contractor shall obtain a construction NPDES permit including NOI and NOT, perform all required periodic inspections, maintain appropriate documentation for the entire site including the substation.

6.2.3.2 Soil erosion and sediment controls shall generally consist of control of runoff, vegetative stabilization, and sediment traps. All slopes, drainage ditches and other exposed areas shall be stabilized by vegetation. Sediment traps such as hay bales or synthetic filter fabric (silt fence) shall be installed at culvert inlets and at the top and toe of slopes. Contractor shall maintain erosion and sediment control systems and ensure compliance with the SWPPP throughout the construction phase of the Project.

6.2.3.3 Contractor is responsible for all penalties incurred as a result of not maintaining erosion and sediment control measures in accordance with the permits, federal, State, and local regulations. Contractor is responsible for all remediation measures and remediation costs incurred by not following and maintaining the erosion and sediment control measures.

6.2.3.4 Contractor shall develop the permanent site Storm Water Management Plan (SWMP) according to all applicable permits. Contractor shall implement all Best Management Practices (BMPs) in order to provide Owner with a compliant site. Site grading, vegetation and other BMP features shall be developed to minimize ongoing maintenance requirements for the Owner to maintain compliance with the SWMP. Contractors shall be responsible for final grading and soil / topsoil quality requirements to accommodate permanent re-establishment of vegetation of the site. Topsoil depth across the site at the completion of construction must match the existing topsoil depth identified in the geotechnical report.

6.2.3.5 Contractor shall perform all necessary hydrological and drainage studies to establish all required design related parameters related to storm water impacts including flood depths. Water induation depths must be shown in the plan set for the pre-construction and post-construction conditions so that the Contractor knows where not to store equipment overnight during construction, and also for quick verification of where solar equipment maybe be subject to flooding and/or standing water.

6.2.3.6 Contractor's site grading and drainage system design shall assume that any existing site drainage tile system is no longer functional due to damage from Contractor's installed piles and site work.

6.2.3.7 Contractor shall perform all needed construction phase and final site grading including the substation. This shall include excavating, demucking, backfilling, filling and compacting of soils as required. Soils unsuitable for sub-grade shall be removed and replaced with suitable backfill material. Contractor shall account for frost and adfreeze in backfill material selection.

6.2.3.8 Contractor shall be responsible for installing and maintaining adequate drainage and preventing soil erosion at the site during construction in accordance with State and local sediment and erosion control rules, regulations, and ordinances.

6.2.3.9 Contractor shall be responsible for final site development, restoration and establishment in order to maintain adequate drainage and prevent soil erosion during operation of the Project, in accordance with State and local sediment and erosion control rules, regulations, and ordinances.

6.2.3.10 The drainage system may consist of storm water basins, berms, diversion berms and outlet structures including rip rap. Design shall consider O&M ease of access and allow for mowing.

6.2.3.11 The drainage system shall be designed to comply with the 40CFR112 Spill Prevention Countermeasures and Control (SPCC) rule changes published in the Federal Register. The Contractor shall develop the Project (including substation) operational SPCC Plan and it shall require a secondary containment for oil storage or electrical equipment. The SPCC Plan shall be sealed by a Professional Engineer.

6.2.3.12 The drainage system shall be designed to an 100-year storm event for protection of equipment and scour analysis.

6.2.3.13 Contractor shall proactively identify location of any pre-existing agricultural drain-tile on the project site and modify as required to prevent the release of sediment at the discharge point. This shall include, as necessary, cutting and capping all site drainage tile discharge points or modification of all discharge points, as required to prevent release of sediment from the site.

6.2.4 Site Restoration

6.2.4.1 All site development areas disturbed during construction, including lay down, temporary spoil pile area, parking and temporary office trailers, etc. shall be restored and stabilized in accordance with post-construction storm water drainage requirements. All soil disposed on-site shall be leveled and seeded.

6.2.4.2 All areas must be free of depressions, ruts, holes, rills, rocks, stumps, logs, trash, nails, and other debris that pose hazards to completing mowing and maintenance operations. Mowing will be part of the longterm maintenance plan for the site and must be able to be completed without potentially throwing projectiles into the air. All surfaces must also be graded smooth to prevent the bouncing of mowing equipment

6.2.4.3 Contractor shall thoroughly clean the areas of the Work, removing all accumulations of scraps, waste, oil, grease, weld spatter, insulation, paint, and other foreign substances in accordance with Prudent Industry Practices

6.2.4.4 Contractor shall thoroughly clean the inside of equipment, modules, and equipment enclosures removing all accumulations of dust, scraps, waste, oil, grease, weld spatter, insulation, paint, and other foreign substances in accordance with Prudent Industry Practices.

6.2.4.5 Any permanent Project equipment or facility surfaces damaged as a result of Contractor's Work or by deposits of insulation, concrete, paint, weld metal, or other adhering materials shall be restored by Contractor.

6.2.5 Roads and Work Pads

6.2.5.1 Sufficient access roads for maintenance and equipment replacement shall be included in the overall Project design.

6.2.5.2 The Project shall include an interior road system that provides service truck and typical service vehicles and equipment access to each inverter station, the onsite substation, and connects to the off-site and public road system.

6.2.5.3 Road system shall be designed, where practical in a looped manner to provide access to equipment locations from two directions; to avoid blocking maintenance access to equipment when roadway or underground work may be occurring. Every dead end radial road shall be provided with a turnaround sized for fire truck turning radius as required by code and/or local fire department.

6.2.5.4 Road Construction

6.2.5.4.1 Site entrance roads shall be constructed with aggregate road base material per DOT specifications. Entrance roads shall extend off of the off-site / public road system the required distance to allow tractor trailer vehicles to fully pull off of the off-site/public road and park prior to entering the project site entrance gate including 100 foot past the gate. These areas will also incorporate either cement stabilization or geofabric into the road design. Roads that are constructed with stone shall use material in accordance Indiana DOT specifications.

6.2.5.4.2 The continuous access road path from each of the project entrances to the Project Substation shall be constructed with aggregate road base material per DOT specifications. These areas will also incorporate either cement stabilization or geofabric into the road design.

6.2.5.4.3 All other on-site roads shall be constructed of compacted soil and shall provide access to each inverter station and connect to the existing off-site road system. Where the native compacted roads encounter a soft/low spot, fill shall be placed and compacted. Roads shall be designed to avoid continual O&M maintenance of importing material.

6.2.5.5 The intersection radius, as measured from the edge of pavement, shall not be less than thirty-five feet (35').

6.2.5.6 Final road design shall be the per Contractor's geotechnical investigation geotechnical investigation and geotechnical engineer's recommendations and requirements.

6.2.5.7 Roads may be constructed at grade to allow for existing drainage sheet-flow patterns to be consistent with pre-development discharge patterns, provided road construction is designed to withstand this sheet flow and prevent road erosion and washout. The maximum slope of roadways shall be 5 percent and the maximum cross slope shall be 2.5 percent. Channelization of water is to be avoided as much as possible. The use of side ditches along the roadway with culverts is to be avoided if at all possible; utilizing low-maintenance measures, such as properly designed low-water crossings, is preferred.

6.2.5.8 Culverts shall be included on site roads as needed to maintain drainage and prevent road washout. Culvert crossings (if any) shall be designed for a minimum of two AASHTO HS-20 loading per day for Project operations. All culverts are required to have flared end sections to protect the culverts and reduce maintenance operations. Culverts must be installed in accordance with the manaufacturer's specifications.

6.2.5.9 Contractor shall design site roads to be able to service and/or replace equipment in future years. Contractor shall include AutoTURN requirements and an AutoTURN design sheet for each vehicle, similar to the 30% package. The crane and trailer shall be able to replace equipment including PCS and BESS equipment after completion of construction. Substation access roads shall be able to accommodate GSU transformer replacement.

6.2.5.10 An unpaved perimeter path shall be provided adjacent to all fence lines for fence Substation and BESS access and maintenance. Perimeter paths shall be a minimum of 24 feet wide with 2 foot shoulder and minimum centerline radii of 50 feet and meet other project setback requirements.

6.2.5.11 Unpaved interior BESS unit access roads shall be a minimum of 14 feet wide with no shoulder and meet other project equipment setback requirements.

6.2.5.12 A work pad shall be provided around each inverter station. The work pad will consist of a five (5) foot wide flat surface around all sides of the inverter station. The work pad and transition slope shall be covered with a min. of 3" of gravel. As required by site SPCC plan, the gravel shall be of sufficient volume to comply as passive secondary containment.

6.2.5.13 Structural fill shall be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density in accordance with ASTM D 1557. General backfill shall be compacted to at least 90 percent of Modified Proctor. The backfill and compaction requirements identified as part of the geotechnical evaluation shall be incorporated, as appropriate.

6.2.6 Fencing and Gates

6.2.6.1 The Project site, including each site area separated by public roadways or site discontinuities, shall be completely enclosed with a perimeter security fence. The site fence shall be an 8 foot tall deer fence. The fence shall be designed for a minimum 30 year life with minimal maintenance requirements. All entry gates shall be metal and shall meet the requirements provide in this section. Deer fencing cannot be used for any part of the substation fencing.

6.2.6.1.1 A minimum of one double wide lockable manual gate at each Project entrance from a public roadway. Swing gates shall be internally braced against sagging and shall be furnished with hinges, latches, stops, keepers, and locking mechanism.

6.2.6.1.2 Additional gates and types of gates, as required by Contractor's final layout to service operation, maintenance and construction shall be provided and installed by the Contractor.

6.2.6.1.3 Contractor shall provide grounding to fence based on findings from grounding study.

6.2.6.1.4 Contractor shall provide deer fencing mesh, line post and corner post details with their proposal. Contractor must provide a fence detail at stream and/or ditch crossings where the potential for debris accumulation exists; the section must include a "flow-through" design that allows debris passage and prevents damage to the fence at such crossings.

6.2.6.1.5 All gate posts and corner posts (where the fence changes direction by minimum of 45 degrees) shall be set in concrete footings having a diameter at least 3 times the post diameter, and a depth of exceeding the design frost and adfreeze bond depths, or a minimum of 3 feet below grade whichever is greater.

6.2.6.2 If permitting requires, contractor shall provide a chain link fence which meets the above requirements as well as the additional requirements provided below, shall be furnished and installed for the site perimeter security fence.

6.2.6.2.1 Seven (7) foot high chain link fence topped with one (1) foot barbed wire extension.

6.2.6.2.2 Provide 45 degree, one piece, three wire extension arms for barb wire. Barbed wire shall be 2 strand, 12.5 minimum W&M gauge wire with 4 point barbs of 14 gauge wire at 5 inch maximum spacing

6.2.6.2.3 Chain link fence fabric material shall consist of commercial grade 2-inch mesh, No. 11 gauge galvanized steel.

6.2.6.2.4 Fence shall have top rail and bottom tension wire. Top rails shall be 1-5/8 inches (outside diameter) O.D. pipe minimum. Wire shall be No. 7 gauge galvanized steel.

6.2.6.2.5 Line posts shall be a minimum 1-7/8 inch (outside diameter) meeting the requirements of ASTM F1043 Group C. End posts shall be a minimum of 2-3/8 inches (outside diameter). End and corner posts shall be braced.

6.2.6.2.6 Contractor shall provide grounding to fence based on findings from grounding study.

6.2.6.3 The Project collector substation fence shall provide a perimeter security enclosure. The substation and switchyard fences shall meet the above listed requirements as modified or added to by the additional requirements provided below, and as required to meet NERC security requirements. Where site perimeter and substation fence share a common run, the more stringent requirements between the two fences shall apply.

6.2.6.3.1 The fence shall comply with the NESC with respect to safety clearance zones.

6.2.6.3.2 Chain link fence shall be zinc coated. Class 2, chain link fence fabric, No. 9 gauge wire, 2 inch mesh. Width of mesh fabric is 108 inches, with top selvage twisted (barbed) and bottom selvage Knuckle finish, K&T. Bottom 12 inches mesh shall be installed below grade gravel.

6.2.6.3.3 Provide 45 degree, one piece, three wire extension arms for barb wire. Barbed wire shall be 2 strand, 12.5 minimum W&M gauge wire with 4 point barbs of 14 gauge wire at 5 inch maximum spacing

6.2.6.3.4 Fence shall have a top rail and bottom tension wire. Top rails shall be 1.63 inches (outside diameter) O.D. pipe minimum. Wire shall be No. 7 gauge zinc coated coil spring wire

6.2.6.3.5 Line posts shall be as a minimum 2.5 inches (outside diameter) O.D. Schedule 40 galvanized steel pipe. End and corner posts shall be a minimum 3 inches (outside diameter) O.D. Schedule 40 galvanized steel pipe. Terminal posts shall be braced. All posts shall be set in concrete footings having a diameter at least 3 times the post diameter, and a depth of exceeding the design frost and adfreeze bond depths, or a minimum of 3 feet below grade whichever is greater.

6.2.6.3.6 Swing gates, a minimum of one for vehicular and one for personnel access shall be provided. Gates shall be internally braced against sagging with adjustable truss rod/turnbuckle assemblies, and furnished with hinges, latches, stops, keepers, etc. The hinges shall not twist or turn under the full swing of the gate. The gate hinge assembly shall be designed to provide a 3-inch maximum opening between the gatepost and the gate frame. Gates shall be outfitted with cane bolts for maintain gate in closed position and for open position as desired. Closed position cane bolt insertion provision shall be incorporated into the gate concrete apron.

6.2.6.3.7 Gate latches shall be PL152 Industrial Gate Latch (also referred to as the Pioneer Latch 152) 18 lbs. International Security Products, or equivalent.

6.2.6.3.8 An eighteen inch thick concrete apron shall be poured at each vehicular gate in order to provide additional security at the bottom. The concrete apron shall extend the entire length of the gate opening terminating at the outside of each gatepost. The apron shall extend a minimum of 12 inches beyond the front of the gate (outside the substation fence) and 12 inches inside the gate (inside the substation fence) – total 24" wide. The concrete contractor shall install control joints spaced a maximum of 8 feet apart in order to prevent corner and shrinkage cracks. The concrete material shall have rebar support per drawing STND-03-908B. The base material installed under the concrete apron shall be designed in a manner such that proper drainage shall occur, providing for protection against frost heave. If poor drainage conditions are anticipated at the site, appropriate adjustments to the base material (e.g., use of crushed stone, modifying the size and or depth of the base material) shall be made.

6.2.6.3.9 Fence shall be grounded where necessary as determined by the Electrical Engineer, where perimeter fence is connected to substation fencing, or where perimeter fence crosses overhead transmission lines.

6.2.6.4 Protective bollards shall be placed in all areas requiring protection from accidental contact by vehicles or equipment, where final design locations warrant them as needed.

6.3 Foundations

6.3.1 The foundation design shall be based on the recommendations presented in the final geotechnical report.

6.3.2 Foundations shall be reinforced concrete slab on grade or steel piles designed to support the imposed loads.

6.3.3 Type of foundations required and allowable bearing values for soil shall be confirmed or as recommended by the geotechnical engineer based on the existing subsurface conditions throughout the complete project site.

6.3.4 All Foundation design shall be designed to prevent frost jacking due to the frost heave and adfreeze pressures.

6.3.5 Contractor shall provide for corrosion engineering recommendations of corrosion rate of steel and galvanizing on the piles specific to the in-situ soils over the life of the Project. These recommendations shall be provided in a report signed and sealed by a Corrosion Engineer, as defined herein. See the Corrosion Engineer Qualifications and Responsibilities section provided herein for Corrosion Engineer definition and corrosion rate calculation methodology minimum requirements. If Corrosion Engineer recommends a larger factor of safety (FS) than required in Corrosion Engineer Qualifications and Responsibilities section provided herein, the Corrosion Engineer's recommendation shall be followed.

6.3.6 Piles shall be designed to support the extreme level wind and seismic loads when full corrosion below top of grade is applied (including the Factor of Safety on the corrosion rates).

6.3.7 Steel piles shall be designed for the worst-case loads resulting from the calculated independent and combination of dead loads, live loads, wind loads, seismic loads, and frost jacking loads.

6.3.7.1 Steel pile design documentation shall include Contractor's pile installation acceptance criteria, in regard to items such as embedment depth, pile twist and orientation, and pile cap elevation, and shall include EOR approved remediation options for correcting these non-conformances as well as for remediating production pile test failures, for Owner review and approval.

6.3.8 Concrete

6.3.8.1 Reinforced concrete structures shall be designed in accordance with ACI 318, Building Code Requirements for Reinforced Concrete. Concrete work shall conform to the requirements of ACI 301, Specifications for Structural Concrete

6.3.8.2 Concrete proportioning shall be in accordance with the applicable ACI Standards and Specifications. All concrete mixes shall be appropriate for the climate conditions at the project site and approved by the responsible design engineer.

6.3.8.3 Grout shall be pre-packaged non-shrinking grout requiring water only, suitable for the service.

6.3.8.4 Reinforcing bars shall be deformed bars conforming to ASTM A615, Grade 60. Welded wire fabric shall conform to ASTM A185.

6.3.8.5 Cement shall be Portland cement conforming to ASTM C150, Type (as required by soil conditions).

6.3.8.6 Aggregates for normal weight concrete shall conform to ASTM C33.

7.0 ELECTRICAL SYSTEMS AND EQUIPMENT

7.1 General Requirements

7.1.1 The Project electrical systems and equipment shall be designed in conformance with the Project Electrical Studies section herein. Contractor shall perform all calculations necessary for proper sizing of electrical equipment and systems to ensure safe and reliable Project operation under all Project operating conditions and electrical transmission system conditions.

7.1.2 All electrical systems shall be designed to minimize the generation of harmonics and the effects of electrical interference between power and control/instrumentation circuits, and comply with applicable standards, codes, and regulatory requirements governing

electromagnetic compatibility. No equipment shall cause radio or television interference in excess of the limits specified in the applicable local or national standard, or IEEE Std. 519 if none are available.

7.1.3 Voltage insulation levels, equipment interrupting and continuous current capacities, circuit protection and mechanical strengths shall be selected and coordinated in accordance with calculations and the recommendations of IEEE, ICEA, NEMA, ANSI, NEC, UL and NESC.

7.1.4 Contractor shall provide backup substation station service power source from local distribution source. Contractor shall coordinate power feed and supply to site.

7.1.5 Contractor shall furnish all industry best practice labels (e.g. NEC required labels, ANSI-approved arc flash labels warning of the dangers of arc flash, etc.). Such labels shall be supplied and affixed to any equipment that may require service or maintenance while energized, as specified in the Contractor-provided arc flash study.

7.1.6 Environmental Conditions

7.1.6.1 All electrical equipment shall be located a minimum of 12 inches above both the ponding elevation that results from a 100-year 24-hour storm event and the 100-year floodplain elevation

7.1.6.2 Conduit and cable tray entry to outdoor enclosures, panels, switchgear, cabinets, etc. shall not be from the top. Bottom entry is preferred for rain protection. If bottom entry is not practical and side entry is required, entrances shall be installed with watertight fittings. All fastening hardware for enclosures, panels, etc. shall use the manufacturer's recommended attachment locations, variations will require manufacturer's approval. Top entry will not be permitted.

7.1.6.3 Enclosures for all equipment shall be in accordance with NEMA Standards and type number and shall be suitable for their location as follows:

7.1.6.3.1	NEMA 1	Indoors (General Purpose)
7.1.6.3.2	NEMA 3R	Outdoors and Indoors (in wet locations)
7.1.6.3.3	NEMA 4	Outdoors and Indoors (in wet locations – dust tight)
7.1.6.3.4	NEMA 4X	Outdoors - Indoors in wet and corrosion resistant locations
7.1.6.3.5	NEMA 7	Classified Areas, Class I, Div 1 Group D
7.1.6.3.6	NEMA 9	Classified Areas, Class II, Div 1
7.1.6.3.7	NEMA 12	Non-environmentally controlled indoor dusty areas

7.1.6.3.8 Enclosures containing non-arching devices (sealed contacts, terminals, etc.) may be NEMA 12 or 4X in Class I, Division 2 areas as the installed location dictates.

7.1.6.4 Enclosures for all equipment, components, weatherheads and conduits shall be provided with seals that comply with NEMA 4X rating and that are designed to prevent intrusion of pests and other wildlife.

7.2 Project Collector Substation

7.2.1 General

7.2.1.1 The Project collector substation shall comply with the requirements as listed herein and in accordance with the requirements of RUS Bulletin 1724E-300 – Design Guide for Rural Substations (RUS Substation Guideline). If discrepancies exist between this Exhibit A and the RUS Substation Guideline, the more stringent requirement shall apply. These discrepancies shall be communicated formally to Owner.

7.2.1.2 See Table 1.1 of this Exhibit A for site specific Project size and voltage ratings.

7.2.1.3 Equipment specifications are provided. If discrepancies exisit between specifications and the Substation Perferred Equipment, then the Substation Perfect Equipment will take precedence. All equipment specifications are indicative and ratings will be determined during detailed design.

7.2.1.4 The substation shall include, at a minimum main step-up transformer(s), circuit breakers, motor operated disconnects, control house, disconnect switches, metering, SCADA equipment, reactive compensation system , and all protective relaying equipment in accordance with Exhibit A and the GIA.

7.2.1.5 Each step-up transformer shall be furnished with a MOD on the HV side of the transformer with auxiliary contacts, 3 PHASE, Switches. MOD's shall be configured to allow local manual operation in the event of motor operator failure.

7.2.1.6 Each step-up transformer shall be furnished with a Disconnect on the low voltage side of the transformer with auxiliary contacts, 3 PHASE, Switches. MOD's shall be configured to allow local manual operation.

7.2.1.7 Main Step Up Transformer secondary containment shall be required, and shall be sized no less than 125% of the liquid capacity of the transformer. The minimum containment volume shall be the greater of 125% of the liquid capacity of the transformer, or 100 % of the oil contained in addition to the anticipated volume of rainwater retained during a 24-hour 25 year recurrent interval storm event. All designed water removal systems shall include a method of monitoring discharged water quality.

7.2.1.8 Collector substation shall be Open-air substation design. Switchgear design within substation control building may be proposed as an option to the base bid for Owner consideration.

7.2.2 Electrical Interconnection

7.2.2.1 The substation shall be in accordance with the technical requirements and design philosophy of the interconnecting utility and regional system operator, as appropriate.

7.2.2.2 The Contractor will furnish and erect the collector substation and transmission lines, including all work up to the deadend connections of the nearby AES Indiana Switchyard.

7.2.2.3 Contractor shall include industry standard fence, lighting system, video surveillance and access security system, and safety/warning signage where applicable.

7.2.2.4 Contractor shall provide a finished and graded surface within the substation fence and access road, determined by the surrounding land using a topographic survey.

7.2.2.5 All temporary and permanent service power from local utility required shall be coordinated and installed by Contractor.

7.2.2.6 Contractor shall furnish all capacitor banks, reactors, and/or other reactive compensation equipment, as necessary, for the Project to comply with GIA requirements

7.2.2.7 Contractor shall provide space provisions for one spare bay outfitted with 34.5kV disconnect. Substation layout and relay panel space shall be reserved for future breaker and associated relaying.

7.2.2.8 Contractor shall test, commission, start-up, and place into operation the Substation.

7.2.3 Voltage and Frequency

7.2.3.1 The Substation shall operate at the nominal operating voltage deemed acceptable by the Transmission Operator, and shall meet ride-through requirements for voltage and frequency.

7.2.3.2 Substation shall be designed to meet the Short-Circuit current (SC) capability of the Transmission Operator requirements.

7.2.4 Power Factor

7.2.4.1 The Project shall be designed for the substation to operate within the power factor limits as set forth in GIA.

7.2.5 Main Step Up Transformer

7.2.5.1 The main step-up transformer(s) shall be sufficiently sized to allow the full Project capacity to be delivered to the POI.

7.2.5.2 Transformer shall be supplied with surge arrestors adjacent to the high voltage bushings of the Transformer.

7.2.5.3 Oil furnished with transformer shall be mineral insulating oil in accordance with ASTM Standard Specification Designation D3487-09 and derived from naphthenic based crude oil or equivalent. The oil shall contain less than 10-ppm water. The Contractor shall certify to Owner that the oil being supplied shall have polychlorinated biphenyls (PCB) at a level of less than 2-ppm and specifically that the oil is classified as non-contaminated by PCB's. Manufacturer shall provide oil for extreme cold temperatures: -45ºC (-49ºF).

7.2.5.4 All voltage transformers furnished under this specification shall be designed in compliance with the latest published revision of the following documents unless stated otherwise in this specification.

7.2.5.4.1 IEEE C57.13 "Standard Requirements for Instrument Transformers".

7.2.5.4.2 IEEE C57.13.5 "Standard Performance and Test Requirements for Instrument Transformers of a Nominal System Voltage of 115kV and Above".

7.2.5.4.3 ASTM D3487-09 "Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus".

7.2.5.5 Each transformer shall be given routine tests in accordance with IEEE C57.13.5 and NETA ATS and ECS standards

7.2.5.6 If any of the requirements of this specification are in conflict with the standard, the Contractor shall notify Owner. Equipment found to be out of compliance with this specification will be rejected and credited, replaced, or brought into full compliance at the Manufacturer's expense

Table 7.1: High Voltage Transformer Ratings

Parameter	Value
Nominal Circuit Voltage, Vpp	345 kV
Maximum Continuous Voltage, Vpp	362 kV
Continuous Overvoltage, V'pp(1.1 x Vpp)	380 kV
Nominal Circuit Voltage (phase to ground), Vpg	199.2
BIL and Full Wave, (Minimum) 1.2 x 50 us	1300 kV
Bushing	
Minimum Creepage Distance (Distance based on >25 mm/kV(max))	> 356 inches > 9050 mm
60 Hz Wet, 10-sec. Withstand	680 kV (or Sw. Impulse if known)
Minimum strike distance	104 inches
Windings	
Primary Voltage	207 kV
Secondary Voltages (rms)	115/69 V
Winding Ratio	1800/3000:1
Secondary Windings	2
Taps per Winding	3
ANSI Accuracy Class @Burden MWXY & Z	0.15
Thermal Burden (Per Winding)	1000 VA

7.2.6 System Grounding

7.2.6.1 Substation shall be considered an effectively grounded system. Substation ground mat design shall be based upon IEEE Std. 80. Parameters to be used in the study, such as fault current magnitude and duration will come from various studies, such as the System Impact Study and relay and protection system evaluation.

7.2.6.2 Substation grounding shall also meet the general Grounding requirements provided herein.

7.2.7 Lightning Shielding

7.2.7.1 Lightning shielding shall be designed following the guidelines of IEEE Standard 998. Static mast poles shall be furnished and installed as required to provide adequate shielding.

7.2.8 Bus System and Structural Steel Design

7.2.8.1 Rigid bus structures shall be designed per IEEE Standard 605 and in compliance with the NESC. The bus work must be designed to withstand all required weather conditions appropriate for the location of the station and withstand all forces due to maximum fault current.

7.2.8.2 Structural supports for bus work, switches, etc. shall be designed in compliance with the RUS Substation Guideline and IEEE 605.

7.2.8.3 Project substation base design shall be Open-air design, see the RUS Substation Guideline for additional substation technical requirements. Switchgear design within substation control building may be proposed as an option to the base scope of work bid for Owner consideration. All net cost impacts for utilizing the option approach shall be included in the option bid costs

7.2.9 Steel Tower Design, Shield Wire Structures

7.2.9.1 Station towers and shield wire structures shall be designed to comply with the NESC and with the appropriate ASCE design specifications, addressing loads on the conductor and tower or pole.

7.2.9.2 The termination structure for the transmission tie line shall be designed in compliance with the NESC section 250 loads, the RUS Substation Guideline , and the ATXI design requirements.

7.2.10 Security

7.2.10.1 The substation shall be provided with a security fence.

7.2.10.1.1 See Site Development Section 4.2 for additional design requirements of the substation security fence.

7.2.10.2 The substation shall be provided with area lighting for security and operations use.

7.2.10.3 The substation shall be provided with video surveillance system. Owner shall contract the security system. Contractor shall provide conduit and power cabling for security system.

7.2.10.4 The substation shall be provided with card reader at control room access door(s).

7.2.11 Station service

7.2.11.1 The Contractor shall determine the loads required for substation equipment and design the AC service to supply that power. Contractor shall incorporate the backup power circuit in the design of the supply circuit. AC service design shall include the service power transformer, primary and backup source, transfer switches, fused disconnect switches, conduit and cables. The backup source shall provide service to all loads supplied by the primary supply system.

7.2.12 Control Building

7.2.12.1 A complete control building to house all BESS, and substation SCADA, communications, relaying, security equipment, Owner equipment and other functions necessary for a complete substation. It is preferred to have an Engineered/prefabricated and delivered to site precast concrete building. Steel, concrete and CMU buildings are all acceptable options.

7.2.12.2 The control enclosure shall contain Vendor-provided station services such as primary and backup AC supply disconnects, an automatic AC transfer switch, AC Load Centers, DC power system and storage battery, and air conditioning units.

7.2.12.3 Control building shall have full thermostat-controlled HVAC redundancy (i.e. 2 x 100%).Each HVAC system shall be fed from different circuit and breaker. One unit is fully running while the other is off to provide backup. Owner may require both units running at the same time for short period of time, hence the design shall accommodate such scenario.

7.2.12.4 One (1) VLA 125 VDC battery system shall be provided along with (2) 130 VDC battery chargers. The batteries and chargers shall be size in accordance of IEEE 485 and considering substation ultimate configuration (if any). The calculation shall consider worst case tripping scenario along with dual trip coil operation. A single charger shall be able to fully charge a completed battery within eight to twelve hours while supplying normal loads.

7.2.12.5 Battery banks shall be located in a separate room of the control house. There shall be enough space so field personnel can reach each cell and battery terminals for testing and maintenance. A minimum of 24 inches height separation between battery racks is needed to accomplish this.

7.2.12.6 Battery DC grounds shall be monitored via indicating lights on the front panel of the battery charger and indication of a DC ground shall be an input to the station RTU. Battery voltage shall be an input to the station RTU.

7.2.12.7 The substation will be equipped with normal and backup AC station service sources supplying 120/240 VAC, 3 wire, single phase power. Station service is preferred to be provided by low- side SSVT, local distribution, or on-site generator in that order. The design shall include two (2) fused disconnect switches for the incoming feeds (secondary feed of the SSVT and emergency feed). The system neutral must be bonded to ground in one and only one of the fused disconnects. These two disconnects shall both be in the control building. The normal station power source also needs to have a fused disconnect switch below the station service transformer. The fuses shall be Type LPN.

7.2.12.8 There shall be specified an automatic transfer switch (ATS) with microprocessor control. The ATS shall be equipped with alarms for loss of normal service and loss of backup service. The ATS shall be capable of managing a standby generator on the backup source. The ATS shall have neutral bonding provisions.

7.2.13 Metering Requirements

7.2.13.1 The metering panel shall be designed and constructed as specified in GIA or project planning phases.

7.2.13.2 Multi-conductor cables no smaller than #10 AWG shall be used to connect the instrument transformer secondary windings to the meter location. Under no circumstances shall CT cables contain splices. Larger conductor size may be required depending on the location of instrument transformers in relation to the meters. Seller shall perform burden calculations to determine appropriate conductor size.

7.2.13.3 Conductor used for grounding the metering instrument transformer tank shall be the same size as that used for the ground grid and in no case be smaller than #4/0 AWG.

7.2.13.4 Metering CTs and PTs shall be 0.15B1.8 sized so that tapping down is not required and 3% extended range TR=2 respectively.

7.2.13.5 All meters shall conform to ANSI Standards C12.20, C12.1, and C12.10.

7.3 Interconnection Facilities

7.3.1 Contractor shall provide transmission interconnection facilities to connect the Project to the transmission facilities in accordance with the requirements provided in herein.

7.3.2 Transmission interconnection shall meet all requirements of transmission owner Interconnect Requirements, GIA, as well as applicable MISO DIR requirements at project

Commercial Operation Date (COD). For the facilities with NERC requirements, all NERC requirements for design, testing, and documentation shall be satisfied.

7.3.3 Contractor shall coordinate the interconnection and back feed power from the transmission system.

7.4 Essential Power Supply Systems

7.4.1 The Project shall be provided with an essential supplies power system. Essential supplies shall be used to retain Project control, safety, and information systems during a loss of primary power supply. The essential supply systems shall offer simultaneous high reliability and high availability.

7.4.2 The essential supplies systems shall enable systems and equipment to be shut down in a safe manner on loss of a Project and incoming supplies. Afterwards, the essential supplies system shall allow a seamless return to normal service. Non-essential loads shall not be connected to the essential supply power sources.

7.4.3 If required for site essential systems, a DC battery shall be provided. Battery voltage and size shall be selected by the Contractor to support DC loads. Valve regulated sealed lead acid batteries with gelled electrolyte having a design life of at least 20 years are preferred. Station batteries shall be installed in a conditioned space, with maximum temperature limited to 77 °F, and complying with all codes and requirements including ventilation with loss of air flow alarm to the control system, spill containment, and personnel safety shower/eye wash station.

7.5 Raceway, and Miscellaneous Services

7.5.1 Conduit and Cable Tray

7.5.1.1 All conduit shall be electrical grade, appropriately sized, and rated for the subject environment, and where exposed to sunlight rated for UV exposure.

7.5.1.2 Underground conduits shall be schedule 40 PVC direct buried rated. Transition to conduit is required at the elbow leading to above grade connections.

7.5.1.3 Aboveground conduit shall be ¾ inch minimum except ½ inch conduit may be used to connect to instruments or devices with ½" nipples as required. Aboveground conduit shall be schedule 80 PVC – UV Resistant.

7.5.1.4 Conduit openings to be provided with seals designed to protect against intrusion of pests and other wildlife.

7.6 Power and Instrument Cable

7.6.1 All MV, LV and DC cable calculation shall comply with latest NEC and ETAP (or equivalent) software based on the selected thermal Rho value, load factor, ambient soil temperature, number of parallel circuits in the trench or ductbank and compaction rate as described in the geotechnical report. If the compaction rate cannot be achieved based on the geotechnical report, additional soil measurement and testing will be required for proper cable sizing.

7.6.2 Adequate physical separation shall be insured between DC and AC power cables, control cables and instrumentation cables to minimize the effects of mutual heating, electrical interference, and other disturbances. Cables associated with the data acquisition system shall be routed and isolated in accordance with system manufacturer's circuit separation criteria.

7.6.3 Medium voltage cable and terminations shall be in accordance with the below requirements.

7.6.3.1 MV AC cable conductor sizes shall be determined from consideration of the maximum conductor temperatures under sustained and three phase short-circuit/ground fault conditions, disconnection time of the protection and voltage regulation under steady state and motor starting conditions. MV AC cable sizing and spacing shall be determined based on the site Rho values and other parameters such as parallel circuits in the same trench, soil temperature, 20-30 deg C, Load Factor of 75% and minimum burial depth in compliance with NEC as required by other site conditions, traffic and loading at grade.

7.6.3.2 MV power cables 4/0 AWG and smaller shall be three conductor copper cable with a bare copper ground. MV power cables larger than 4/0 AWG shall be single conductor construction with separate ground conductor.

7.6.3.3 Direct burial aluminum cables are acceptable provided that the cable is suitable for the environment, and that all direct buried cable will be backfilled with Customer-approved material on all sides predicated that soil conditions are favorable as determined by the final Geotechnical Engineering Investigation.

7.6.3.4 The neutral wires to be sized to handle a single line-to-ground fault for duration of 20 cycles or per RFP. Any fault duration longer than 30 cycles may require larger neutral wires to reduce step and touch potential to tolerable limits. EPC to perform the short circuit and grounding study prior to finalizing the neutral wire sizing.

7.6.3.5 All conduits shall be appropriately supported to meet all codes.

7.6.3.6 Conductor insulation shall be ethylene propylene rubber (EPR). Conductor and cable jackets shall be thermoplastic CSPE or CPE. The jacket material shall be flame and oil resistant. All jackets shall meet the requirements of ICEA S-97-682, Standard for Utility Shielded Power Cables Rated 5-46KV and UL 1072, Standard for Safety Medium Voltage Power Cables. The individual conductors of multi-conductor cables shall be identified by printing numbers (1, 2, 3, etc.) on single-color insulation or jacket (Section 8.4, NEMA WC-74).

7.6.3.7 Insulation shielding shall be applied over the insulation of MV cables.

7.6.3.8 Insulation shielding shall consist of a nonmetallic covering over the conductor insulation and a nonmagnetic metal component over the nonmetallic covering. The metal component of the insulation shield shall be a five mil tinned copper tape applied over the nonmetallic covering in a helical wrap with a minimum overlap of 15% of tape width.

7.6.3.9 Minimum bend radius and maximum side-wall pressure shall be calculated and observed for all power cable installations. Conductors shall be terminated using compression fittings. Conductors shall be adequately supported and arranged in a neat and orderly manner.

7.6.3.10 MV cable terminations shall be fully insulated and terminated with a heat shrink termination kit as manufactured by Raychem (Tyco) Type HVT or 3M Type QT. Air terminations shall have adequate clearance and creep distances.

7.6.3.11 Connection boots are preferred at switchgear and motor connections but when taping is required, all joints shall be taped with TPC Vulco wrap or approved self-vulcanizing tape.

7.6.3.12 Contractor shall furnish and install stress cone terminations on the MV cable at each of the substation termination structures. Terminations shall be 3M Model 7666-S-8-19-AL-3P-BT or approved equivalent for the applicable voltage system.

7.6.3.13 Contractor shall furnish and install 600 amp dead break elbows as required for all padmount step-up transformer MV terminations and sectionalizing cabinets. The elbow connectors shall be 600 A, three-phase rated (21.1/36.6 kV) dead break and shall meet the full requirements of ANSI/IEEE Standard 386.

7.6.3.14 Where feasible, a minimum of 18" excess slack shall be provided to allow re-termination in the event of failure.

7.6.4 Low Voltage cable and terminations shall be in accordance with the below requirements.

7.6.4.1 Multi-conductor control and power cable shall be rated 600 V, 90°C, stranded copper or aluminum (as specified in the design) conductors, XLP or EPR insulation and an overall PVC, CPE or CSPE cable jacket. Control and power cable sizes larger than 1/0AWG shall be single conductor construction with separate ground conductor. Power cable sizes smaller than #2AWG shall be three conductor copper cable with green insulated ground conductor.

7.6.4.2 Single conductor wire and cable shall be rated for the appropriate voltage and temperature. Single conductor tray cable greater than #1/0 AWG shall have EPR insulation with a PVC, CPE or CSPE cable jacket. Non-jacketed FREP insulation with appropriate UL flame test may also be used for large single conductor cables.

7.6.4.3 Single pair instrument cable shall be rated 600 V, XLP or PVC insulation, twisted shielded pairs with drain wires and a PVC, CPE or CSPE cable jacket.

7.6.4.4 Multi-pair instrument cable shall be rated 600 V, XLP or PVC insulation, twisted shielded pairs with drain wires, overall shield, and a PVC, CPE or CSPE cable jacket.

7.6.4.5 Contractor shall follow standard process for wiring contractors (spring lugs, ratcheting crimper, wiring requirements) Owner follows ICEA E-1 color code method

7.6.4.6 All custom control panel wiring shall be insulated with 600 V NEC type SIS insulation and all panel wiring shall have wire numbers for identification. Vendor supplied control panels of a proven field design may provide their field proven cable insulation.

7.6.4.7 The allowable ampacity of power cables shall be in accordance with ICEA and NEC requirements.

7.6.4.8 Lighting and fixture cable shall be specified with 600 volt insulation.

7.6.4.9 Cables shall meet IEEE 383 flame test requirements.

7.6.4.10 For 1500 Vdc, low voltage cable shall be rated 2kV, 90°C, stranded copper or aluminum conductor (as specified in the design), with insulation conforming to UL-4703.

7.6.4.11 AC and DC cable burial depth and conduit fill shall meet the requirements of the NESC and, when required by the AHJ and the NEC.

7.6.4.12 The individual conductors of multi-conductor cables shall be identified by printing numbers (1, 2, 3, etc.) on single-color insulation or jacket (Method 4, Paragraph E.3.4, NEMA WC- 57).

7.6.4.13 Minimum bend radius and maximum sidewall pressure shall be calculated and observed for all power cable installations.

7.6.4.14 Conductors shall be terminated using compression fittings. Conductors shall be adequately supported and arranged in a neat and orderly manner. The DC cable connection to the inverter shall be made with compression or shear bolt lug connections, mechanical set screw lug connections are not acceptable.

7.6.4.15 Cable termination boxes for high current single conductor power cables shall be designed to avoid cable heating due to closed magnetic loops.

7.6.5 Fiber Optic Cable

7.6.5.1 Cables for SCADA and control system communications shall be routed in conduit. When redundant communications are required, they shall be routed in separate conduits. Fiber optic cables routed in any open areas or in trench way shall be in innerduct.

7.6.5.2 Fiber optic cables shall have a flame retardant, moisture and UV resistant, rugged and durable outer jacket. It shall be rated for outdoor aerial and duct, indoor vertical riser and general purpose horizontal according to NEC Article 770.

7.6.5.3 The type and wavelength of the fiber shall meet the SCADA system or equipment supplier's requirements. Fiber cables shall be 12 or 24-strand, single-mode throughout the project site. All fiber strands shall be terminated on the fiber patch panel with LC type connectors or approved equal. Fiber optic cables and terminations shall meet ANSI/TIA/EIA-568-B. A field test shall be provided for all fiber optic cables which identifies each cable, certifies that it meets the ANSI/TIA/EIA-568-B test specification and provides pertinent test data for each cable including insertion loss.

7.6.5.4 Multicore fibers shall be pulled from area to area and terminated in fiber optic patch panels using the manufacturer's recommended cable breakout and termination kits. Fiber jumpers utilizing Owner-approved connectors shall be used from the patch panel to the final device except where specific manufacturer's equipment requires a different type connector.

7.6.5.5 Copper communications cables such as for device net, RS-485, or other device communications shall have the same requirements as for fiber cable.

7.6.6 Control and Instrument Cable

7.6.6.1 General service control cables shall be rated for 600V. Insulation and overall jacketing material shall be 150°C Tefzel (ETFE) or 90°C Cross-linked polyethylene (XLPE). Minimum conductor size shall be 14 AWG. Multiconductor cables shall be used for all applications.

7.6.6.2 General service instrument cable shall be rated for 600V. Insulation and overall jacketing material shall be 150°C ETFE, or 90°C XLPE. They shall consist of twisted pairs or triads with an overall shield. Shielding of these cables shall consist of aluminum-polyester tape and copper drain wire. Minimum conductor size shall be 16 AWG. The shield drain wire for each instrument cable shall be insulated with a spaghetti sleeve and terminated on an ungrounded terminal. The ground wire shall be carried from the source device to the destination device without external ground contact.

7.6.6.3 Control conductor terminal connectors shall be compression type connectors properly sized for the conductor and the terminal. The connectors shall be constructed of copper and shall be tin plated. The interior surface of the connector wire barrel shall be serrated, and the exterior surface of the connector wire barrel shall be furnished with crimp guides.

7.6.6.4 Uninsulated terminal connectors shall be used for conductors terminated on devices equipped with individual fitted covers, such as General Electric Type SB-1 control switches.

7.6.6.5 Preinsulated ring type terminal connectors shall be used on all current and potential transformer circuits. All other terminal connectors for conductors smaller than 8 AWG shall be preinsulated ring type.

7.6.6.6 Preinsulated terminal connectors shall include a vinyl sleeve, color coded to indicate conductor size.

7.6.6.7 Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary device shall be permanently labeled to coincide with the identification indicated on the drawings.

7.6.6.8 All cables shall be marked with the designated cable or run number and the destination (device at the opposite end of the cable). The marker shall be white, slip-on generated by a commercially available wire label maker; Brady, Panduit, etc. For example:

7.6.6.8.1 12AAPH (cable run number)

7.6.6.8.2 TO JUNCTION BOX 1BMTB03 (destination)

7.6.6.9 Individual conductors of multiconductor cables shall be marked with the designated functional wire name. Marking methods shall be the same as above. For example:

7.6.6.9.1 1AQ-PT004+(functional wire name)

7.6.6.10 Where wiring passes thru terminal blocks that can be labeled (such as GE EB-25 style blocks), new wire names shall be neatly written or printed and affixed to the blocks.

7.6.6.11 Conductor identification shall be permanent, unaffected by age, heat, solvents, or steam, and not easily dislodged. Adhesive labels are not acceptable.

7.7 Communications Infrastructure

7.7.1 This Section defines Contractor's requirements and work scope with respect to in-Project communications and IT infrastructure.

7.7.2 Contractor shall provide communication and network equipment to connect the Project to Owner's offsite control and monitoring facilities

7.7.3 Contractor shall be responsible for arranging and coordinating temporary telephone and data networking service from offsite providers during construction. Contractor shall arrange and coordinate permanent data connections from offsite providers and assign to Owner. Contractor shall coordinate with Owner on the appropriate timing and use of these services.

7.7.4 Communications wiring must meet following standards

7.7.4.1 Fiber runs shall meet NEC article 770 specifications and be rated for indoor or outdoor use.

7.7.4.2 Fiber shall be outdoor rated 24 or 48 single mode fiber with SC termination.

7.7.4.3 Single mode fiber from the substation control house to the inverters shall be provided with a Loop ring connection from substation fiber switch to each skid.

7.8 Project Electrical Studies

7.8.1 Contractor shall perform the following electrical studies and analysis to demonstrate the adequacy of the Project design:

7.8.1.1 Short Circuit Study: short circuit analysis of collection system circuits, Substation, and transmission interconnection line, including secondary values on inverters. The short circuit analysis and study shall be utilized in Contractor's electrical designs to support relay coordination study and equipment specification.

7.8.1.2 Reactive Compensation Study: reactive power flow report, including power factor study at Point of Interconnection. The study shall identify reactive compensation required to meet the GIA.

7.8.1.3 Substation Grounding Report: grounding system study of ground grid conductors and interconnection (if any) with the ground grid. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80. Contractor shall test and document final ground grid values.

7.8.1.4 Arc Flash Study: arc flash hazard analysis of the Equipment, including all energized equipment in the collection system circuits and Substation. This analysis shall be performed in accordance with the applicable version of NFPA-70E and IEEE 1584. The study shall be performed for two cases, with and without the substation protective relays in maintenance mode. As-Built arc flash software model files shall be provided to Owner upon project completion.

7.8.1.5 Protection Coordination Study: relay and protection equipment coordination study, including detailed calculations, one-line and three-line diagrams, fuse curves, coordination curves, protected equipment data, and relay set points. Cable ampacity calculation shall be based on the 75% load factor on DC cables and 100% load factor on all LV and MV cables. Soil and ambient temperatures shall be from ASHRAE. Burial depth shall comply with NESC.

7.8.1.6 Load Flow Study: Load Flow, Voltage Drop, Reactive Power and System Loss Study in accordance with IEEE 399.

7.8.1.7 Harmonics Study: Harmonics Study Analysis shall be performed in accordance with the requirements and procedures provided in IEEE 399.

7.8.1.8 Grounding & Step/Touch Potential study

7.8.1.9 Overvoltage analysis

7.8.1.10 Insulation coordination

7.8.1.11 Ferroresonance Analysis (if required)

7.8.1.12 Other studies as required by the GIA.

8.0 PERMITS

8.1 Contractor Permits

8.1.1 Contractor shall obtain and adhere to all Contractor Permits required by Applicable Laws and in accordance with the requirements provided in Exhibit A Attachment 7.

8.2 Owner Permits

8.2.1 Contractor shall adhere to all Owner Permits required by Applicable Laws and in accordance with the requirements provided in Exhibit A Attachment 7.

9.0 PROJECT SPECIFIC CONSTRUCTION SITE REQUIREMENTS

9.1 General Requirements

9.1.1 Contractor shall adhere to all construction hours as specified by the permit conditions and community regulations.

9.2 Site Management

9.2.1 Contractor shall manage the site, including all personnel, material, and activities throughout the construction phase until turnover to Owner. Contractor shall maintain the site and all site activities in compliance with all applicable permits and laws, site safety requirements, and in accordance with typical industry standards for a utility grade construction site.

9.3 Construction Power

9.3.1 Contractor shall be responsible for providing construction power to site, as well as distribution infrastructure onsite for construction power

9.4 Construction Support Facilities

9.4.1 Contractor shall provide all necessary temporary facilities, inclusive of include portable toilets and hand wash stations, at the site to support its staff and labor force and the delivery, unloading and storage of equipment and materials.

9.4.2 Contractor shall provide one (1) 50’ x 12’ furnished office trailer for to support four (4) Owner on-site staff. Inclusive of power, HVAC and internet and drinking water. Owner shall share parking and portable toilet facilities as provided in 11.2.1.1.

9.4.3 Any temporary trailers and storage facilities shall meet any state, federal, or local requirements

9.5 Construction Security

9.5.1 Contractor shall, at their discretion and responsibility, provide reasonable site security during construction and commissioning.

10.0 ENVIRONMENTAL

10.1 Environmental Control Program

10.1.1 Contractor shall develop and maintain an environmental control program to assure that all construction and start-up activities associated with the Project conform to best environmental practices, federal, state and local regulations, Applicable Permits, and any other construction constraints identified in the Project’s environmental permitting process. The program shall include an Environmental Plan and all other relevant program documents (i.e., permit matrices, storm water pollution prevention plan, spill prevention, control and countermeasure plan, copies of permits, etc.). The Environmental Plan will provide all relevant references for the project’s environmental management.

10.1.2 The environmental control program shall include the processes that will be followed in order to comply with Applicable Laws and Applicable Permits. The plan shall include, at a minimum, the following:

10.1.2.1 List of responsible parties with contact numbers

10.1.2.2 Map locating construction facilities and environmental control areas

10.1.2.3 Erosion and sedimentation control

10.1.2.4 Fuel and waste storage management

10.1.2.5 Chemical inventory tracking and management

10.1.2.6 Liquid, solid, universal and hazardous waste management

10.1.2.7 Basis of decision for waste characterization

10.1.2.8 Surface water pollution prevention

10.1.2.9 Construction debris control

10.1.2.10 Traffic control

10.1.2.11 Revegetation Plan

10.1.2.12 Construction facilities management

10.1.2.13 Personnel training

10.1.2.14 Program monitoring and documentation

10.1.2.15 Non-compliance reporting procedures

10.1.2.16 Oil Spill Response Plan

10.1.2.17 SPCC Plan

10.1.2.18 Emergency action procedures

10.1.2.19 The Environmental Plan document shall also include a matrix of permit compliance activities, due dates, responsible person and current status. Copies of Contractor's environmental permits applicable to the Project shall be included in the document

10.1.3 Contractor shall develop and provide to Owner the operational SPCC Plan.

11.0 TRAINING

11.1 General Requirements

11.1.1 This Section describes the Contractor's responsibilities in regards to personnel training.

11.1.2 Training session breakdown and organization will be established with Owner after award.

11.1.2.1 Contractor shall include seven (7) days of onsite training as their base proposal. Training sessions on-site shall be planned for eight (8) hours per day, not including a thirty (30) minute lunch period.

11.1.2.2 Contractor shall account for equipment vendor representation on site as required to support this seven (7) day training program and to provide a complete training program to allow for Owner's operations and maintenance staff to safely operation and maintain the complete Project.

11.1.2.3 Contractor shall provide rates for additional training days and shall accommodate additional training as requested by Owner.

11.1.3 Contractor shall develop, implement, and present a training program covering all aspects of the operation and maintenance of the Contractor's equipment. Contractor shall also

provide hands on training for the operators during equipment and system commissioning while providing site services during these activities. Training shall include any OEM specific training required to certify Owner staff in operations of equipment as required for maintaining equipment warranty.

11.1.4 Contractor shall use qualified trained personnel as instructors, fluent in both oral and written English. Personnel shall be employees of the Contractor's firm with a minimum of 5 years experience with the firm and equipment. Instructors shall have previous experience in classroom and field training. Contractor shall use qualified instructors from sub-suppliers when appropriate.

11.1.5 Contractor shall provide a listing of any special prerequisite training or knowledge level of the personnel attending the training program.

11.1.6 On-site training shall be provided in classroom format as well as via site orientation walkthroughs covering all aspects of operation and maintenance.

11.1.7 As a minimum the following training shall be provided:

11.1.7.1 On-Site classroom sessions for supervisory, operations and maintenance personnel in overview of equipment and general information pertinent to the operation and maintenance of the equipment

11.1.7.2 On-Site walk-through for supervisory, operations and maintenance personnel to provide overall familiarization with the location and function of all major components and systems

11.1.7.3 On-Site classroom and field sessions for specific groups of operations and maintenance personnel to cover group-specific aspects of the equipment.

11.1.7.4 Sessions shall cover the system processes, protection systems, local operations and operations from the Control House and SCADA systems.

11.1.8 Contractor shall provide the training facilities and equipment required to execute the training program. All material, training aides, and handouts shall be provided by Contractor.

11.1.9 Contractor shall provide each participant in the training session a training manual. The training manual shall include operation and maintenance information for all equipment in the Contractor's Work. A minimum of Three (3) hard copies of the Project O&M manual shall also be made available at each session for participant reference and to support the training activities.

11.1.10 Training manual content shall include but not be limited to:

11.1.10.1 Training Objectives

11.1.10.2 Equipment overview

11.1.10.3 Major component description

11.1.10.4 Controls: Instrumentation, controls, and interlocks

11.1.10.5 Principal of operation including operating parameters, start-up, normal operation, shutdown, infrequent operations modes, emergency procedures, and maintenance.

11.1.10.6 Support systems needed for operation

11.1.10.7 Visual aids of equipment and system design.

11.1.10.8 Hazards and safety features

11.1.10.9 Routine maintenance

11.1.10.10 System controls and operations

11.1.11 Contractor shall provide the electronic files to the Owner in the editable native format as well as a duplicate set of all training aids (i.e. actual equipment, equipment manuals, view graphs) for future training needs. Training sessions may be videotaped by the Owner for use in follow-up and new hire training.

11.2 Training Schedule

11.2.1 All or a part of the training shall be scheduled prior to initial startup as required to allow the operating personnel to participate in the startup of the systems.

11.2.2 Contractor shall provide a dry run of its training program two (2) weeks in advance of the scheduled date for starting the classroom training. This dry run shall cover all aspects of the training program in an abbreviated one-day format. Any outstanding concerns will be resolved and approval of the training program by the Owner or Owner's representative will be granted. The location of the dry run will be at the Owner's selected location.

11.2.3 The following items shall be submitted to the Owner 8 weeks prior to the scheduled classroom training and shall comply with the pertinent provisions of Exhibit A - Attachment 10:

11.2.3.1 Training course outline

11.2.3.2 Training manual

11.2.3.3 Preliminary training schedule

11.2.3.4 List of training aids

11.2.3.5 Training facilities required

Contractor shall incorporate comments resulting from the Owner review of all training materials.

12.0 COMMISSIONING, START-UP, AND TESTING REQUIREMENTS.

12.1 General Requirements.

12.1.1 Contractor shall develop and execute an acceptance testing, commissioning, and Project startup plan for the Project Substation, as well as a performance testing plan. These plans together, shall comprise the Start-up & Commissioning (SU&C) Execution Plan and shall describe in detail all aspects of the SU&C program including how commissioning and testing activities shall be incorporated into the design, procurement and construction of the Work.

12.1.2 Contractor shall be responsible to coordinate requirements activities with local transmission company including coordinating Lock Out, Tag Out procedures for personnel safety, schedule, initial energization procedure, testing, and checkout.

12.1.3 Electrical and SCADA commissioning shall include testing validating range of operation to meet Transmission MIA requirements, MISO DIR requirements (as applicable), and NERC testing requirements. Commissioning documentation will meet requirements for reporting on applicable NERC standards.

13.0 PROCUREMENT, MATERIAL MANAGEMENT, AND SPARE PARTS

13.1 Specifications

13.1.1 Contractor shall prepare equipment specifications for procurement of equipment for the Project. Contractor shall purchase all equipment and materials, consumables, and services to complete the Project with the exception of Owner provided equipment and services as specifically defined herein.

13.1.2 Where specific requirements for equipment are included herein, Contractor shall ensure that these requirements are included in their specifications and are complied with by the selected manufacturer. Contractor shall be responsible for proposing resolutions to any exceptions taken by manufacturers to the requirements outlined herein and obtaining the Owner's concurrence with these resolutions prior to accepting the exceptions and purchasing.

13.2 New Material

13.2.1 Contractor's equipment and material supplied shall be new and unused, proven effective and reliable for its application, and designed for industrial service typical of power plant environments (Prudent Utility Practices). Used equipment or material is unacceptable. The use of recycled material combined with virgin material in the production of a new product is allowed.

13.3 Selection of Equipment Suppliers

13.3.1 Contractor shall procure equipment in accordance with the requirements of the Agreement from reputable suppliers who normally produce the type of equipment specified for use in heavy industrial applications.

13.3.2 Where specific requirements for equipment are included herein, Contractor shall ensure that these requirements are included in Contractor's specifications and complied with by the selected manufacturer. Contractor shall be responsible for proposing resolutions to any exceptions taken by suppliers to the requirements outlined herein.

13.3.3 For other equipment, manufacturers and model numbers listed in this Contract are representative only of the quality of equipment proposed. Manufacturers and model numbers of equal quality may be substituted for those listed in this Contract.

13.4 Vendor Inspections

13.4.1 The Owner reserves the right to participate or cause Owner's representative to participate in scheduled vendor inspections of any equipment. Contractor shall submit to the Owner a listing of their planned inspections for the equipment to be supplied.

13.5 Material Management

13.5.1 This section provides packaging and shipping requirements for all materials to be delivered to the Site.

13.5.2 A top priority of the Project is safety. All parties must strive to ensure safe handling and transport of shipments and to avoid any action that could jeopardize safety of workers or result in damage to property. It is Owner's goal to complete the Project with zero accidents and incidents.

13.5.3 Contractor shall be responsible for controlling and ensuring timely delivery of all shipments. Contractor shall be responsible for traffic and logistics. Contractor shall implement procedures and specifications to adequately control and ensure delivery of all materials and products, including requirements for export/import documentation package, package/container identification, packing, and preservation.

13.5.4 In general, equipment and materials will be delivered to the site by truck. Contractor shall coordinate and provide adequate on site access roads and any necessary improvements to the entrance road.

13.5.5 Truck deliveries and traffic shall comply with permit requirements.

13.5.6 Contractor shall coordinate and perform the ordering, delivery, receipt, unloading, storage, care and custody, and management of all Contractor supplied tools, equipment, components, and material necessary for the performance of the Work.

13.5.7 Contractor shall coordinate and perform the receipt, unloading, storage, care and custody, and management of all Owner supplied materials, inclusive of previously procured and stored materials and Owner direct delivered materials necessary for the performance of the Work.

13.5.8 All hazardous materials must be packed and marked in accordance with all applicable local, state, national and international Codes.

13.5.9 A Safety Data Sheet (SDS) for all substances shipped to the Site that require an SDS in accordance with OSHA regulations shall be included with the shipment. For shipments of any dangerous, toxic, or hazardous materials, an SDS shall be furnished to the Site prior to shipment.

13.5.10 Lay down and storage areas shall be furnished as determined by the Contractor to support their work. Contractor shall furnish and install permanent storage facilities as defined under Article 3.1.3.

13.5.11 Removal and disposal of all waste material from Contractor and Owner provided materials, tools, equipment, etc. Contractor shall minimize landfill waste by recycling materials where possible.

13.5.12 Contractor shall be responsible for damage, loss, theft, casualty, shortages, shrinkage, and non-conformance of materials and equipment.

13.6 Spare Parts and Special Tools

13.6.1 Contractor shall provide, with their proposal and as a final deliverable, lists of spare parts for both start-up and commissioning and for ongoing operations and maintenance activities. that will be sourced and should be maintained by Owner for the preventive and corrective maintenance and reliable operation of all equipment within the Project.

13.6.2 Contractor shall provide Owner with a spare parts list that contains the following information:

13.6.2.1 Equipment name and tag number(s)

13.6.2.2 Part name, part number, and assembly drawing number

13.6.2.3 OEM's name, OEM part number, and assembly drawing number

13.6.2.4 O&M manual title and reference number as applicable

13.6.2.5 Quantity to be in inventory

13.6.2.6 Lead time for delivery

13.6.2.7 Storage requirements

13.6.3 Contractor shall price the supply and storage of all recommended commissioning spare parts, in accordance with manufacturer's recommendations, with their base bid.

13.6.4 Contractor shall include in their proposal a listing of all special tools required to maintain or service the equipment.

13.6.5 Contractor shall provide two sets of all special tools required to maintain the equipment. One set may be used by the Contractor; the other(s) shall remain new and provided for maintenance use only. Contractor shall indicate in their special tools list if any of the special tools will not be supplied with the equipment in the original purchase.

13.6.6 All special tools shall be given to the Owner at system turnover in serviceable condition. If a piece of equipment has more than five special tools, they shall be given to the Owner in containers or gang boxes that are labeled with the name of the equipment.

13.6.6.1 Contractor shall provide Owner with its planned schedule of preventive maintenance and frequency of spare parts replacement to allow the review of the operating spare parts list.

13.6.6.2 The Contractor shall coordinate with the Owner for the designation of spare parts storage space in the Contractor supplied Operations and Maintenance Building.

14.0 QUALITY PROGRAM

14.1 General

14.1.1 Contractor shall provide and implement a descriptive plan defining methods for providing quality assurance and quality control services for the Work. The plan shall require documentation adequate to assure the items or services provided meet all Contract and code requirements. Contractor shall resolve any comments to the Owner's satisfaction.

14.1.2 The Contractor's plan shall describe the methodology by which they will manage quality of the products/components they will supply and/or install for the project. This quality plan shall include both the "controls" to achieve the quality defined in the design specification and the "assurance" that those quality levels were met.

14.2 Quality Plan

14.2.1 Contractor shall define and implement a descriptive plan defining methods for providing quality assurance and quality control services for the following and other activities specified elsewhere in the Contract Documents. The type and quantity of data provided shall take into consideration the nature and complexity of the items or services to be supplied. Data shall cover the following as applicable:

14.2.2 The type and quantity of data provided shall take into consideration the nature and complexity of the items and services to be supplied. Quality documents, such as those listed below, shall either be included in the Quality Plan to be submitted or shall be made available upon Owner-request:

14.2.2.1 Quality control program

14.2.2.2 Organization

14.2.2.3 Design and design documentation control

14.2.2.4 Procurement document control

14.2.2.5 Identification and control of purchased material, equipment and services

14.2.2.6 Material certifications

14.2.2.7 Inspection and testing, including Code mandated Special Inspections:

14.2.2.7.1 Inspection check sheets and nondestructive examination records

14.2.2.7.2 Inspection and Testing Instructions, detailed step-by-step procedures, acceptance criteria and any supplementary drawings or sketches to support activities

14.2.2.8 Control of special processes

14.2.2.9 Manufacturer's data reports (Form-U)

14.2.2.10 Control of measuring and test equipment

14.2.2.11 Handling, storage and shipping

14.2.2.12 Nonconformance items

14.2.2.13 Corrective action

14.2.2.14 Quality assurance records

14.3 Inspection and Test Plan

14.3.1 The Contractor shall submit with their proposal a preliminary inspection and test plan (ITP) for Owner review/approval prior to and as to be followed in furnishing the Work. The ITP shall define points for inspections, witnessing of tests, and final acceptance testing. The ITP of the Contractor is subject to modification as determined by the Owner for implementation of an acceptable inspection and test program. The Owner reserves the right to witness inspections and tests as deemed necessary.

14.3.2 All testing reports shall be provided to Owner.

14.3.3 Factory acceptance testing shall be performed on all major equipment and as specified for other materials and components.

14.4 Regulatory Requirements

14.4.1 Contractor shall comply with all Codes, Laws, & Rules of Federal, State & Local jurisdictions.

14.5 Quality Assurance

14.5.1 Contractor shall have in place quality forms and checklists and shall submit samples of said forms and checklists applicable to Contractor's scope of Work.

14.5.2 The Contractor shall be responsible for the following at a minimum:

14.5.2.1 Obtaining producer test reports, analyses, and certificates of compliance.

14.5.2.2 Providing documentation on appropriate forms of the results from all inspections and tests required under the specification.

14.5.2.3 Providing adequate notice, fully coordinating, and demonstrating that all required tests and inspections are performed.

14.5.2.4 Auditing implementation of the quality program procedures

14.6 Quality Control

14.6.1 Contractor and its approved lower tier Subcontractors shall have in effect a Quality Control Program approved by the Owner or Owner's representative.

14.6.2 Contractor shall designate a Quality Control Manager to manage Contractor's Quality Control Program.

14.6.3 Contractor shall be responsible for the performance of all inspection and testing activities as set forth in, and as required to demonstrate compliance with, the drawings, specifications, referenced standards, applicable codes and industry practices.

14.6.4 Contractor shall provide competent inspection for work on site and off site.

14.6.5 Contractor shall perform required inspections and tests to determine and verify that quality of work and materials conform to specified requirements.

14.6.6 Contractor shall inform the Owner of the Work's progress and shall notify the Owner in a timely manner of the scheduled inspections and testing that will take place.

14.6.7 Special Inspections

14.7 Verification

14.7.1 The Owner shall have access to the work to perform assessments, quality audits, or witness test activities during all site work and to review applicable records. Owner may designate an authorized agent to perform these activities. The authorized agent may be an employee of the Owner or an outside agency.

14.8 Non-Compliance

14.8.1 Upon identification of non-compliance with the requirements of the Contract, the Contractor shall document the non-compliance issue. For non-compliance issues where the nonconforming characteristic can be restored to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirement, the Contractor shall submit the non-compliance to the Owner for approval.

End