KYMEA RFP NO. 2023-3 ATTACHMENT 2 – EPC SCOPE OF SUPPLY

ENGINEERING, PROCUREMENT, CONSTRUCTION, AND COMMISSIONING SERVICES FOR

EIGHT (8) WARTSILA 20V34SG RECIPROCATING INTERNAL COMBUSTION ENGINES, GENERATOR SETS, ASSOCIATED AUXILIARY EQUIPMENT, AND RELATED MATERIALS TO BE INSTALLED AT A KYMEA SITE IN MADISONVILLE, KY DESIGNED TO ACCOMMODATE UP TO FOUR (4) ADDITIONAL WARTSILA 20V34SG RECIPROCATING INTERNAL COMBUSTION ENGINES

TABLE OF CONTENTS

1.0 GENERAL

The Kentucky Municipal Energy Agency ("KYMEA" or "Owner"), formed pursuant to Sections 65.210 to 65.300 of the Kentucky Revised Statutes, as amended, known as the "Interlocal Cooperation Act" ("the Act"), seeks written proposals from qualified firms ("Proposers" or "EPC Contractor") to provide engineering, procurement, and construction services for the engineering, procurement, construction, and commissioning of eight (8) Wartsila 20V34SG reciprocating internal combustion engines, generator sets, associated auxiliary equipment, and related materials to be installed at a KYMEA site in Madisonville, Kentucky designed to accommodate up to four (4) additional Wartsila 20V34SG reciprocating internal combustion engines ("Project")[1]. Additional information related to the Project, the proposed site, and other relevant information is included in KYMEA RFP No. 2023-3.

The EPC contractor will engineer, supply, install, and test the balance of plant equipment, systems, and control systems necessary for the facility to be a complete and functioning plant. In addition, the EPC contractor will provide the civil work, foundations, structures, piping, mechanical connections, electrical connections, and tanks for the entire facility and will install the Wartsila 20V34SG reciprocating internal combustion engines (under the direction of manufacturer), install the auxiliary equipment provided by KYMEA and manufacturers, as well as support KYMEA and manufacturers during commissioning, startup, and testing of the Project. The new reciprocating internal combustion engines facility is anticipated to begin commercial operations no later than the spring of 2027.

2.0 General Information

2.1. Operating Conditions

2.1.1. Each engine generator set shall be fired on natural gas only. The total net output of the Project with all engines operating at 100 percent capacity shall be at least 74MW at summer design conditions which are defined in the following Section.

2.1.2. The Project shall be designed for continuous service at 100 percent rated output and shall be capable of operating at all times of the day and night and at all times of the year.

2.1.3. It is anticipated that the plant will be operated as a peaking plant with a minimum of 2 starts and stops per day, 7 days per week along with baseload capability. However, EPC Contractor provided systems and equipment shall be designed and shall be capable of supporting more than 2 starts and stops per day, 7 days per week.

2.1.4. The maximum time required for hot starts for each engine generator to full load and compliance with air emissions shall be 2 minutes. EPC

[1] The site is located in Madisonville, KY outside of a populated area, with approximate coordinates of 37.320029, -87.550774

Contractor provided equipment and systems shall be supplied to support this requirement.

2.1.5. The Project shall have load change capability (ramp rate) of from minimum load to maximum load of 25%/min. EPC provided equipment and systems shall be supplied to support this requirement.

2.1.6 Each engine generator set, support skids, and balance of plant equipment and systems shall be able to operate at an anticipated minimum electrical load of 40 percent of its maximum electrical rated output capacity while operating for an extended period of time and while meeting air permit emission requirements.

2.1.6. The engine generator sets will be installed indoors.

2.1.7. The Project shall have a design operating life of 30 years and shall be capable of normal operation when connected to a public power transmission grid and isochronous operation when in island mode or connected to a small grid.

2.1.8. Black Start/emergency diesel generator, diesel storage tank, and enclosure.

2.2. Engine Dual Fuel Option

2.2.1. EPC contractor will be responsible for design, engineering and procurement of any and all systems not provided by the engine OEM should the Owner decide to utilize dual fuel (NG/Diesel) engines.

3.0 PROJECT SITE SPECIFICATIONS

3.1. General

3.1.1. EPC provided systems, equipment, and components shall be designed for and capable of operating at 100 percent rated electrical output at the Project Site conditions provided in Table 1.

3.1.2. EPC contractor shall use design temperatures for normal operation; however, equipment, components, systems, and instruments shall be capable of continuous operation at 100 percent load at the maximum and minimum ambient temperatures. Heat tracing and insulation shall be required for all outdoor exposed (non-insulated) piping and instrument lines with the exception of the engine main cooling lines.

Table 1
Project Design Conditions (*Anticipated*)

Design Ambient Conditions [2]	
Altitude	
Altitude above mean sea level (ft)	430
Temperature	
Summer design dry bulb temperature (°F)	97
Summer design wet bulb temperature (°F)	83
Maximum ambient dry bulb temperature (°F)	110
Winter design dry bulb temperature (°F)	20
Winter design wet bulb temperature (°F)	0
Minimum ambient dry bulb temperature (°F)	-20

4.0 CONTRACT SUBMITTALS

4.1. General

4.1.1. EPC Contractor shall supply all applicable drawings and documents to the Owner as part of the Scope of Work. Required drawings and other documents are listed in the Division of Responsibilities and are described elsewhere in this document.

4.1.2. The EPC Contractor shall also provide electronic document storage and transfer system that notifies and allows access to EPC Contractor documents by the Owner, Owner's engineer, and engine generator supplier.

4.2. Transmittals

4.2.1. All drawings and documents shall be transmitted to the Owner accompanied by a transmittal letter or email which shall include the Contract Document number, submittal number, list of data being transmitted and status of the submittal. Revision numbers for each item shall be included on each transmittal. The sequence of submission of all drawings and documents shall be such that all information is available for reviewing each drawing and document as it is received.

4.3. Format

4.3.1. All drawings and documents submitted shall be numbered, titled, dated and contain the Project identification.

4.3.2. Drawings shall generally follow the practices of ANSI Standards for drawing preparation. All drawings, data, instruction books, manuals, etc. shall be in the English Language and all dimensions and units shall be English units. Correspondences shall be written in the English Language.

4.3.3. EPC Contractor shall submit (3) full size prints (24”x36”), and (1) electronic file on CD of all final, certified and as-built drawings at the conclusion of the Contract. This submittal shall include a master drawing list showing all of the EPC Contractor supplied drawings, documents, equipment and associated items for the entire Project. Note that all EPC Contractor prepared final drawings, which are used to support acquisition of permits, shall bear the seal of a registered professional engineer licensed in the State of Kentucky.

4.3.4. In addition, all drawings shall include a title block to identify the manufacturer, drawing number, revision, date and the equipment including the address of the manufacturer.

4.3.5. Documents shall be available in the latest versions of Adobe Acrobat format or word processing (Microsoft Word), spreadsheet (Microsoft Excel) or database format (Microsoft Access).

4.3.6. All drawings and associated documents submitted shall be fully completed, checked, signed and certified to be correct by the EPC Contractor. Calculations and construction drawings shall be PE stamped by a professional engineer licensed in the state of Kentucky as required by the laws of the State of Kentucky.

4.3.7. All drawings and associated documents shall be scanned or printed into an Adobe Acrobat file format.

4.4. Reproduction of Shop Drawings

4.4.1. The Owner shall have the right to reproduce any original drawing or print received from the EPC Contractor, as may be necessary in connection with the design, construction, operation and maintenance of this Project.

4.5. Owner Review Period

4.5.1. EPC Contractor shall make submittals to the Owner in accordance with the approved Detailed Construction Schedule. Submittals shall be made no later than (30) calendar days prior to release for fabrication. The Owner’s review time for all submittals shall be (10) working days. Time interval shall start upon receipt of hard copy from EPC Contractor.

4.5.2. The Owner will notify the EPC Contractor by email each time the Owner has completed review of the documents and has posted the results of the review. Delays in receipt of submittals from the EPC Contractor shall not reduce Owner’s review period, and shall not be an acceptable basis for extension of any kind from the Schedule or Contract Completion Dates.

4.5.3. Review by the Authorized Representative shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the EPC Contractor from full responsibility for errors or omissions including proper design, performance, installation and safety of the equipment and ancillaries.

4.6. Drawings and Data Status

4.6.1. Drawings reviewed by the Owner shall be returned to the EPC Contractor marked:

a. ACCEPTED

b. ACCEPTED AS REVISED

c. REVISE and RESUBMIT

4.6.2. Drawings submitted by the EPC Contractor as INFORMATION ONLY submittals shall not be returned by the Owner. When drawings are returned and marked ACCEPTED AS REVISED or REVISE AND RESUBMIT, the changes noted thereon shall be made and the drawing resubmitted for review in a timely manner under the same procedures described previously. If the EPC Contractor elects not to incorporate the changes indicated, the Owner shall be informed immediately.

4.6.3. Changes to previously reviewed EPC Contractor drawings shall be submitted to the Owner for re-review. A brief explanation of the changes with justification shall be included. Any expenses resulting from redesign or reconstruction work, etc., as a result of EPC Contractor-

initiated changes to Owner-reviewed EPC Contractor drawings shall be at the EPC Contractor's expense.

4.6.4. EPC Contractor shall make revisions required by the Owner or the Owner's authorized representative. If the EPC Contractor considers a revision to be a cost or warranty related change the Owner shall be notified in accordance with the requirements listed in the Contract documents.

4.6.5. The EPC Contractor is responsible for preparing "As-Built" issues of the drawings listed below. All drawings shall be issued to the Owner with an "As-Built" designation in accordance with the requirements of the Contract. The As-Built drawings shall be submitted to the Owner at the completion of the Work, with final as-built information incorporated.

a. Site plot plan and general arrangement drawings

b. Grading and drainage plans

c. P&ID's

d. Process flow drawings

e. Electrical schematics

f. All underground drawings

g. Structural drawings

h. All civil drawings

i. Piping ISO drawings for 4 inch and larger piping

j. Field fabricated drawings

k. 3-Dimensional model

4.7. Lists

4.7.1. EPC Contractor shall prepare all typical lists, including the following:

a. Valve List

b. Spare Parts

c. Special Tools Lists

d. Electrical Load List (Motors, Heaters, etc.)

e. Equipment List

f. Instrument List

g. Cable and Raceway Schedule

h. Pipe Classifications and Line List

i. Instrumentation, Control, and I/O List

j. Breaker List, including high, medium, and low voltage breakers

4.8. Spare Parts

4.8.1. The EPC Contractor shall provide the Owner a spare parts recommendation list for the equipment and systems provided by the EPC Contractor. The spare parts recommendation shall include all gaskets and other expendable items that may be required during the

preliminary operating period that includes commissioning and start-up. Each of the spare parts shall be fully identified by part number and drawing number.

4.8.2. A spare parts recommendation for operation and maintenance shall also be submitted which includes all the spare parts that the EPC Contractor recommends should be stocked at the site to enable prompt repair due to any failure for one year after commercial operation that can reasonably be expected, taking into account the length of time required to obtain replacement parts.

5.0 PERMITTING AND NOISE

5.1 Permitting

5.1.1 The EPC Contractor shall be responsible for determining and obtaining: 1) all permits required for the design and construction of the Project (except those permits that would be the responsibility of the engine generator supplier, or Owner provided permits); 2) approvals necessary for design and construction for EPC Contractor's scope of work; and 3) notifications related to the Project for EPC Contractor's scope of work. EPC Contractor shall be responsible for all temporary and/or construction permits and approvals and for compliance with construction provisions of all construction permits. Additionally, EPC

Contractor shall obtain all permitting necessary to obtain sufficient water supply to facilitate operation of this power plant at full load and required permits for the sanitary waste and potable water systems.

5.1.2 The EPC Contractor shall provide information regarding site layout, off-site discharges, construction methods, and other significant items as requested by regulatory agencies and the Owner in support of the above-mentioned permits.

5.1.3 The facility shall be designed and constructed to comply with all applicable noise regulations, and with the OSHA regulation for worker noise exposure. In addition, the work areas within the Project, including the equipment, control room, and office spaces, shall be designed and constructed to provide for a suitable working environment.

5.2 Noise

5.2.1 Far Field Noise:

5.2.2 The EPC Contractor shall provide a test protocol for Owner's review and shall conduct a far field noise survey at the Project Site boundary and at the nearest receptor during the day and evening prior to starting construction activities at the Project site. The far field noise requirement with the Project operating at 100 percent of total capacity measured at the nearest receptor shall not exceed 3 dBA above the background levels measured prior to starting construction.

5.2.3 After the facility is in operation, EPC Contractor shall perform an additional noise survey with the plant at 100 percent of maximum load to determine the actual acoustical behavior of the facility under normal operating conditions at the nearest receptor.

5.2.4 The EPC Contractor shall be responsible for noise abatement of equipment and facilities and elements of construction within the EPC's scope for noise abatement purposes. The noise levels must conform to the Occupational Safety & Health Act and State of Kentucky regulations.

5.2.5 The EPC Contractor must demonstrate that all installed equipment within his scope complies with the established property-line noise criteria. The EPC Contractor shall coordinate his noise testing with all other site contractors, subcontractors and the Owner.

5.2.6 EPC Contractor shall provide any and all acoustic treatment that is required to bring the noise level of the equipment in his scope within the specified levels.

5.2.7 Near Field Noise:

5.2.8 For equipment areas, the near field noise level shall not exceed 85 dBA at 3 feet from equipment when measured under normal range of operating conditions.

6.0 PERFORMANCE REQUIREMENTS

6.1. The Project's anticipated performance requirements shall be as shown in Table 2, and shall be confirmed with Wartsila as necessary.

Table 2 Project Performance Requirements

Minimum Net Electrical Output (MW) at a net power factor of 0.95 leading to 0.95 lagging (summer design conditions)	74
Maximum Heat Rate for each Engine Generator Set (Btu/kWh) HHV (summer design conditions) at 100% electrical load	8,354
Maximum Heat Rate for each Engine Generator Set (Btu/kWh) LHV (summer design conditions) at 100% electrical load	7,536
Minimum each Engine Generator Set Availability (%)	95 (performance test requirement for 120 hours)
Near Field Noise - Maximum Equipment Noise Limits for equipment measured at 3 feet from equipment (dBA)	85
Far Field Noise– the Maximum Far Field Noise Limits measured at the site boundary (dBA)	Less than 3 dBA above Background
Minimum Electrical Turndown for each Engine Generator Set while meeting air permit emissions	40% of Max Electrical Output
Warm Start Duration to full load and emission compliance (minutes) for each engine	2 Minutes
Oxidation catalyst inlet temperature range (°F)	450 to 1350

7.0 OWNER SUPPLIED ITEMS

Owner furnished items will include those items shown as Owner and Engine Supplier responsibilities as listed in the Division of Responsibilities (DOR) Section of this document. The Owner and engine supplier responsibilities are shown separately for clarity as to the actual responsibility.

Engine supplier will provide mate-up flanges for all supplied equipment. Flanges will be in metric sizes but will be able to mate up to U.S. pipe sizes.

Initial and final drawings provided by engine supplier may be in English and Metric units.

8.0 EPC CONTRACTOR SUPPLIED ITEMS

8.1. General

8.1.1. See Attachment 1 of KYMEA RFP No. 2023-3 (the "Division of Responsibilities"). EPC Contractor furnished items shall include those items shown as EPC Contractor responsibilities. Please note that the DOR is intended to show responsibilities for major items and tasks and is not a comprehensive list of all items and tasks to be provided.

8.1.2. The EPC Contractor shall supply the complete design, engineering, procurement, installation, construction, start-up, and commissioning of the balance of plant systems and equipment for the commercial operation of the Project.

8.1.3. The Project design and construction shall comply with all current local, state, and federal regulations, codes, and applicable standards.

a. The Project fire protection system shall also comply with Owner's insurance company requirements.

8.1.4. All equipment supplied shall be designed to ensure satisfactory operation under the specified ambient temperature conditions and other atmospheric and environmental conditions prevailing at the site.

8.1.5. All equipment, components, and materials shall be new and shall not be first-of-a-kind.

8.1.6. Unless otherwise specified, the EPC Contractor shall be responsible for insulating and heat tracing all piping and exhaust duct including piping and equipment supplied by Owner where necessary.

8.1.7. The EPC Contractor shall verify all information provided by Owner, Owner's contractors, and the engine generator supplier prior to incorporating the information into EPC Contractor's design.

8.1.8. The EPC Contractor shall supply any required information as it applies to the EPC Contractor's scope of supply to interconnect the Project to the transmission grid, not otherwise specific to the engine generator design.

8.2. Structures, and Systems

8.2.1. The DOR provides details regarding the scope for the EPC Contractor and the attached site layout drawing (provided in Appendix A) shows the EPC Contractor's scope for buildings and structures. In general, the EPC Contractor's scope includes providing the following:

a. Water Treatment Building and raw water polishing system designed for the use of leased polishing bottles, including transfer and storage system.

b. Maintenance/Warehouse Building

c. Administration Building

d. Engine halls & Control Room(s)

e. Stormwater control and discharge

f. Raw Water System

g. Service water system

h. Fire water system, pumps, and fire water pump building

i. Compressed air system for service air and instrument air and air compressor building

j. Security System and key card system installation at the Project access road entrance

k. Black Start/emergency diesel generator, diesel storage tank, and enclosure

l. Parking areas, perimeter fencing, curbing, gravel, and all landscaping for the finished Project site

m. Process wastewater system

n. Natural gas supply system from Owner supplied gas line. Coalescing filter with knock out tank and isolation valves on the inlet and outlet. Gas pipe installation from Owner provided connection to the Project equipment.

o. Raw water wells and raw water supply system for supplying makeup water for potable, service, fire, and deionized water systems. Includes a single raw-water/fire-protection- water storage tank

p. Potable water system

q. Ammonia off-loading, transfer, storage system, and supply system

r. Fresh oil transfer and storage system

s. Service oil transfer and storage system

t. Used oil transfer, storage, and off- loading system

u. Maintenance water transfer and storage system

v. HVAC systems for all buildings.

w. Fire protection system as required to meet NFPA, Owner's insurance company requirements, and local government requirements, including electric motor and diesel- driven pumps.

x. All piping, valves, pumps, instruments, conduit and electrical conductors, and instrumentation to completely connect and operate all systems.

y. New Lubricating oil storage, unloading, and forwarding system sized to allow at least one month of operation with on-site storage.

z. Exhaust Stack including platforms and EPA testing ports and installing engine supplier provided exhaust duct and emission control equipment and monitoring systems

aa. Plant monitoring and control system, including connection to engine generator monitoring and control system

bb. Generator step-up transformers

cc. Station electrical service system

dd. DC system

ee. UPS system

ii. Plant grounding system

jj. Plant cathodic protection system

kk. Containment for all oil and diesel fuel storage and loading and unloading areas.

8.2.2. The EPC Contractor's scope includes but not limited to providing foundations, piping valves, instruments, wiring, conduit, cable tray, duct bank, supports, ladders, stairs, platforms, railings and installing and mechanically and electrically connecting the following items provided by the engine generator supplier:

a. Engine generators and associated equipment

b. Auxiliary modules

c. Exhaust gas modules

d. Lubricating Oil system

e. Engine cooling system

f. Exhaust duct system

g. Emission control system including testing ports at the inlet to the control devices

h. Charge air system

i. Ammonia system

8.3. Electrical and Instrumentation & Controls Design and Engineering

8.3.1. The EPC Contractors shall provide engineering, procurement and installation of the high- voltage, medium-voltage, low-voltage power equipment and associated instrumentation and controls required to operate the RICE generators and meet the Project Performance requirements specified

8.3.2. The DOR outlines the necessary electrical engineering studies, but in general, the EPC Contractor must perform all of the evaluations necessary to properly rate electrical equipment according to prudent electrical practices, industry specification and codes, and building permit requirements.

8.3.3. The EPC Contractor's scope of electrical, instrumentation and controls includes:

a. 161kV Substation (i.e., including 13.8 kV/161kV generator step-up transformers)

b. 13.8 kV/480 V step-down transformers

c. 480 V switchgear, 480 V motor control centers, and lower voltage AC distribution equipment

d. Supply and connection of all electrical circuits, including within the Substation, between the Substation and Owner supplied 13.8 kV switchgear, RICE generators and associated equipment, etc.

e. Ground electrode, equipment grounding, and lightning protection systems

f. Emergency power systems, including DC and AC uninterruptible power equipment

g. Black start diesel generator and associated switchgear

h. Any fiber and other physical media network and associated equipment, that is otherwise not a part of the engine supplier's scope, for central control and monitoring of the Project

i. Installation of all necessary power, control, and instrumentation wiring, conduit, tray, and other components that is otherwise not a part of the engine supplier's scope

j. Lighting equipment and systems

k. Cathodic protection system

l. Communication interface to allow for remote dispatch of the Project.

m. Temporary construction power system

8.4. Engineering and Construction Services

8.4.1. Construction management which includes but is not limited to the following.

a. Preparation of the Site including grading, excavation, backfill, fencing, and preparation of laydown area(s)

b. Construction of the Project

c. Scheduling

d. Construction labor, supervision

e. Construction equipment

f. Safety and loss control program

g. Site security

h. Quality assurance program

i. Procurement and expediting

j. Receipt, off-loading and transportation to the site of rail-shipped equipment and materials provided by EPC Contractor

k. Off-load at Project Site, engine supplier's auxiliary equipment and install (engine supplier will off-load engines and generators at Project Site and move them to installation location).

l. Equipment and materials receiving, handling and secure storage.

m. Pre-operational checkout, testing, and startup support.

n. Construction closeout

o. Provide Project Site fire protection (during construction)

p. Storm water runoff and control during construction to meet construction permit requirements

q. Participation in coordination conferences and other meetings as the Owner may request.

r. Construction parking

s. Construction power hookups for the entire site

t. Telephone service during construction.

u. Broadband internet service

v. Construction water, fire protection water, and sanitary facilities.

w. Treatment and disposal of waste waters resulting from construction and startup and testing activities.

x. Disposal of solid waste generated from construction and startup and testing activities

y. Temporary installations, including two offices for Owner's staff and four offices for engine supplier staff for the duration of the construction.

z. Temporary sanitary facilities with at least one unit marked for women only. Maintenance of these units shall be exclusively by contractor.

aa. Startup, Testing, and Commissioning

i. The engine supplier shall have the overall responsibility for managing and conducting the engine commissioning, startup, performance, and emissions tests. The EPC contractor shall support the engine supplier with the commissioning, startup, and testing of the Project. However, the EPC Contractor shall have the responsibility to perform commissioning, startup, and testing of the equipment and systems provided by the EPC Contractor. The provisional performance tests (including engine- generator emission tests) and final performance guarantee tests will be the responsibility of the engine supplier. The EPC Contractor shall be responsible for conducting the following performance tests; the EPC Contractor auxiliary load performance guarantee test, black start generator emission guarantee (submission of generator supplier emissions certificate as required in Section 16.7 of this document will meet this requirement unless), firewater diesel pump emission guarantee, and near field and far field noise guarantees which will be conducted by the EPC Contractor. EPC Contractor shall provide site technical advisors (mechanical, electrical, and checkout/start up) during startup, testing and commissioning as necessary.

bb. Performance testing of EPC Contractor provided equipment and systems to ensure compliance with the requirements of the EPC contract.

cc. EPC Contractor shall provide up to 10 days of on-site training for Owner's personnel on systems and equipment within EPC Contractor's scope

dd. Provide manufacturer's emissions and equipment warranties

ee. Documentation and Submittals and maintaining an On-Site document center which shall be made available to the Owner and engine-generator supplier.

ff. Engineering documentation as listed on the Division of Responsibilities.

gg. EPC Contractor standard additional documentation

hh. Final Construction, Test, Inspections and Startup Reports that pertain to the EPC's scope of supply

ii. As Built, Operation and Maintenance (O&M), drawings and documents

8.4.2. Administration and Reporting

a. EPC Contractor's responsibilities shall include, but not be limited to the following Project management tasks:

i. Provide overall project schedule and two-week updates to the schedule. The Construction Schedule shall be developed using the critical path method. This shall be a level III schedule that presents significant meaningful detail.

ii. Issue to the Owner monthly progress reports for the complete Project describing in detail all significant matters relating to the work. Reports shall commence one (1) month after the Notice to Proceed Date, and continue until Final Completion.

iii. Participate in regular coordination meetings.

iv. Obtain Owner's prior written approval of the content of any announcements, publication, photograph, or other type of communication. This requirement for prior approval shall not apply to any communication between EPC Contractor, subcontractors and vendors required solely for, and necessary to, the performance of the work.

v. Provide and designate, in writing, suitably experienced and qualified permanent staff to manage the Project for its full duration, including:

1. A Project Manager who shall control the prosecution of the work and shall act as a single point of contact in all matters on behalf of the EPC Contractor;

2. A Construction Manager and staff to supervise and coordinate the work of the EPC Contractor, Owner's other contractors, EPC subcontractors, and EPC vendors.

3. An Environmental Coordinator who shall coordinate environmental activities that are the responsibility of the EPC Contractor.

4. A Safety Manager who is responsible for site safety during construction and startup and testing.

b. The EPC Contractor shall cooperate with the Owner's Authorized Representatives and Owner in the preliminary and final review of design documents, the completion of inspections, and the Performance Tests and other matters hereunder relating to the work.

c. The Owner and the EPC Contractor's Project Manager shall be authorized on behalf of such party to administer this Contract, agree upon procedures for coordinating the efforts of Owner and EPC Contractor, and, when appropriate, to furnish information to or receive information from the other party in matters concerning the Work.

9.0 QUALITY ASSURANCE

9.1. General

9.1.1. The EPC Contractor shall have a Quality Assurance (QA) Program that meets the requirements of ISO 9000 and is deemed acceptable by the Owner. Within 15 days after the Owner issues Notice to Proceed to the EPC Contractor, the EPC Contractor shall issue the Quality Assurance Program and QA Plan to the Owner for review. The Owner reserves the right to audit the EPC Contractor's QA program at any time during the Project.

9.2. Quality Plan

9.2.1. The EPC Contractor shall prepare a Quality Plan for the EPC Contractor's scope of work and submit to the Owner for acceptance.

9.2.2. Two copies of the final Quality Plan for the Contract shall be submitted to the Owner for review and comment.

9.2.3. All equipment and materials shall be handled and stored in accordance with the EPC Contractors Quality Plan.

9.2.4. The Quality Plan shall address design control, the procurement process, document control, welding, inspections, and testing.

9.2.5. The Quality Plan shall include the measures to be taken for receipt, control, storage, handling, and maintenance of Owner provided equipment and components, and EPC Contractor's equipment from receipt of the equipment and components up to commercial operation of the Project. This shall include:

a. Packing and Preparation for Shipment

i. All equipment and materials provided by EPC Contractor shall be suitably crated, boxed, or otherwise prepared for shipment to prevent damage during handling and shipping. It shall be the responsibility of the EPC Contractor to take all precautions required to reasonably ensure that all equipment and materials arrive in an undamaged and satisfactory working condition.

b. Receiving Inspection

i. As a minimum, the receiving inspection shall cover the following requirements for inspection of incoming equipment and materials including items supplied by Owner.

1. Shipping Damage Inspection
2. Item Inspection
3. Disposition of Received Items
4. Site Handling and Storage

c. Traceability and Storage of Materials and Equipment

i. EPC Contractor shall be responsible for storing all materials and

equipment, including Owner supplied equipment and materials at the Project Site in accordance with manufacturer's requirements. As a minimum, the following Owner supplied items shall be stored indoors:

1. Catalyst
2. Electrical switchgear
3. Batteries
4. Computers and servers

ii. EPC Contractor shall implement a material control system for tracking materials and equipment, including Owner supplied equipment and materials, from the time material and equipment arrive on the Project Site until installation of the material and equipment.

9.2.6. The Quality Plan shall provide a list of quality records that will be maintained during the execution of the Project and turned over to the Owner prior to or at Final Completion.

9.3. Welding

9.3.1. Welder Qualification and Welding Procedures

a. Welding procedures, welders, and welding operators shall be qualified in accordance with:

b. ASME B31.1 for Power Piping

c. ASME Section VIII for Unfired Pressure Vessels

d. AWS D9.1 for Carbon Steel Sheet Metals

e. AWS D1.1 for Structural Carbon Steels

f. All other welding shall be qualified to ASME Section IX. ASME Code Sections indicated refer to ASME Section IX for qualification rules. Records of the names of the welders who make each weld shall be maintained.

g. Documentation relative to the welder operator and procedure qualification shall be made available at a location where the work is being performed and shall be available for audit.

h. All welders shall be tested and qualified in accordance with the appropriate welding standard.

i. The test welds accepted by the testing authority in qualifying each welder shall be available for inspection by the Owner at any time prior to completion of the work. These shall represent the minimum standard of weld acceptable form each particular welder.

9.3.2. Production Welding

a. All welding on pipe work shall be performed only by qualified welders using qualified procedures. All valves and other components which could be damaged during the welding process, shall be removed or protected as appropriate. Each qualified welder on the job shall be issued with a distinct identification symbol. Paint shall be used to clearly mark on the pipe adjacent to each completed weld the symbol of the welder responsible and the date of the welding. These markings shall not be removed until the welds have

been inspected and accepted, and the permanent record has been updated accordingly. The permanent record shall be a set of drawings showing all pipe work. The size, type, location, welder identification, and date of welding of each welded joint shall be clearly recorded on the drawings. This record shall be maintained by the EPC Contractor and shall be available to the Owner at any time prior to the completion of the work. The permanent record shall be handed over to the Owner on completion of the work.

b. The EPC Contractor shall be responsible for maintaining weld quality consistent with the requirements of this specification and the referenced standards.

c. The Owner may request additional radiographic, liquid-dye penetrant, or magnetic particle examination of any production welds. The EPC Contractor shall arrange such inspections as appropriate. All costs associated with arranging such inspection of welds subsequently found to be defective shall be borne by the EPC Contractor.

d. All costs associated with the repair or replacement of welds shall be borne by the EPC Contractor.

9.3.3. Non-Destructive Testing

a. NDT inspection shall be carried out in accordance with the applicable design code and the special requirements detailed below.

b. All welds shall be visually inspected for surface defects by qualified inspectors.

c. The type of nondestructive examination required for each system shall be in accordance with the applicable code. Acceptance criteria shall be in accordance with the applicable code.

9.4. Subcontractor's Quality System

9.4.1. The EPC Contractor shall require that all its' subcontractors and suppliers have an ISO 9000 qualified QA program or require such subcontractors and suppliers to work under the EPC Contractor's QA program.

9.5. Quality Records

9.5.1. One electronic copy and three hard copies of all quality records as specified in Quality Plan and as required by applicable codes and standards, shall be submitted to the Owner prior to or at Final Completion.

10.0 PROJECT CONTROLS PLAN

10.1. General

10.1.1. The EPC Contractor shall provide and implement a detailed Project Controls Program that addresses all phases of the work including engineering, procurement, construction and commissioning and covers scheduling, productivity analysis, progress reporting, cost and schedule trending, contract cost status, change order management, and invoicing.

10.1.2. Develop and issue a work breakdown structure for the Project that shall breakdown the Project into manageable work packages or areas of work that shall become the basis for cost and schedule management of the Project.

10.1.3. Prepare and issue monthly updating of a Milestone Project Schedule (Level I) that contains only the major activities at a summary level of the Project for presentation to top management.

10.1.4. Prepare and issue monthly updating of a Master Project Schedule (Level II) that contains sufficient detail to manage the Project to the level of most major work activities of the Project as referred to in this document.

10.1.5. Prepare and issue weekly updating of very detailed schedules (Level III) for critical path portions of the work that require detailed analysis of day-to-day work activities. Activity breakdown detail shall need to be broken down, for example, to formwork, re-bar, and concrete placement for concrete work, and cable pulling, terminations, and testing for cable installation.

10.1.6. Prepare and issue three week look-ahead schedules (Level III type) that shall be used at progress meetings to discuss the upcoming planned activities of the Project.

10.1.7. Report schedule progress that shall include earned value progress vs. planned, productivity analysis of various major work activities such as piping work, electrical cable pulling, etc., and analysis of critical paths and recovery plans where delays are occurring.

10.1.8. Conduct weekly progress meetings between the Owner, Owner's contractors and the EPC Contractor addressing current work activities, interfaces, issues affecting construction and critical path activities and addressing recovery measures where applicable.

10.1.9. Prepare and issue a project monthly status reports including management summaries, design drawing status, purchase order status, progress charts for engineering, procurement and construction, and productivity analysis and trending, site labor man-hour progress curves - histograms (actual vs. planned) and projections, procurement and delivery status of equipment and materials and its effects to Project schedule, start-up and commissioning status, subcontract issuance schedules, cost changes or cost impact to the Owner, and other factors that shall affect Project cost and schedules.

10.1.10. Conduct monthly Project meetings with the Owner and Owner's contractors to address general Project progress and issues.

10.2. Project Master Schedule

10.2.1. The EPC Contractor shall develop and submit to Owner a Level II Master Project Schedule that includes engineering, procurement, construction and commissioning work activities and Milestones that includes the following as a minimum:

a. Limited Notice to Proceed when the EPC Contractor is released to begin limited design and procurement.

b. Full Notice to Proceed when the EPC Contractor is fully released to implement the work.

c. Detailed engineering and design activities for the Project that includes design work for all the major disciplines of work

d. Procurement activities including issuance of purchase orders, shop testing, shop fabrication shipping dates and delivery of all equipment for the Project and major materials needed for construction, and issuance of major Subcontracts.

e. Construction activities for civil, mechanical, instrumentation and controls, DCS, and electrical work that are detailed and broken down into sub-activities that fall to the level of work such as installation of temporary facilities, excavation, concrete placement, cable installation, piping for each system, hydro-testing of piping systems, installation of all equipment of the Project, mechanical equipment alignment, insulation work, instrumentation and DCS, painting, and Project site finishing. Site Mobilization when the EPC Contractor requires access and begins site

presence shall be identified. Mechanically

Complete shall also be identified when the installation of 90-percent of the permanent Project equipment can be validated.

f. Start-up and pre-commissioning activities and milestones that shall include: pre- commissioning electrical testing, flushing of piping systems, energization of electrical equipment and switchgear, back feed to the main transformer, power up DCS, loop checking, receiving of first fuel, commissioning of fuel system/s, test runs and tuning of all equipment, initial synchronization, all hot commissioning activities, performance test on natural gas and fuel oil (if dual fuel is selected), reliability test, and commercial operation.

g. Commercial Operation date when the EPC Contractor has satisfied the power generation output requirements of the Contract.

h. As-Built final document submittal serving as the permanent Project record of design, constructing and testing.

10.2.2. The Project Master Schedule shall be prepared with all activities linked together in the scheduling software and loaded with resources. This schedule shall be the most widely used schedule to monitor progress and manage the Project. The Project Master Schedule shall be updated weekly with actual site progress, and issued monthly to the Owner unless the Owner requests more frequent updates or if the Project critical path is behind schedule.

11.0 ENGINEERING AND DESIGN SERVICES

11.1. General

11.1.1. The EPC Contractor's balance of plant systems shall be capable of supporting continuous operation on natural gas fuel.

11.1.2. Waste water discharges shall comply with the Environmental Protection Agency (EPA) and Kentucky Division of Water limits for discharge to existing surface water drainage.

11.1.3. Black start provisions are required with a backup generator providing required starting power for Project systems.

11.1.4. Natural gas fuel will be per fuel analysis supplied by the Owner.

11.1.5. The balance of plant facilities shall be designed to obtain an annual availability contribution of greater than 99 percent. Availability is defined per the following:

a. Availability = 1- (Forced outage - Planned outage)/Time period

11.1.6. The balance of plant shall be designed such that no single failure shall cause plant shutdown.

11.2. Performance Guarantees

11.2.1. The EPC Contractor shall provide the following performance guarantees:

a. Auxiliary electrical load for systems and equipment provided by the EPC Contractor

b. Black Start Generator emissions guarantee

c. Diesel Firewater Pump emissions guarantee

d. Near field noise guarantees

e. Far field noise guarantee (except Engines)

f. Schedule completion (Provisional Acceptance by Owner Date)

g. Engine supplier is responsible for air emission guarantees

11.3. Design Package Elements

11.3.1. The design package shall adequately describe the construction of the KYMEA Power Project and shall include:

a. Drawings

i. Drawings shall provide equipment lists, elevations, plans, details, process and instrumentation diagrams which provide a comprehensive description of the Project. Drawings shall be organized and numbered by engineering discipline i.e., mechanical, civil, structural, electrical, instrumentation and control.

b. Specifications

i. Specifications shall adequately describe the requirements for each component and system. Specifications shall be arranged in the standard specification numbering format for convenient location.

c. Equipment Catalog Sheets

i. Catalog cut sheets and specific equipment performance and application data shall be included for all equipment including valves. Where possible it shall describe equipment design points and vendor contact data. It shall include manufacturer's operation and maintenance instructions and suggested spare parts lists. Each equipment catalog sheet, manufacturer's drawing or specific performance information sheet shall be numbered and listed in an equipment index inserted at the front of the Equipment Catalog Section.

d. Equipment List

i. EPC Contractor shall include a completed version of the equipment list. The lists shall be specific to each engineering discipline for example, civil, mechanical, electrical, and instrumentation and controls.

11.4. Codes and Standards

11.4.1. The facility shall be designed and constructed in accordance with all Federal, State and local codes and standards including the most applicable sections of the following codes, standards and regulations.

11.4.2. This list of Codes and Standards is not complete, and does not relieve the EPC Contractor from complying with any other requirements and regulations applicable to this Project.

11.4.3. The effective dates of Codes and Standards shall be the most recent revision prior to the Contract date.

11.4.4. Design documents certification by a Registered Professional Engineer shall be provided in accordance with the State of Kentucky law.

AASHTO American Association of State Highway and Transportation Officials

ACI American Concrete Institute

40 CFR Part 60 Standards of Performance for New Stationary Sources

40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants

ADA Americans with Disabilities Act

AFBMA Anti-Friction Bearing Manufacturers Association

AGA American Gas Association

AGMA American Gear Manufacturers Association

AISC American Institute of Steel Construction

AISI American Iron and Steel Institute

AMCA Air Movement and Control Association

ANSI American National Standards Institute

API American Petroleum Institute

ARI Air-Conditioning and Refrigeration Institute

ASCE American Society of Civil Engineers

ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers

ASME American Society of Mechanical Engineers

ASME Code for Pressure Piping (formerly ANSI B31.1)

ASNT American Society for Nondestructive Testing

ASTM American Society for Testing and Materials

AWS American Welding Society

AWWA American Water Works Association

CMAA Crane Manufacturers Association of America

CRSI Concrete Reinforcing Steel Institute
EIA Electronic Industry Association

EJMA Expansion Joint Manufacturing Association

EPA Environmental Protection Agency

EPRI Electrical Power Research Institute

FM Factory Mutual

HEI Heat Exchange Institute

IBC International Building Code, 2009 Edition

ICEA Insulated Cable Engineers Association

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

IES Illuminating Engineering Society

ISA International Society of Automation

ISA M C96.1 Temperature Measurement Thermocouples

ISA S5.1 Instrumentation Symbols and Identification

ISA S5.2 Binary Logic Diagrams for Process Operations

ISA S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

ISO International Standards Organization

MBMA Metal Building Manufacturers Association

MSS Manufacturers Standardization Society of Valves and Fittings Industry

NAAMM National Association of Architectural Metals Manufacturers

NACE National Association of Corrosion Engineers

NEC National Electric Code (NEC)

NEMA National Electrical Manufacturers Association

NESC National Electrical Safety Code

NERC North American Electric Reliability Corporation

NETA International Electric Testing Association

NIST National Institute of standards and Technology

NFPA National Fire Protection Association
NFPA 85 Boiler and Combustion Systems Hazard Code
OSHA Occupational Safety and Health Administration
PFI Pipe Fabrication Institute

SMACNA Sheet Metal and Air Conditioning EPC Contractor's National Association

SSPC Steel Structures Painting Council

TEMA Tubular Exchanger Manufacturer Association

UL Underwriters Laboratory

11.4.5. In the event conflicts arise between the codes, standards, specifications, or manufacturer recommendations, the more stringent code shall apply.

11.5. Maintainability

11.5.1. Maintenance features shall be provided to optimize maintenance work. This shall include adequate space inside enclosures, removable panels in enclosures to allow removal of equipment, and other features that facilitate material handling.

11.6. Operability and Safety

11.6.1. The Facility shall be designed for operation from a remote and central control room with local startup, operation, and shutdown, and emergency shutdown capability for equipment. Project equipment, valves, instrumentation, motor controls and testing devices shall be designed for ease of operation and maintenance. Special attention shall be given to adequate lighting, ventilation and acoustic dampening of operational spaces. The Project shall comply with OSHA requirements.

11.6.2. The Project shall be operable from the control room under all normal conditions including several daily startup and shutdowns from 0 percent load to full load and back to 0 percent.

11.6.3. Where redundant equipment is supplied, the idle device shall be capable of immediately backing up the operating device. The switchover shall be accomplished automatically through the control system.

11.6.4. The Project shall be designed such that the loss of any single device, instrument or switch (with the exception of one of the engines, generators or GSUs) shall not result in the loss of any generation capability. Level transmitters or valve limit switches used for pump protection shall be redundant. Breaker position switches shall employ two (2) sets of contacts where those contacts are used for operational interlocks.

12.0 MECHANICAL DESIGN REQUIREMENTS

12.1. General

12.1.1. All mechanical design shall be in accordance with the International Mechanical Code (IMC), the International Piping Code (IPC), and the International Fire Code (IFC). The additional documents incorporated by reference and the additional requirements herein. All mechanical design shall be performed by or done under the direction of a Professional Engineer registered in Kentucky. All Life Safety requirements shall meet all national, state, and local codes, as well as agree with the local Authority Having Jurisdiction.

12.2. Piping

12.2.1. General

a. This Section addresses the requirements for the design, fabrication, installation and underground protection of all Project piping. The EPC Contractor shall be responsible for the mechanical design of the piping system, material selection, stress analysis, supports, sizing and general arrangement for safe and successful operation. All system design and material selection shall be in accordance with ASME Section VIII and/or ANSI B31.1, Power Piping.

12.2.2. Piping Standards

a. Piping standards are listed in Table 3, which identifies proper pipe material and usage based on service. To the extent that there is any conflict between the piping standards listed below and any other provision of this Agreement, except code, the piping standards shall have priority. Non-standard pipe sizes shall not be used.

Table 3
Piping Material and Standards

Service	Media	Material
Chemical Feed System	TBD by EPC Contractor	TBD by EPC Contractor
Water	TBD by EPC Contractor	TBD by EPC Contractor
Deionized Water	Water	TBD by EPC Contractor
Raw and Service Water	Well Water	TBD by EPC Contractor
Instrument Air Tubing	Air	TBD by EPC Contractor
Instrument Air Piping	Air	TBD by EPC Contractor
Lube Oil	Oil	TBD by EPC Contractor
Natural Gas	Natural Gas	TBD by EPC Contractor
Potable Water	Water	TBD by EPC Contractor
Sanitary Waste	As appropriate for waste water type	TBD by EPC Contractor
Service Air Piping	Air	TBD by EPC Contractor
Ammonia System	TBD by EPC Contractor	TBD by EPC Contractor
Underground and Above-ground	TBD by EPC Contractor	TBD by EPC Contractor
Flange bolting		TBD by EPC Contractor
Starting Air Piping	Air	TBD by EPC Contractor

12.2.3. Pipe Sizing

a. Unless equipment manufacturers require or allow different maximum pipe velocities, the maximum velocities provided in Table 4 shall be used for selecting pipe sizes.

Table 4 Maximum Pipe Velocities

Media	Maximum Velocity
Water Suction: Discharge:	TBD by EPC Contractor
Fuel Gas (LNG & Gas)	TBD by EPC Contractor
Oil	TBD by EPC Contractor

12.2.4. Minimum Wall Thickness

a. Minimum wall thickness shall be as designed in accordance with ASME B31.1. The value of "A" for steel piping shall be a minimum of 0.0625 inch. The minimum wall thickness for carbon steel piping is standard weight. Manufacturing tolerances (minus 12.5 percent of nominal) shall be subtracted from the nominal thickness when determining minimum wall thickness.

12.2.5. Piping slope

a. Appropriate pipe slope shall be introduced to situations requiring draining or gravity flow.

i. Underground Piping

1. Special consideration shall be given to the design of underground piping to prevent excessive loading/movement during operation and seasonal ambient temperature variations. All piping subject to freezing shall be installed below the frost line.

2. Polyethylene piping shall be per ASTM D-3350 and shall be used only in buried designs, usually for cold water only. Installation and application shall be in accordance with the manufacturer's recommendations.

3. All underground steel piping shall be protected from corrosion by an active or passive protection system (coating, sacrificial anodes, cathodic system) depending on the soil conditions.

12.2.6. Pipe Line List and Marking

a. During the Project design phase, the EPC Contractor shall prepare a piping line list showing line number, classification, size, insulation symbol, material, design pressures and temperatures, hydrostatic test pressure and "normal" operating pressures and temperatures. Process lines shall be clearly marked indicating service and direction of flow.

12.2.7. Vents, Drains and Manholes

a. High points shall be vented and low points drained to ensure quick and efficient start up and operation of all mechanical systems. Vents and drains shall be located on the piping drawings.

b. Drains from skid-mounted equipment shall go directly to the floor drains without effluent running across the floor.

c. Fuel Gas piping shall be provided with adequate connections, with double valves, for purging of the line segments with an inert gas.

12.2.8. Fabrication and Installation

a. General - Pressure Piping Systems

i. All piping shall be erected in a neat workmanlike manner. Runs shall be straight and true to dimension throughout. It is intended that the Owner secure a neat workmanlike installation, which provides headroom, access to equipment and valves, proper support, etc. Studs and threaded connections shall be coated with a suitable anti-seize compound before the joint is tightened.

ii. Particular attention shall be paid to ensure proper drainage of all piping.

iii. Piping shall be installed with suitable clearances being allowed for insulation where pipes cross or run parallel or where pipes run close to equipment or building structures.

iv. No valves shall be installed before they have been thoroughly cleaned, inspected, and tested to make certain that they are tight closing and in good operating condition. After welded end valves have been welded into the pipelines and any required stress relieving has been performed, they shall be tested to assure that they have not been damaged. The EPC Contractor shall tighten valve stuffing boxes or replace packing as required to correct leaks during operational testing.

v. All valves, fittings, pipe, and other materials are to be verified as clean inside and out before erection. The inside of all pipes and fittings shall be free of rust, scale or dirt when erected. All piping shall be thoroughly inspected before being placed in operation to ensure that the inside of all parts of the system are free from foreign matter.

vi. All piping shall be flushed or otherwise cleaned prior to initial service.

vii. All gas and liquid fuel lines shall be completely drained of water and dried after hydrostatically testing the piping (hydro testing).

b. Root Connections

i. Root connections for service on condensable vapors or wet gas shall be taken from the top and side of the pipe.

ii. Root connections for service on liquids shall be taken only from the side of the pipe, with the root nipple horizontal.

iii. Root connections for service on dry gases shall be taken from the top of the pipe.

12.2.9. Fabrication Requirements

a. Fabrication shall be in accordance with the applicable ASME Codes for power piping. All piping and fittings shall be new and clean.

12.2.10. Surface Cleaning

a. Cleaning of external surfaces which are not to be painted or coated shall be done according to the supplier's recommended practice.

12.2.11. Inspection

a. The EPC Contractor shall be responsible for inspection of all shop-fabricated piping material. The EPC Contractor shall maintain qualified personnel to check shop and field fabrication for both material specifications and dimensional accuracy, including weld integrity.

12.2.12. Protection for Shipment

a. All flange faces, machined surfaces and threads shall be clean and shall be protected from damage during shipment. Flange faces and machined surfaces shall be protected with wood, plastic, or metal covers as appropriate. Couplings, openings, and threads shall be protected by steel pipe plugs, tape, or by plastic protectors.

12.3. Facility Valve Requirements

12.3.1. Valves shall be arranged for convenient operation from floor level and, if required, to be greater than 6-feet above floor level shall have extension spindles, chain operators, and gearing. Hand-actuated valves shall be operable by one person. Gear operators shall be provided on manual valves 8 inches or larger.

12.3.2. Valves shall be arranged to close when the hand wheel is rotated in a clockwise direction when looking at the hand wheel from the operating position. The direction of rotation to close the valve shall be clearly marked on the face of each hand wheel.

12.3.3. The stops that limit the travel of each valve in the open or closed position shall be arranged on the exterior of the valve body. Valves shall be fitted with an indicator to show whether they are open or closed; however, only critical valves shall be remotely monitored for position. Valve materials shall be suitable for operation at the maximum working pressure and temperature of the piping to which they are connected. Steel valves shall have cast or forged steel spindles.

12.3.4. Seats and faces shall be of low-friction, wear-resistant materials. Valves in throttling service shall be selected with design characteristics and of materials that shall resist erosion of the valve seats when the valves are operated partly opened.

12.3.5. Valves operating at less than atmospheric pressure shall include means to prevent air in- leakage. No provision shall be made to repack valve glands under pressure.

12.4. Pumps

12.4.1. Centrifugal pump sizing shall include 5-percent flow margin. Impeller size shall not exceed 90-percent of the maximum diameter for a given pump casing size. Impeller tests shall be performed according to Hydraulic Institute Standards. As a minimum, all pumps shall be hydrostatically tested. Pumps with seal drains shall have seal drains directed to the floor drain system without effluent running across the floor to the drain.

12.4.2. All pumps/systems shall be protected against low flow/deadhead operation across all operating conditions, using minimum flow lines/valves.

a. Minimum flow/recirculation lines from a pump's discharge to a pump suction line are not acceptable. As a minimum, each pump's minimum flow shall be per pump manufacturer's recommendations.

b. Pump driver shall be sized to operate continuously at the pump "run out" at a motor service factor of 1.15 unless otherwise specified.

12.5. Insulation and Lagging

12.5.1. Insulation and lagging shall be provided for piping, tubing, gas ducts, tanks and equipment to reduce system heat losses, reduce noise, provide personnel

protection, prevent condensation, and prevent freezing as required for the specific application.

12.5.2. Anti-sweat insulation shall be designed on the basis of the relative humidity of the ambient air considering the fluid temperature within the system in that area.

12.5.3. All material shall be asbestos free and shall have a fire rating of 25 or less when tested by ASTM E84 method.

12.5.4. Parts of the Project requiring insulation to reduce heat loss or afford personnel safety shall be thermally insulated. Minimum insulation thickness for hot surfaces near personnel shall be designed to limit the outside lagging surface temperature to a maximum of 140°F, based on 80°F ambient temperature and 20 mph air velocity.

12.5.5. The thermal insulation shall have as its main constituent calcium silicate, foam glass, fiberglass, or mineral wool, and shall consist of pre-formed slabs or blankets, where feasible. Asbestos materials are prohibited. An aluminum jacket or suitable coating shall be provided on the outside surface of the insulation. Where a hard-setting compound is used as an outer coating, it shall be nonabsorbent and non-cracking. Thermal insulation shall be chemically inert even when saturated with water. Insulation system materials, including jacketing, shall have a flame spread rating of 25 or less when tested in accordance with ASTM E 84.

12.5.6. Install removable and reusable insulation, blankets, or pads on orifice flanges, conical strainers, valve bonnets, and other locations where access to piping, valves, or in-line specials may be required for maintenance.

12.6. Freeze Protection

12.6.1. Freeze Protection shall be provided for all outdoor piping and equipment subject to freezing. This shall include insulation and heat tracing.

12.7. Heat Tracing

12.7.1. Heat tracing shall be furnished as required to prevent freezing, loss of control or system failure.

12.8. Tanks

12.8.1. General

a. The scope of this package includes a specification for the design, supply and installation of all tanks, including final insulating, lining (for field erected tanks) and painting of all tanks.

b. All components, features and design parameters specified herein are minimum requirements. If the EPC Contractor design dictates that these minimum requirements are insufficient as specified in the tank data sheets, to provide a safe, reliable operating unit, then the EPC Contractor shall inform the Owner of any required changes or deviations.

c. All equipment and materials supplied shall be new, unused and undamaged. Goods that become damaged while in-transit or on-site shall be replaced with new, equal, or better goods. EPC Contractor shall supply any special tools required necessary to support installation, start-up, commissioning and maintenance.

d. For all lube oil storage tanks, the tank inlet and outlet shall include filters on the inlet and outlet piping of the tank.

e. For oil and diesel fuel storage tanks, the EPC Contractor shall provide secondary containment sufficient to hold the entire tank volume plus the 100-year, 24-hour rain fall volume.

f. Tanks shall have local visual level indication as well as level transmitters for remote monitoring of tank level.

12.8.2. Work Provided by EPC Contractor

a. The EPC Contractor's work shall include, but not necessarily be limited to design, supply, field fabrication, cleaning, coating, painting, testing, all documentation and inspection of the field fabricated storage tanks and accessories

b. Field Erected Tanks Design Requirements

i. The tanks shall be fabricated on a concrete foundation with compacted sand base under the tank bottom plate.

ii. Tank diameter shall be measured as inside diameter.

iii. The EPC Contractor shall provide a minimum of four (4) grounding pads equally spaced around the exterior of each tank. The contact surface shall be flat and smooth and shall be protected during construction to maintain the contact surface quality. EPC Contractor shall not paint the stainless steel.

iv. All tanks shall be provided with ½" asphalt impregnated felt pads, ASTM D 1751, under tank bottom plates.

c. Tank Structural Design

i. Structural Design shall be in accordance with the codes and standards applicable to the tank's service and IBC latest edition as adopted by the state of Kentucky, Local Building Code, latest editions. EPC Contractor shall determine the design of shell openings and allowable external piping loads on tank openings.

ii. All calculations shall include relevant codes and standards. Calculations shall source paragraphs, values used in the formulas, calculated results, and where applicable, comparisons with acceptable values. Where calculations are based on other than code formulae, the source of the formulas shall be referenced. Where a computer program performs calculations, a program description shall be given, including name and version of the program.

d. Tank Nameplates

i. The EPC Contractor shall supply a stainless-steel certification nameplate for each tank. The nameplate shall be welded to the tank and easily accessed. The nameplates shall contain as a minimum:

1. Name of Tank Manufacture
2. Equipment tag number
3. Rated capacity, gallons
4. Date of manufacture
5. Owner's mark number
6. Manufacturer's model, and serial number or contract number
7. Manufacture purchase order number
8. Design Code
9. Design pressure and temperature
10. Tank Size

e. The words "DO NOT WELD – LINED TANK" shall be stenciled on the outside of lined, painted tanks. The words shall be visible from all sides of the tank.

12.8.3. Tank Surface Preparation and Coating

a. General Surface Preparation and Coating

i. The EPC Contractor shall not paint or coat stainless steel.

ii. The EPC Contractor shall be responsible for providing and applying the protective coatings to the internal and external surfaces of all tanks. In the final condition, all exposed carbon steel surfaces shall be coated. Protective coatings shall not be applied until all weld examination and leak testing is complete and Owner's acceptance is obtained.

iii. The requirements for the coating work defined in this document apply equally for all internal accessories, attachments, and assemblies, interior faces of blanking plates, manholes, supports, struts, piping, etc. The coating shall cover the interior and full face of all nozzle and manhole flanges.

iv. All carbon steel components shall have surface preparation according to the lining and paint manufacturer recommendations. Tanks shall be interior lined and exterior coated according to the selected manufacturer.

v. The underside of the tank floor plates in contact with the soil or concrete shall receive an epoxy coating to within 3 inches of the weld seams.

b. Tank Hydro-Static Leak Test

i. The tanks shall be subjected to a leak test in accordance with the codes and standards applicable to the tank's service. Test procedures and methods required for the tanks, shall be prepared by the EPC Contractor in accordance with governing specifications and codes. The procedures are subject to review by the Owner.

ii. There shall be no substitute for hydro-static leak detection.

iii. The hydro-static test shall be performed prior to painting.

13.0 CIVIL DESIGN REQUIREMENTS

13.1. General

13.1.1. The Project design shall take into account existing site conditions with respect to soil characteristics, site clearing, grading, and drainage. The EPC Contractor shall be responsible for all site preparation and development, including any demolition and soil stabilization and site development work required to support facility construction. Site grading shall be compatible with the general topography and uses of adjacent properties, right-of-way, set- back, and easement. Overall Project design must incorporate the provisions of all applicable state and local codes.

13.1.2. All construction-related debris and material removed shall become the immediate property of the EPC Contractor and shall be removed from the premises and disposed of by the EPC Contractor.

13.1.3. All temporary access roadways used by the EPC Contractor shall be maintained in serviceable condition.

13.1.4. All signs and barricades shall be provided and maintained by the EPC Contractor and shall be in accordance with jurisdictional regulations for accident prevention.

13.1.5. The EPC Contractor shall be responsible for dust control at the site during construction and for meeting any permit requirements. The EPC Contractor shall prevent the spread of dust during its operations. This shall include the use of gravel and/or road base in parking areas and Project roadways. EPC Contractor shall moisten all surfaces with water to reduce the risk of dust becoming a nuisance to the public and neighbors. The EPC Contractor shall furnish all labor and equipment necessary for dust control, including tank trucks and hoses.

13.1.6. On-site open burning shall not be permitted unless approved by appropriate State and local authorities.

13.1.7. All site work shall be done in accordance with the Project documents for the proposed construction. All local, state, and federal regulations shall be adhered to, including but not limited to site specific zoning and plotting conditions. The ASTM standard appropriate to each aspect of the work shall also be followed.

13.1.8. EPC Contractor shall properly level the site with no construction debris. Consideration shall be given to drainage to ensure no low-lying areas are left which would accumulate water. All drainage shall be away from buildings, structures, and permanent exposed slopes.

13.1.9. All structural materials shall be new and conform to a nationally recognized standard such as ASTM. Structural materials shall be selected to withstand the environmental conditions expected at the site as described elsewhere in this proposal document.

13.1.10. Earthwork

a. All areas disturbed during construction shall be graded to a smooth surface and covered with appropriate material. Soil compactions shall be confirmed by independent test labs and shall in no case be less than the recommendations of the geotechnical report and found to be within the limits of the codes and standards set forth in this Contract.

b. The EPC Contractor shall provide earthwork specifications or drawing notes, which properly detail the excavation plans and grades and the procedures for backfill placement and density control.

13.1.11. Excavation

a. The EPC Contractor shall also be responsible for selecting the method(s) of excavation for the differing soil density/consistency conditions existing across the site. Methods of excavation and excavated material processing or handling shall be designed to maximize that materials' use as engineered control backfill yielding minimal settlement potential. EPC Contractor shall be responsible for locating suitable disposal sites for all materials excavated from the project site that cannot be disposed of onsite.

13.1.12. Erosion and Sediment Control

a. Earthwork specifications or applicable and equivalent drawing notes shall also address excavation guidelines and shall include provisions for temporary erosion and sediment control and slope protection from both runoff and wind.

b. The EPC Contractor is responsible for preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the construction storm water permit. The Owner shall review and approve the SWPPP prior to the start of activities at the Site and the Owner reserves the right to audit the implementation of the SWPPP including BMPs at any time during construction.

13.1.13. Site Grading

a. The site grading and drainage system shall be designed to comply with all applicable federal, state, and local regulations. The general site grading shall establish a working surface for construction and Project operating areas, and provide adequate soil coverage for underground utilities. Site grades shall be established to reasonably balance earthwork cut and fill volumes. The limits of excavation into the slope and the bench elevations shall be determined once topographic data is available. The maximum grade of site roads shall be limited to 6-percent where practical. The general site grading scheme shall be presented as a construction drawing denoted as the "Rough Grading Plan".

i. EPC Contractor shall perform all site rough grading. This shall include excavating, backfilling, filling, and compacting of soils as required. A balanced cut and fill design is assumed. Soils unsuitable for subgrades shall be removed and replaced with suitable backfill material. The removed soils may be used for general site fill in accordance with the geotechnical report, if appropriate.

ii. The EPC Contractor shall be responsible for installing and maintaining adequate drainage and preventing soil erosion at the site during construction.

iii. 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 around catch-basin inlets, culvert inlets, and at the top and toe of slopes.

13.1.14. Finish Grading and Drainage

a. Finish grading shall be performed to conform to the finished design elevations for surface drainage and to prepare the areas to receive the specified surface finishes. Finished ground grades adjacent to proposed structures shall be sloped to provide positive free drainage away from the foundations. No areas shall be constructed that shall allow water impinging upon the site neither from outside sources nor to pond near footings and slabs. Finish grading schemes shall be presented as a construction drawing(s) denoted as "Detailed Grading and Drainage Plan."

b. Surface runoff shall be controlled by the use of ditches and/or catch basins and underground conduits. The drainage for uncontaminated runoff from the Project area, including roof drainage from the buildings and enclosures, shall be diverted to natural watercourses via closed conduits and/or open ditches.

c. Drainage ditches shall be installed inside the Project area to provide drainage of surface water and to ensure stability of the facilities. All swales shall be erosion-control protected by vegetation and/or rip rap for velocity dissipation.

13.1.15. Landscaping

a. Areas of the site which have been disturbed but not built upon, stoned, or paved shall be stabilized as per the requirements of the SWPPP permit and protected from erosion by the use of grass or other means appropriate to the site's setting. Low maintenance perennial type grass suitable for local site ambient conditions shall be used.

13.1.16. Roadways/Paving

a. The site roads and service roads around the powerhouse shall be asphalt pavement. The Project roads and paved areas shall be asphalt and shall be designed to the State of Kentucky Department of Transportation standards to withstand the heaviest equipment loading associated with the construction, operation and maintenance of this Project. Parking space shall be provided as indicated in the site plan and/or other Project drawings. Roadway and parking spaces shall be designed to facilitate storm water run-off. Asphaltic pavement, wearing surfaces, etc., shall be designed to avoid breakdown and bleeding in resistance to the ambient temperatures for this site.

b. Asphalt pavement shall be continuous to the site facilities. Access roads shall consist of two 12 feet wide lanes with 3-foot-wide shoulders. Single lane roads shall be 12 feet wide with 2-foot-wide shoulders.

c. Paved areas must be in compliance with environmental requirements pertaining to impervious surface limitations.

13.1.17. Crushed Stone Surfacing

a. Construction parking areas and lay down areas shall be graded to drain and to be surfaced with 6-inches of compacted stone.

13.1.18. Fencing and Gates

a. Security fencing shall be provided and installed by the EPC contractor including automatic access gate with provisions from remote control from the Control Room.

13.1.19. Signs

a. All temporary construction and permanent signs shall be provided and

installed by EPC Contractor with Owner approval.

13.1.20. Structural material specifications shall meet the requirements of Table 5

Table 5 Material Requirements

Concrete	TBD by EPC Contractor
Reinforcing Steel	TBD by EPC Contractor
Structural Steel	TBD by EPC Contractor
Bolted Connections	TBD by EPC Contractor
Grating	TBD by EPC Contractor
Checkered Plate	TBD by EPC Contractor
Ladders	TBD by EPC Contractor
Hand railing	TBD by EPC Contractor
Masonry	TBD by EPC Contractor
Anchor Bolts	TBD by EPC Contractor

13.2. Drainage

13.2.1. General

a. The working areas of the site shall be well drained during and after construction. The site drainage plan and discharge from the site shall conform to federal, state, and local laws and regulations. Facilities for handling rainfall shall be subject to approval by the Owner. These facilities shall be adequate to handle a 100-year, 24-hour storm event.

13.2.2. Erosion Control

a. During the execution of the work at the site, the EPC Contractor shall constantly monitor his operations to avoid the creation of conditions that could lead to excessive erosion of soil with the surface runoff from the work areas. Control shall be provided to prevent violation of local, state and federal water quality standards; and shall be in accordance with Project documents.

b. Erosion and sediment control, both during and after construction, shall be provided as required to retain sediment onsite, and to control erosion of embankments, temporary and final exposed slopes, and temporary material stockpile(s). Both during-construction and post-construction Erosion and Sediment Control Plan(s) are to be provided by the EPC Contractor. These plans shall conform to current best management practices, and shall include any or all, as necessary, silt fences, check dams, drainage ditches or swales, temporary seeding, and pre-manufactured geotextiles, etc.

13.2.3. Storm Water Drainage System

a. Ditches and drainage pipes shall be sized and graded to have a minimum velocity of 2.0 feet per second and be self-cleaning. Drainage pipes laid on steep slopes shall terminate at

a rip-rap apron or in a designed energy dissipater. The maximum surface runoff shall be calculated using the Rational Formula Method.

b. Surface runoff that has the potential to come in contact with oil from machinery oil spills or releases shall be routed to a separate collection system and conveyed to an oil/water separator.

c. Swales and ditches at greater than 6-percent grade shall be paved or lined with 6 inches of crushed stone or riprap (subject to approval by the Owner) to control concentrated flow velocities and minimize erosion and siltation concerns. The surface area of unpaved areas around and within the Project where access is needed for equipment such as the radiators and tanks shall be sealed with an asphalt/stone mixture to facilitate drainage, prevent ponding, and provide a sealed surface during wet conditions. Site drainage shall be by surface drainage and swales with roadway culverts as required.

13.2.4. Manholes and Catch Basins

a. Design and selection of manholes and catch basins shall conform to local city or county standards. These items shall be provided and installed in accordance with the approved design.

13.2.5. Floor Drains and Sumps

a. A system of floor drains and sumps shall be incorporated into the overall design of the power Project buildings. The system shall consist of collection troughs, sumps, piping, fittings, and valves necessary for gravity drainage of wastewater to various collection points. From these points, the wastewater shall flow by gravity and/or be pumped to the oil/water separator sump, and then on to the treatment facility effluent discharge point.

13.2.6. Subsurface Investigation

a. Appendix D provides preliminary geotechnical information for the Project Site. For design, the EPC Contractor shall hire a third-party geotechnical subcontractor, who shall fully investigate the soil conditions and prepare a final report. The final report shall include detailed stratigraphy and physical properties of the soils underlying the Site, especially strength and deformation characteristics of the soil strata, so that satisfactory and economical foundations may be designed. The final report shall also include foundation selection and installation recommendations meeting the general structural requirements for this Project.

b. Conduct standard proctor tests in accordance with ASTM D 698 to determine the appropriate densities and moisture content of soil to be used in preparing underground trenches, and provide compaction curves (dry density vs. moisture content) of samples tested. Conduct thermal resistivity testing of reconstituted soil samples in accordance with ASTM D 5334, and provide thermal dry out curves (thermal resistivity vs. moisture content) of samples tested.

c. Conduct earth electrical resistivity testing of the Project Site utilizing the "Wenner Method" in accordance with IEEE Standards 80 and 81. The number of directions (across the Project Site), data points and spacing's shall be adequate to determine the proper grounding electrode design. Additionally, testing shall include measurement of the pH value, soluble salt content, and ammonium nitrate to determine overall corrosiveness of soils.

14.0 ARCHITECTURAL REQUIREMENTS

14.1. General

14.1.1. All auxiliary buildings and structures shall be designed to meet all applicable building, accessibility, and life safety code requirements.

14.1.2. Large buildings shall be pre-engineered or custom designed. Smaller buildings and equipment enclosures may be either pre-engineered or factory built.

14.1.3. All building shall be constructed of either steel frames with metal siding and roofing or concrete masonry unit bearing walls with steel roof structures and membrane roofs.

14.1.4. See section on Architectural Materials and Finishes for specific information regarding exterior envelope systems as well as interior build-out materials and finishes.

14.2. Operations and Maintenance/Storage Building

14.2.1. The EPC contractor to provide Maintenance/Warehouse Building. EPC to recommend building appropriate for this size plant. EPC contractor to detail building size and room sizes and arrangement. Building will be heated, cooled, and ventilated.

14.3. Administration Building

14.3.1. The EPC contractor to provide Administration Building. EPC to recommend building appropriate for this size plant. EPC contractor to detail building size and room sizes and arrangement. Building will be heated, cooled, and ventilated.

14.3.2. Approximate areas and associated dimensions within the Administration Building, subject to input from the EPC Contractor

a. Kitchen and eating area (450-sq.ft.)
b. Plant manager's office (240-sq.ft.)
c. Admin. Specialist's office (100-sq.ft.)
d. Visitor/spare office (160-sq.ft.)
e. Spare office (160-sq ft)
f. Entrance lobby/waiting area (200-sq.ft.)
g. Office equipment room (100-sq.ft.)
h. Office supply/storage room (100-sq.ft.)
i. Conference Room (450-sq.ft.)
j. Reference library/file storage room (240-sq.ft.)
k. Men's restroom (240-sq.ft.)
l. Women's restroom (240-sq.ft.)
m. Janitors closet (60-sq.ft.)
n. Storage/supply room (100-sq.ft.)
o. Mechanical equipment room (160-sq.ft.)
p. Electrical equipment room (140-sq.ft.)
q. Communications/telephone closet/IT/SCADA (120-sq.ft.)

14.4. Engine Halls

14.4.1. Two engine halls shall contain all engine generating sets, as well as all associated equipment and piping. Motor control centers for each engine generator banks shall be located near each engine bank. Each engine hall shall house half of the total engine generator sets. The building shall be insulated per state and local standards with heating and ventilation.

14.4.2. Each engine hall shall include an overhead crane with a hook reach the length and width of each engine hall and shall be capable to lift all engine components and generator.

14.4.3. Single "man" doors as well as double equipment access doors shall be located where appropriate for both life safety and operational convenience.

14.5. Fire Water Pump House

14.5.1. The Fire Water Pump House shall be a single story, low-bay, open structure of roughly 600- sq.ft. (15ft x40ft). It shall provide weather protection for the fire water pumping equipment. The two sets of pumps, diesel and electric, shall be separated from each other by a fire-rated barrier wall.

14.5.2. A single "man" door as well as double equipment access doors shall be located where appropriate for both life safety and operational convenience in each section of the building.

14.5.3. The Fire Water Pump House shall be insulated, heated and ventilated.

14.5.4. The Fire Water Pump House shall include a water supply for hose bibs.

14.5.5. Although not located in the Fire Water Pump House, a diesel fuel storage tank with containment shall be included.

14.6. Water Treatment Building

14.6.1. EPC Contractor shall construct a water treatment building with insulation and automatic climate control heating suitable to house the Water Polishing System. This building shall be insulated and shall be sized to accommodate the water polishing system with room to remove polishing tanks and pumps and for storage of water treatment chemicals.

14.6.2. The Water Treatment Building shall be a single story, low-bay, open structure.

14.6.3. A single "man" door as well as an overhead equipment access door shall be located where appropriate for both life safety and operational convenience.

14.6.4. The Water Treatment Building shall include a water supply for hose bibs.

14.7. Air Compressor Building

14.7.1. The Air Compressor Building shall be a single story, low-bay, open structure. It shall provide weather protection for the air compressor equipment.

14.7.2. A single “man” door as well as an overhead equipment access door shall be located where appropriate for both life safety and operational convenience.

14.7.3. The Air Compressor Building shall be insulated, heated, air conditioned, and ventilated. Ventilation air for cooling the air compressors shall be separate from the building cooling system.

14.7.4. The Air Compressor Building shall include a water supply for hose bibs.

14.8. Architectural Materials and Finishes

14.8.1. Exterior Envelope

a. The buildings shall be enclosed and sealed weather tight.

b. The pre-engineered buildings shall be constructed of steel frames with factory formed and painted, foam core insulated, metal sandwich roofing and siding panels.

c. Exterior concrete masonry bearing walls with a membrane roof over rigid foam insulation boards over a metal deck and all supported on a steel joist roof framing system. Roof slope to drain to be accomplished with tapered insulation.

d. Gutters or scuppers and downspouts shall be provided to direct rainwater to the Project storm water collection system.

14.8.2. Typical Architectural Room Finishes

a. In general, maintenance, shop and process areas shall include poured concrete, sealed flooring with painted, masonry walls and exposed ceilings. Personnel and overhead roll- up doors and windows (double-paned) shall be provided.

b. Generally, finishes in the buildings shall be gypsum board walls, tiled flooring and acoustical type ceiling in conformance with Table 6.

Table 6 Architectural Room Finishes

Room Name	Floor	Wall	Ceiling
Control Room	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Hallways and Corridors	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Electrical Equipment Rooms	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Offices, Restrooms, and Kitchens	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Workstations, Lobby, Storage Rooms	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Shower, Locker rooms	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
HVAC Equipment Room	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Maintenance, Shop, & Process Areas	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Storage	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor
Telephone Closet	TBD by EPC Contractor	TBD by EPC Contractor	TBD by EPC Contractor

15.0 STRUCTURAL REQUIREMENTS

15.1. General

15.1.1. All structural design shall be in accordance with the International Building Code (IBC 2009), the additional documents incorporated by reference by IBC 2009 and the additional requirements herein. All structural design shall be performed under the direction of a Professional Engineer registered in the State of Kentucky.

15.2. Design Loads

15.2.1. Loads for design of structures and foundations shall be in accordance with the IBC. Loads shall include equipment manufacturer data and any additional specific process, operating, maintenance and construction conditions expected at the facility. The following loads and forces shall be considered in all structural designs:

15.2.2. Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including walls, floors, roofs, equipment, piping, electrical trays/conduits, etc. Dead loads shall be in accordance with ASCE 7-05, as a minimum.

15.2.3. Live load shall be considered as loading not permanently fixed to the structure and occurring over areas not occupied by equipment. No live load reduction shall be permitted in areas where lay down loads are considered. Floors and roofs of enclosures shall be designed to support the uniformly distributed live loads or the concentrated loads given in Table 7, whichever produces the greater effects. The concentrated load shall be located so as to produce maximum stress conditions in the structural member.

Table 7 Concentrated Loads

Control and Switchgear Room	TBD by EPC Contractor
Storerooms / areas	TBD by EPC Contractor
All concrete Slabs on Grade	TBD by EPC Contractor
Walkways & Stairs	TBD by EPC Contractor
Building Elevated Platforms	TBD by EPC Contractor
Platforms attached to Equipment	TBD by EPC Contractor
Surcharge Adjacent to Structures	TBD by EPC Contractor
Stair Treads	TBD by EPC Contractor
Offices	TBD by EPC Contractor
Utility Rack Platforms	TBD by EPC Contractor
Handrails	TBD by EPC Contractor

15.3. Structural Design

15.3.1. Structural design of all structures and foundations shall include the production of engineering calculations, specifications and drawings. These and other related documents shall be submitted to the Owner for review and/or information.

15.3.2. Design of the steel structures shall be in accordance with AISC 360, AISC 341 and AISC 303.

15.3.3. Steel joists and joist girders shall conform to the requirements of the Steel Joist Institute.

15.3.4. All steel, with the exception of piping, located outdoors shall be galvanized. This includes, but is not limited to grating, railings, structural steel, stairways, supports, etc.

15.3.5. All grating and stair treads shall be galvanized with 3/16-inch by 1 1/4-inch minimum, bearing bars. Serrated grating (3/16 inch by 1 1/2-inch bearing bars, minimum) shall be used on all outside exposed applications.

15.4. Concrete Design

15.4.1. The design of concrete mixes shall be in accordance with ACI 301 or ACI 318 and ACI
211.1R. Mix designs and test records shall be submitted for review prior to any production of concrete.

15.4.2. All concrete structures and foundations shall be designed for the loads and load combinations detailed herein and in Section 9.2 of ACI 318-05. Load factors and strength reduction factors shall be as indicated therein.

15.4.3. Transformer fire walls shall be cast-in-place or pre-cast concrete or concrete block masonry. Location and height of fire walls shall be in accordance with NFPA 850.

15.4.4. Transformer containment pits shall be reinforced concrete basins, sealed to prevent leakage. The basin floor shall be pitched and shall contain a drainage sump with a valve.

15.5. Foundation Design

15.5.1. Buildings and equipment foundations shall be reinforced concrete. The foundation recommendations of the EPC Contractor's geotechnical report shall be incorporated in the design.

15.5.2. The combustion driver-generator foundation shall be a reinforced concrete mat isolated from any surrounding building or equipment foundations. The foundation shall be designed for the static and dynamic loading conditions and settlement criteria provided by the equipment manufacturer.

15.5.3. Foundations for storage tanks shall be reinforced concrete ring walls or mat type.

15.5.4. Minimum annual ground frost line at depth shall be per local code in design of foundations.

15.6. Building Design

15.6.1. Buildings may be pre-engineered, or custom designed. They may be steel frame with insulated metal siding/roofing or concrete/concrete block masonry type.

15.6.2. Steel Construction

a. Steel building and structure erection shall comply with AISC 303-10 and AISC 360-10, the EPC Contractor's steel erection specification and the steel fabricator's approved erection and shop detail drawings.

b. The erection of other steel components (including; floor grating and plate, floor and roof decking, etc.) shall be in accordance with the EPC Contractor's erection specification and the manufacturer's approved erection and shop detail drawings, installation specification and industry standard specifications.

15.6.3. Ladders and Stand-off Platforms

a. Tanks with roofs shall be equipped with ladders and stand-off platforms to provide access to each tank roof, roof hatches vents, and agitator drive assemblies. Platforms shall be designed to support a uniform load of 150 psf.

b. Stairs shall be provided for access to:

i. The top of each radiator.

ii. Exhaust stack sample ports

iii. Engine charge air filters

c. EPC Contractor is responsible for installing the Buyer supplied railing on the top of each radiator.

d. EPC Contractor shall provide platforms and stair access at each engine air intake,

e. Ladders, stairs, platforms, non-skid walkways, handrails, etc. shall be designed in accordance with the International Building Code 2009, local building codes, and OSHA requirements. Safety cages and rest platforms shall be provided in accordance with OSHA requirements.

f. EPC Contractor shall provide exterior hot-dip galvanized ladders, stand-off platforms, stairs, nonskid walkways, handrails, etc. provided within this specification in accordance with OSHA requirements.

g. Ladders, stairs, and stand-off platforms shall be provided so that no climbing devices are needed, except as noted on sketches or drawings in this specification. Ladders and stand- off platforms shall be provided so that each ladder span is horizontally offset by a stand- off platform from the successive ladder span. All ladders shall have cages.

h. Stand-off platforms, shall not be less than 2 feet, 6 inches wide. OSHA approved safety gates must be installed at all platforms.

i. Tanks with roofs shall have an OSHA handrail around the complete top circumferential perimeter with a safety chain access to the ladder.

15.7. Protective Coating

15.7.1. In general, all exposed non-stainless, non-galvanized steel shall be primed and painted, except where identified below.

15.7.2. The EPC Contractor shall prepare a comprehensive painting/coating schedule that identifies every component that is painted or coated and delineates the type of paint, number of coats, dry film thickness (DFT), surface preparation, colors, and need for field finish coat.

15.7.3. The EPC Contractor shall work with the Owner to determine finish color schemes for the Project with due consideration of manufacturers standard paint offerings.

15.7.4. Hot dip galvanizing is an acceptable alternative to painting for structural steel framing.

15.7.5. EPC Contractor shall take into consideration the existing ambient air conditions when finalizing protective coatings.

15.7.6. All equipment, motors, valves, instruments and other manufactured components shall receive the manufacturer's factory applied primer and finish paint compatible with the approved Project painting scheme.

15.7.7. The EPC Contractor shall field touch-up the primer and the finish coat, as required, after equipment installation.

15.7.8. All stainless steel, galvanized or nonferrous surfaces shall not be finish painted.

15.7.9. All un-insulated carbon steel piping shall receive a surface preparation of SSPCSP6 with one coat (3 to 4 mils DFT) of organic zinc/epoxy primer and a finish coat of acrylic polyurethane (3 to 5 mils DFT).

15.7.10. Piping shall be color coded by service in accordance with ANSI recommendations.

16.0 Electrical Requirements

16.1. General

16.1.1. The electrical systems include equipment and materials necessary for the Project to generate electrical power, interconnect with the Project or Utility Switchyard, and supply the Project's design power output. The Generator Step Up (GSU) transformers convert electrical power received via the main switchgears at generator voltage level to the transmission voltage of 161kV. The EPC Contractor's scope of supply will end at two dead-end structures located in the Utility or Project Switchyard. An overhead transmission line from each unit (by others and connected to the EPC Contractor supplied dead-end structures) will transmit power to a Utility Switchyard (by others). The electrical power system consisting of the generators, main medium switchgear, GSU transformers (EPC Supplied & Installed), and the plant auxiliary power system shall be sized so that in no case they limit unit output power. The electrical power system installation shall be designed for safe operation and maintenance where cost effective continuity of supply is the prime consideration.

16.1.2. Load flow, short circuit, voltage drop, coordination, and other studies shall be performed to properly determine equipment capacity, withstand requirements, transformer impedances, etc.

16.1.3. Short circuit studies are to be computed utilizing the Utility's available short-circuit current data for the point of interconnection with the transmission system.

16.1.4. Electrical systems shall be designed to operate within both normal operating conditions, transmission system voltages between 0.95 and 1.05 per unit, and contingency operating conditions, transmission system voltages between 0.90 and 1.10 per unit.

16.1.5. Electrical systems shall not inhibit the Project from complying with Voltage Ride Through (VRT) requirements as outlined in the utility interconnect agreement.

16.1.6. Areas of the Project subject to explosive concentrations of dust or gases due to faulty systems, failure of ventilation, etc. shall be classified as hazardous locations in accordance with the latest NFPA criteria. Accordingly, electrical equipment shall be provided with the appropriate enclosures for the installed locations.

16.1.7. Electrical system design shall be performed under the supervision of a professional engineer licensed in the State of Kentucky. Specifications and drawings shall be sealed if required for submittal to regulatory agencies. The professional engineer sealing the specifications and drawings shall be considered as the Engineer of Record.

16.1.8. Electrical circuit breakers insulated with SF6 shall have a leak rate of no more than 0.5 percent by weight and be equipped with a leak detection system; or an alternative to and/or limited SF6 to be environmentally compliant like vacuum breaker and fluorinated gas alternatives.

16.1.9. Electrical systems shall be equipped with protection relaying to trip circuit breakers for de- energizing and isolation of equipment in the event of electrical faults. EPC Contractor supplied relaying protection will include primary and back-up relaying, and overlapping zones of protection. EPC Contractor protection relaying is to be coordinated with Owner supplied equipment relaying, namely the engine generators and 13.8 kV switchgear. Areas of EPC Contractor supplied relaying will include, but not be limited to, the Project or Utility Substation, GSUs, 480 V system, black start diesel generator, and DC/UPS systems. Protection relaying shall comply with interconnect requirements. Owner prefers use of Schweitzer manufactured relays.

16.1.10. Throughout the entire Project's electrical system (i.e., including Owner supplied equipment), the EPC Contractor shall supply and affix labels at suitable locations (i.e., breaker compartments, panelboard doors, etc.) identifying the arc-flash hazard of the respective locations.

16.2. High Voltage Substation

16.2.1. The Project shall be equipped with a 161kV Substation, located adjacent to the Utility Switchyard. The Project's 161 kV Substation shall include two Generator Step Up Transformers (GSUs), each equipped with a high-voltage circuit breaker and disconnect switch and grounding switch for maintenance. The EPC Contractor's scope of supply will include wiring out to two separate, dead-end structures, which will be connected to Owner supplied transmission lines. A breaker and a half bus configuration shall be used in the substation design.

16.2.2. The EPC Contractor's scope shall include steel support structures, foundations for equipment, bus and conductor fittings, electrical trenches and conduits, electrical and instrumentation cables, potential and current transformers, station service transformers, substation ground grid and surface rock, substation fence, switch stands, safety placards, lighting, lightning protection, fault recording, revenue metering, etc.

16.2.3. The EPC Contractor's scope shall include an air-conditioned control building, equipped with AC and DC auxiliary power systems and equipment, protection relaying panels, station battery and redundant chargers, SCADA system, etc., including sufficient room for communication equipment. Digital relaying and revenue metering for substation breakers, GSU's and MV switchgear shall be electric utility grade; similar to Schweitzer Engineering Laboratories Inc. quality or equal.

16.2.4. The SCADA system will be designed to provide control and indication of substation equipment at the Project's central control room.

16.2.5. Medium voltage underground cable circuits are to be provided to connect the low-side winding of each Project GSU to the 13.8 kV switchgears.

16.2.6. The EPC Contractor shall provide two Polled Settlement ("EPS") metering units, one installed between each GSU and transmission line dead-end structure. EPS metering shall be provided in accordance with 1) Interconnect Requirements Section 8, and 2) Nodal Protocols, Section 10 – Metering, and the current Settlement Metering Operating Guide ("SMOG"). Each metering unit is to be equipped with dedicated potential and current transformers, of which ratios, rating factors, etc. are to be selected to ensure optimum metering accuracy, as required in Section 1.6.5 of the SMOG. Power metering shall be bi- directional, including kWh and kVarh measurement, high-accuracy, high-speed, capable of electrical losses compensation and being integrated with SCADA and energy management systems, and equipped with alarming, data recording, and power quality analysis features.

16.3. Generator Step-up Transformers (GSU)

16.3.1. The EPC Contractor shall be responsible for the final design specification for the GSU's based on the following criteria.

16.3.2. Each (GSU) shall be a three-phase, oil-filled two-winding, copper-wound transformer. The high-side winding shall be rated 161 kV (approximate) and the low-side winding shall be the final nominal generator output voltage and verified with associated system studies. Each three-phase unit shall include an oil preservation system and a de-energized tap changer in the high-voltage winding with five taps, (system studies will determine tap positions). GSU cooling method shall be ONAN/ONAF/OFAF or manufacture's standard. GSU accessories shall include, but not be limited to, oil level indication, oil and winding temperature indication, tank pressure relief devices including directed relief flow attachment(s), and a fault gas monitoring system. The GSUs shall be designed with N+1coolers, where N is the number of coolers required for rated output.

16.3.3. Oil-filled power transformers shall be rated for a 65C temperature rise and designed in accordance with ANSI C57.12.00 and C57. 116 (GSU). Transformers shall be capable of continuous operation at rated MVA on any tap positions. Transformers installed outdoors shall include physical separation or fire walls and oil containments as required by code.

16.3.4. The EPC Contractor is to notify Owner of GSU factory testing so that Owner can witness this testing.

16.4. Main Switchgear

16.4.1. Owner will supply arc-resistant, indoor 13.8 kV Switchgear consisting of two separate double-ended with tie breaker bus arrangements. The 13.8 kV Switchgear will be supplied with Schweizter relaying protection. Each 13.8 kV bus will connect three engine generators and supply one, EPC Contractor supplied, step-down transformer (i.e., Unit Auxiliary Transformers, Section 16.5). Each 13.8 kV bus will be rated for 15 kV, 4000A, 63 kAIC, and 95 kV BIL or as recommended by the EPC electrical engineer with owner approval.

16.4.2. The EPC Contractor's building arrangement shall include provision for storing two, Owner supplied, spare 13. 8 kV breakers (one 1200A breaker, one 4000A breaker).

16.5. Unit Auxiliary Transformers

16.5.1. Secondary power transformers (UATs) feeding 480 V load centers shall be oil-filled, two winding, copper-wound units rated ONAN/ONAF (55°C rise). UATs shall include a de- energized tap changer in the high-voltage winding with five taps, two 2.5% above and two 2.5% below nominal positions. UAT accessories shall include, but not be limited to, oil level indication, oil and winding temperature indication, and tank pressure relief devices including directed relief flow attachment(s).

16.5.2. UATs shall be rated to carry the operating load of the double-ended bus configuration at the self-cooled rating. The fan cooled rating shall be the target margin (i.e., 25%).

16.6. 480 V Switchgears, Motor Control Centers, Panelboards

16.6.1. 480 V Switchgear and Motor Control Centers (MCCs) shall be located indoors and/or within enclosures appropriate for the environment. Switchgear and MCCs located outdoors will have NEMA 3R or 4 weatherproof enclosures. Switchgear and MCC enclosures will be in accordance with NEMA 1 when installed in an environmentally controlled/ventilated room/enclosure or NEMA 12 (dust tight) when installed in indoor dusty areas. Switchgear and MCCs will not be located in classified areas.

16.6.2. 480V Switchgear and MCCs shall utilize copper bus bar. 480V Switchgear and MCCs shall be provided with a minimum 5% and 10% spare ampacity, respectively.

16.6.3. 480V load center incoming and tie breakers will have electrically operated breakers and will be controlled through the Project control system and by locally (switchgear) mounted hand switches. Switchgear cubicles will be equipped with local/remote selector switches. Breaker status-indicating lights will be provided in medium voltage switchgear assemblies.

16.6.4. Load center feeder breakers to MCC, panels, or transformers will be manual breakers and controlled locally at the breakers. Some load center feeder breakers, if required for load shedding, will be electrically operated breakers.

16.6.5. Low voltage switchgear may use conventional power circuit breakers or vacuum circuit breakers as appropriate.

16.6.6. Low voltage MCCs can employ electromechanical or vacuum contactors for the larger size starters if warranted. Low voltage MCCs shall utilize molded-case motor circuit protectors or circuit breakers as appropriate.

16.6.7. 480V MCCs shall be provided with a minimum of one spare size 1 and one spare size 2 starters per MCC.

16.6.8. An arc reduction maintenance switch (ARMS) or equivalent will be provided for each of the 480 V load center incomers to enable selection of a protective setting in the incomer circuit breaker for faster operation during the equipment maintenance mode.

16.6.9. The overall height of switchboards, cubicles, and enclosures for electrical apparatus shall not exceed 8 ft above floor level, except as required for arc venting. Relays, instruments, indications, locking devices, and door handles shall be placed not higher than 6 ft and not less than 2 ft above floor level.

16.6.10. Maintenance access shall be provided at the front and rear of all switchboards and relay cubicles if required by the electrical equipment. If rear access is required at least 3 ft shall be provided. Front access shall allow for complete withdrawal and maneuvering of any circuit breakers. All enclosures and

apparatus shall be clearly labeled indicating the function, and where applicable, the tag number.

16.7. Black Start Diesel Generator

16.7.1. Stack dimensions shall be sized to meet air permit requirements.

16.7.2. The black start diesel generator shall be properly sized but meet any air permit requirements.

16.7.3. The black start diesel generator shall be certified per the requirements of 40 CFR Part 60, Subpart IIII

16.7.4. The black start diesel generator shall meet requirements for the Project to serve as a Black Start Resource.

16.7.5. The Black start diesel generator shall supply one 480 V switchgear, arranged to connect via two interlocked circuit breakers the Project's two 480 V double-ended with tie breaker buses.

16.7.6. Black start diesel generator shall doubly serve as the Project's emergency diesel generator.

16.7.7. The black start diesel generator shall be capable of being manually and automatically synchronized to the Project's electrical system for its periodic testing and loading.

16.7.8. The black start diesel generator shall be equipped with protection relaying typical for a small generator interconnected to a power plant's auxiliary power system.

16.8. Variable Frequency Drives

16.8.1. Variable speed drives are to be supplied for engine hall ventilation fan motors, radiator fans and any other applicable locations per EPC design engineer and approved by the Owner.

16.9. Grounding System

16.9.1. A station grounding system shall be supplied to provide adequate safety for Project personnel and equipment. The system shall provide a low impedance path to allow excessive energy caused by ground fault currents, lightning and surges to dissipate to earth without causing damage to the plant structure and its contents and allow for the detection of line to ground faults.

16.9.2. The grounding system shall consist of a ground grid, ground risers, and equipment grounding. An interconnected network of bare copper conductor and copper – clad ground rods (if required) shall be used.

16.9.3. All joints, splices and connections to structural steel shall be made using exothermic welds or a bolted compression connector.

16.9.4. The station grounding grid shall be designed and sized with adequate capacity to dissipate ground current under the most severe conditions in areas of high ground fault current concentrations, with grid spacing such that safe voltage gradients are maintained.

16.9.5. The grounding system shall consist of a ground ring installed around the perimeter of the plant foundation connecting to the grounding grid and a means by which to lower the resistance to ground to meet a target resistance value.

16.9.6. The target resistance value shall be low enough to minimize hazards to personnel, permit prompt operation of circuit protective devices and to minimize voltage gradients which occur during faults. The ground resistance can be lowered by using ground rods, and vertical or horizontal enhanced electrodes as required to meet the target resistance value.

16.9.7. All above ground metal structures or equipment that may become energized shall be bonded together and connected to the ground grid.

16.9.8. Switchgear, secondary unit substations, MCCs, and control and relay panels shall have integral ground buses connected to the station ground grid.

16.9.9. Electronic panels and equipment shall be grounded using insulated grounding wire, connected in accordance with the manufacturer's recommendations, where required.

16.9.10. A separate isolated instrumentation grounding system for the main control room. Project control system cabinets shall be provided consisting of an insulated single point connection to the station grounding grid or grounded per manufacturer's requirements. The system shall be capable of being tested for isolation integrity.

16.9.11. The station grounding system shall be interconnected and bonded to the 161 kV switchyard grounding system.

16.9.12. For low- and medium-voltage power supply circuits that utilize a separate ground conductor, conductors shall be sized according to all applicable codes. Motors below 50 HP shall be grounded through connection of metal raceway or conduit ground wires to motor termination boxes. All motors between 50 HP and 200 HP shall have one copper ground conductor connected between the motor frame and the station ground grid. Motors larger than 200 HP shall have two copper ground conductors connected between the motor frame at diagonally opposite corners and the station ground grid.

16.9.13. All structures, cable tray, conduit and electrical equipment shall be grounded per specifications herein, NEC, or applicable state and local codes, whichever are the more stringent requirements.

16.9.14. It is assumed that the maximum soil electrical resistivity for the site will be determined by EPC Contractor testing after site preparation and will be used in the ground grid sizing calculation.

16.10. Electric Motors

16.10.1. Electric motors will be provided based on the manufacturer's premium efficiency for the specified application; however, for low voltage motors, the manufacturer's efficiency model shall meet EPA efficiency requirements. Generally electric motors will be designed for across the line starting. Electric motors shall be designed for a Class B temperature rise, and equipped with minimum class F insulation. During normal operation, motor terminal voltage shall be maintained between 90 percent and 110 percent of the motor rated voltage. During motor starting, motor terminal voltage shall not drop below 80% of motor rated voltage.

16.11. Battery/UPS System

16.11.1. Owner will supply DC battery power systems for engine control and 13.8 kV switchgear control. EPC Contractor will supply all other DC battery power systems, including but not limited to the Project Substation, Black Start Diesel Generator, etc.

16.11.2. Owner will supply one uninterruptible power supply ("UPS") for operator control stations. EPC Contractor will supply a Project UPS for supporting SCADA, and plant distributed control system, and other controls.

16.11.3. Each DC power supply system shall include two redundant chargers, a flooded cell lead-acid or Nickel Cadmium (Ni-Cad) batteries complete with accessories (i.e., battery rack, inter-cell connectors, protective relaying, etc.), and a main DC switchboard.

16.11.4. The battery chargers shall be redundant, designed for parallel operation supplying the DC load and maintaining the battery charge. Battery charger accessories shall include, but not be limited to, ground detection, equalize timers, local voltmeter and ammeter, and alarm indication to the plant control system. Each battery charger shall be supplied by separate 480V switchgear buses, one of which is the critical 480V switchgear that can be fed by the emergency diesel generator. The battery chargers shall be sized to restore the battery charge from minimum terminal voltage within 24 hours while powering the specified continuous load. The chargers shall reside in an environmentally controlled room.

16.11.5. The battery shall be a flooded cell lead-acid type. Each battery shall be rated with sufficient capacity to shut down the unit and provide for the unit's DC load profile for a minimum of four (4) hours. The battery shall be designed for a minimum terminal voltage at the end of the duty cycle of 105V. In addition to the specified duty cycle, the battery shall be provided with a 15% design margin, 25% aging factor, and temperature correction for the expected environmental conditions.

16.11.6. The battery shall be located near the chargers, but in a separate area that is ventilated to remove hydrogen gases and environmentally controlled for battery longevity. The battery room shall be equipped with an eye wash station and floor drain.

16.11.7. The battery rack shall be of such a configuration to allow viewing for maintenance the full flooded cell jar height. The rack shall be positioned to coordinate with the battery acid spill containment system.

16.11.8. The main DC switchboard shall be adjacent to the battery room. Additional DC panels may be distributed in various areas of the Plant as required. DC panels shall include blown fuse indication if applicable.

16.11.9. The EPC Contractor shall supply one on-line, solid state (static) or ferro resonant inverter for supplying critical AC loads. The inverter shall be equipped with static transfer switch, manual bypass switch, a regulating bypass transformer for alternate source, distribution panels, and accessories.

16.11.10. Where required by practical design considerations for remote satellite Uninterruptible Power Supplies (UPSs) (in addition to the Owner supplied UPS) shall be supplied to provide the function of the critical power supply system. These satellite UPSs shall be limited in number, emphasizing the preference to utilize the central system. Satellite UPSs do not require the level of functionality of the central critical power supply system however the service to the intended users shall be comparable to the central UPS.

16.11.11. The inverter will be fed from the Project station batteries. The inverter will be current limiting and supply filtered and regulated power not exceeding the necessary limits for Total Harmonic Distortion of the output voltage.

16.11.12. The inverter accessories shall include, but not be limited to, status and alarm indication to the DCS, input/output breakers, and local voltmeters and

ammeters. The alternate source shall be fed from the unit's essential 480VAC switchgear.

16.11.13. The static transfer switch provides a high speed make-before-break transition to the alternate source upon failure of the inverter.

16.11.14. The manual bypass switches are integral make-before-break devices.

16.11.15. If the inverter is taken out of service for maintenance, the connected loads will be fed via the manual bypass switch and the regulating transformer.

16.11.16. The UPS shall feed essential loads such as the Project control system (PCS) primary power supplies and other critical loads.

16.11.17. The core elements of the UPS shall be centrally located in an environmentally controlled room.

16.12. Raceway and Wiring

16.12.1. The function of the raceway system is to provide a support network for electrical cables between various pieces of equipment, devices, and cabinets, and to protect those cables from mechanical damage. The raceway system includes cable trays, conduits, duct banks, junction boxes, raceway accessories, and raceway supports.

16.12.2. Galvanized steel or aluminum expanded metal ladder type cable trays shall be used for bulk raceway where practical. Where required, trays shall have covers to exclude dirt and foreign matter and to shade cables from direct sunlight and where crossing under grating walkways. Peaked covers will be provided on outdoor trays. Covers will be provided where needed for mechanical protection from falling debris, including under grating walkways. Covers will be provided on riser trays (not to be vertically stacked) for the first six feet above grade or platform. Multiple tray systems will be used in order to segregate classes of wiring such as medium voltage power, low voltage power, control, and low-level signal. Where quantity of cable warrants only one tray, metal barriers may be provided to segregate classes of wiring. The cable tray system shall be installed electrically continuous. Open raceway shall not be used in high dust areas to include but not be limited to coal handling and other material handling areas; as well as to accommodate area wash down requirements. Hazardous locations shall have only conduits. For other areas trays with cover would also be acceptable.

16.12.3. Exposed conduit indoors, outdoors, and in all hazardous areas will be rigid metal (RGS or aluminum) conduit. Electrical metallic tubing (EMT) or Type ALS cable may be used only for lighting, maintenance power, and intercommunications circuits in indoor non-hazardous areas. PVC conduit for underground circuits shall be Schedule 40 for encased conduit and Schedule 80 if direct buried using steel long sweep elbows.

16.12.4. Aboveground circuits will be installed in conduit, tray, and free air (e.g., above MCCs, switchgear, load centers, free-standing control panels, instrument racks,

drops to lighting fixtures, and within vaults) in accordance with the National Electric Code (NEC). Allowable fill requirements of the NEC shall be adhered to in the design/routing of circuits through conduit and tray. For packaged mechanical systems when supplier's standard is "open wiring", this may be permitted. In these cases, the cables will have the required mechanical strength to permit that design.

16.12.5. Underground circuits will be installed in direct buried conduit, in un-reinforced duct bank or by direct burial as required by the final design. Underground circuits under roads or heavy haul routes will be in reinforced concrete encased duct bank designed to meet HS-20 loading requirements. Direct buried conduits will be schedule 80 PVC. Direct buried cables will be used only for cable runs to outlying areas for plant and only for those cables not directly associated with plant power production such as lighting. The main underground duct bank design will provide 10% spare ducts between manholes for Owner's future use. Manholes may serve multiple service levels. Cabling in manholes will be separated as required by code. Underground cables can be initially sized (i.e., proposed) on the basis of 90 °C-cm/watt soil thermal resistivity and 20 °C ambient earth temperature, and a concrete thermal resistivity (rho) value of 60 °C-cm/watt; however, site-specific soil and concrete thermal resistivity data will be determined by EPC Contractor testing, and such data is to be used in the underground cable sizing calculations. Furthermore, EPC Contractor underground cable design should be based on the expected dry thermal rho for site soils and a 100 percent load factor.

16.12.6. Flexible metallic conduit shall be used for short extensions not exceeding five feet to equipment subject to movement.

16.12.7. Raceway penetrations of fire rated floors and walls shall be sealed with a material certified to restore the penetration to the rating of the boundary penetrated.

16.12.8. The raceway system will have the following service levels:

a. MV (both 13.8 kV)

b. LV large power (480V and lower, 4/0 AWG and larger)

c. LV power and start/stop control (480V and lower, including DC; cables 2/0 AWG and lower)

d. Instrumentation, analog I/O, 48V digital I/O and data highway

e. Telecommunication/LAN

16.12.9. Medium voltage power cable shall be stranded copper, single/three conductor (Single conductor power cables smaller than 250 kCmil shall not be used, three conductor cables larger than 4/0 AWG shall not be used), rated 90 degrees C with ethylene propylene rubber or cross-linked polyethylene insulation and PVC jacket. Medium voltage power cable above 5000 volts shall be shielded. Insulation level will be 133%.

16.12.10. 600-volt power cables shall be rated 90 degrees C, stranded copper, with ethylene propylene rubber or cross-linked polyethylene insulation. Multi-conductor assemblies shall have an overall PVC jacket. Lighting and convenience power cable may be unjacketed, single conductor, rated 75 or 90 degrees C, stranded copper with thermoplastic insulation. All lighting and convenience power wiring will be enclosed in a completely separate conduit system except when armored sheathed cable (type ALS) is used.

16.12.11. 600-volt control cable will be multi-conductor, color coded, jacketed, rated 90 degrees C, stranded coated copper, with cross linked polyethylene or ethylene propylene rubber insulation and an overall PVC jacket.

16.12.12. 300-volt instrumentation and signal cable shall be single and multiple twisted pairs, individual pair shielded (or overall, for triad), color coded, jacketed, rated 90 degrees C, stranded coated copper conductor, with cross-linked polyethylene or ethylene propylene rubber insulation and an overall PVC jacket.

16.12.13. 300-volt thermocouple extension wire shall be single and multiple twisted pair, shielded, color coded, rated 90 degrees, solid conductors with ethylene propylene rubber or cross-linked polyethylene insulation and an overall PVC jacket.

16.12.14. Inter-communication cable may be of special type as furnished by the equipment manufacturer. Cable shall be totally enclosed in a completely separate conduit system.

16.12.15. Special power and control cable for high ambient areas will be unjacketed, single conductor, stranded coated copper with thermoplastic insulation and rated at 125 degrees C or 200 degrees C as required.

16.13. Lighting and Service Power

16.13.1. The lighting system shall provide personnel with illumination for plant operation under normal conditions in all areas of the plant, means of egress under emergency conditions, and essential / emergency lighting for operations

during a power outage of the normal power source. Emergency lighting for the central control room shall be powered by the main station battery system. Emergency AC lighting for egress and for emergency operations shall be backed up from internal battery packs. Essential lighting supplied by the standby diesel generator shall be provided in selected areas of engine control building to facilitate operator actions. Power used to supply lighting fixtures shall be 120 VAC, 208 VAC, 277 VAC, 480 VAC, 48 VDC, or 125 VDC as determined by the EPC design engineer and approved by the Owner.

16.13.2. Illumination shall be provided in accordance with, at a minimum, current OSHA, State, and local requirements for all exit facilities and means of egress, and for firefighting access. Exit signs shall be illuminated by AC or DC systems. The DC system for these signs may use internal battery packs for backup power and shall be equipped with test switches to verify that the battery is charged.

16.13.3. The system shall provide, as a minimum, lighting intensities at levels recommended by the Illuminating Engineering Society (IES).

16.13.4. The lighting system shall be designed so that portions of the system can be selectively energized during normal plant operation and the remainder can be energized in selected areas on an as-needed basis.

16.13.5. Interior lighting shall be fluorescent or LED technology; color as approved by the Owner (typically 3000 to 3500 K color temperature range). Exterior lighting shall be flood and high mast color-corrected high-pressure sodium or LED.

16.13.6. Exterior lighting shall be designed so as to reduce the transmission of light beyond the plant boundaries via use of directed and cut-off light and various types of luminaries. Photo cells and lighting contactors will control outdoor lighting circuits.

16.13.7. Accessibility for maintenance of lighting fixtures and components shall be incorporated in the overall design.

16.13.8. A 120 VAC maintenance convenience receptacle system powered from the plant 480-volt system shall be provided throughout the facility. Ground fault circuit interrupter (GFCI) type weather protected receptacles are required outdoors and for indoor receptacles located in wash down areas. Where practical convenience receptacles will be located within 100 feet of a process location.

16.14. Electrical Protection Relaying

16.14.1. Nominal secondary current and voltage signals produced by current and voltage instrument transformers for relaying shall be 5 amperes and 120 volts, respectively.

16.14.2. Lockout relays shall be used to receive signal inputs from protective relays and to provide the contacts needed to initiate protective action. All lockout relays shall have a manual reset feature which shall require an operator to manually reset the lockout relay prior to returning the affected equipment to service.

16.14.3. Electrical protection devices shall make use of terminal blocks for connection of field wiring, fuses and test switches for potential circuits, and shorting type test switches for current circuits.

16.14.4. All protective devices that are capable of data telemetry via a data communications interface shall be connected to a protective relaying communications bus which is bridged to the plant control system.

16.14.5. The trip contacts of HV circuit breaker protective schemes shall be wired in series with a single-pole test switch to open trip circuits during in-service testing.

16.14.6. Unit differential current protection relaying shall be provided.

16.14.7. Breaker failure protection relaying shall be provided.

16.14.8. Transmission line differential current protection relaying shall be provided.

16.14.9. Any protection relaying required by interconnecting utility to interconnect the Project (i.e., if not otherwise provided for within the engine generator supplied protections) shall be provided. This protection relaying could include, but not be limited to, transmission line distance relaying, over/under voltage, over/under frequency, etc.

16.14.10. Black Start diesel generator shall be equipped with a multi-function relay of typical configuration and protection functions for the size of generator.

16.14.11. Transformer protection relaying (in addition to electrical protection equipment that is supplied with the transformers) shall include a minimum of the following:

a. Timed and Instantaneous phase over-current

b. Ground over-current

c. Differential current

16.14.12. 480 V Switchgear and MCC incoming breakers shall include the following minimum protection:

a. Timed and Instantaneous phase over-current

b. Main and tie breakers shall be provided with synch-check protective function.

16.14.13. 480 V motor protection shall include timed and instantaneous phase over-current, ground over-current, and thermal overload.

16.14.14. Each combination starter within an MCC which supplies power to a motor shall be equipped with a motor circuit protector (MCP) type molded case circuit breaker for short-circuit protection and solid-state current sensor in the starter to protect motors against overload. Three phase overload elements may also be used in certain applications. Motor starters Size 3 and above shall also be equipped with ground fault protection.

16.14.15. Certain loads shall be fed from MCC feeder circuit breakers. The breakers shall be thermal- magnetic molded case breakers sized to protect supply cable and individual loads.

17.0 Instrumentation and Control System

17.1. General

17.1.1. The instrumentation and control system, referred to as the Project control system (PCS), shall consist of instruments, control devices, programmable logic controllers (PLCs), and various other interconnecting means and interfaces required to control, monitor, alarm, protect, interlock, diagnose, maintain, and safely operate the facility. The integrated Project control system (PCS) shall perform the functions of modulating and discrete control, equipment protection and process interlocking, component diagnostic, unit/process upset analysis, maintenance guidance, and data archiving to meet all operational conditions, assuring a safe, environmentally compliant, and economic operation of the facility.

17.1.2. Project startup, normal operation, shutdown, upsets, and other operation conditions shall be performed by a single operator in the central control room (CCR). The operator shall also be able to perform the above functions manually in the CCR.

17.1.3. The monitoring and management functions shall be highly centralized by means of operator interface stations. The functions of control, protection, and interlock shall be extensively distributed to individual microprocessors or programmable controllers. Interface equipment between the PCS and the control and instrumentation packages of individual equipment shall be integrate all plant areas into one control scheme to enable centralized control from the CCR. The control scheme shall be designed for high reliability, including redundant process control elements for critical systems, to enable the desired degree of automated operation.

17.1.4. Monitoring and control of some relatively independent auxiliary systems may be as self- contained as practical. The systems may be controlled through PLCs with local control panels incorporating a human machine interface (HMI). Important data and control signals along with system diagnostic information shall be sent to the PCS. Local control stations and local HMIs shall be developed consistently based on control system design criteria for improved operation and maintenance.

17.1.5. The fundamental control functions shall be segregated such that failure of one or more functions does not result in the failure of other functions. The control system shall be designed so that no single fault will cause the complete failure of any system, or cause the engine/generator protection system to malfunction or anti-action. Process control element redundancy shall be provided for all parameters that may directly cause a unit safeguard function to activate. Redundancy in the control system structure shall be provided so that no single fault within a control system can cause failure of the controlled equipment, or cause the standby equipment to be unavailable. In case of a failure of in-service equipment, the standby equipment shall start automatically without any system interference. Specific standby components, shall have automatic start field wired to function in parallel with the PCS control.

17.2. Central Control Room

17.2.1. One central control room (CCR) shall be designed for the Project. Incorporated within the CCR shall be PCS operator interface stations, PCS alarm monitors, original equipment manufacturer (OEM) control interface consoles, and other ancillary equipment necessary to achieve the operating philosophy. The control room equipment shall be ergonomically arranged to optimize the human factors operability for centralized monitoring, control, and integrated operating management of the units.

17.2.2. Independent control panels or interfaces shall be provided for Project fire protection and alarming, plant paging communications, plant access control and security, and black start/emergency diesel generator control. Communications equipment shall be integrated into the CCR to allow for ease of operation while maintaining communications with other resources.

17.2.3. The CCR shall be arranged in a manner such that the unit can be operated by a single control room operator. During periods of unit startup, shutdown, and upset conditions, additional personnel may be required. The PCS operator interface station configuration shall allow Project technical staff to perform tuning and control configuration changes via one console in the CCR.

17.2.4. Owner supplied workstations to be located in the CCR include three manufacturers' workstations, one engineering workstation, two manufacturers (historian) workstations, one video server, two standard PC for Owner reporting, and two data acquisition work station.

17.3. Instrumentation

17.3.1. Instrumentation shall be provided as necessary to fulfill the following functions:

a. Pressure transmitters and gauges on inlet and outlet of all flow processes where differential pressure is an indication of performance.

b. Thermocouples and thermometers on inlet and outlet of all flow processes where differential temperature is an indication of performance.

c. Liquid level transmitters and gauges or gauge glasses on tanks.

d. Voltage, current, real and reactive power, and frequency transducers where required for prudent operation and maintenance.

17.3.2. Local plant instrumentation shall be designed to provide information regarding plant operating parameters which are:

a. Necessary for periodic review to monitor equipment performance.

b. Necessary for proper and intelligent operation of any local controls which require that an operator at the local control station be knowledgeable of the parameters being controlled from that local control station.

c. Local audible alarms shall be provided for remote independent systems when warranted for system and personnel safety or system troubleshooting.

17.3.3. Local instrumentation falls into the following categories:

a. Direct reading thermometers and pressure gauges mounted on pipelines or equipment.

b. Direct reading pressure gauges mounted on gauge boards and connected to the point of measurement on pipelines or equipment by tubing.

c. Thermometer test wells mounted on pipelines or equipment.

d. Pressure test connections, either separately connected to pipelines or equipment, or branched off at a gauge board from the pressure sensing line connecting a pressure gauge, switch or transmitter with the pipeline or equipment.

e. Direct reading liquid level glasses mounted on equipment.

17.3.4. Voltage, current and multi-function indication meters.

18.0 GAS CONDITIONING AND DELIVERY SYSTEM

18.1. EPC Contractor Supplied Equipment

18.1.1. EPC Contractor shall supply fuel gas metering equipment and coalescing filter with knock-out tank to meet the engine generator requirements. EPC Contractor shall provide pressure regulating equipment and particle filtration equipment. The EPC Contractor shall design and install a system that meets the technical requirements of the engine generator manufacturer. EPC Contractor shall install piping downstream of the last filter. The Owner- supplied gas pipe isolation valve shall constitute EPC Contractor's point of connection.

18.2. Fuel Gas Flow Requirements

18.2.1. All equipment furnished shall include at least a 10 percent margin for flow.

18.3. Fuel Gas Scope of Supply

18.3.1. The scope of supply for the fuel gas heating system shall include but is not limited to: heaters, piping, valves, controls, drain tanks, expansion tanks, and safety relief valves.

18.4. Materials

18.4.1. All fuel gas piping from the interconnect point to the final filter/separators shall be carbon steel. Piping after the final filter/separator to the engine generator manufacturer's inlet connection shall be stainless steel.

18.4.2. EPC Contractor shall provide a dew point heater for the natural gas. Startup fuel gas conditions are to be 20°F minimum superheat above the dew point. Range

is to be between 85°F to 290°F maximum at inlet to engine, as required by engine manufacturer. EPC Contractor to recommend most efficient style heater for this project.

18.4.3. The gas heater shall have its own self-contained PLC. The outdoor enclosure shall be rated to the ambient conditions in a Class 1, Division 1 environment. The PLC shall include the capability for full remote control and monitoring from the PCS including the gas outlet temperature set point.

18.4.4. All natural gas roof vents shall extend above the peak of the roof.

18.5. EPC Contractor Installation

18.5.1. The natural gas delivery system shall be provided and installed by the EPC Contractor at the Project site to deliver natural gas from the metering station.

18.6. Additional Items

18.6.1. Gas piping systems furnished shall also include the following:

a. Pressure regulation
b. Instrumentation
c. Interconnecting piping
d. Cathodic protection
e. Natural gas filter/strainer/knock out tank/coalescing filter.

19.0 COMPRESSED AIR SYSTEM

19.1. General

19.1.1. EPC Contractor shall provide a service air and instrument compressed air system that meets the engine supplier's compressed air requirements as specified in Appendix C and additionally the requirements of the EPC Contractor provided systems and equipment.

19.1.2. Control of the Compressed Air System shall be from the main control room with local start and stop capability also at a local control panel.

19.1.3. Alarms from the Compressed Air System shall report at a local alarm panel and in the main control room.

19.2. Service and Instrument Air

19.2.1. **Capacity**

a. The service and instrument air supply shall be from three - 50 percent capacity air compressors. The compressors shall be sized for the total combined capacity of the instrument air and service air systems. The system shall be complete with compressor inlet filters, after cooler, one 100-percent ASME code air receiver tank, TEFC motor, controls, automatic condensate trap, piping and valves.

19.2.2. Air Drying/Receivers

a. All air after the compressor(s) shall be directed through two (2) 100-percent twin tower desiccant air dryer. The dryer shall be a regenerative absorption air dryer rated -40° F air outlet dew point complete with pre-filter, after-filter, moisture indicator and regulatory valve. Air receivers shall be provided for both instrument air and service air.

19.2.3. Pressure Regulating Valve

a. The service air system shall have a pressure-regulating valve designed to modulate/close to prevent heavy service air system usage from degrading the instrument /control air pressure.

19.2.4. Dew Point Monitoring

a. The compressed air system shall include a dew-point monitoring system which provides local and remote alarms if dew-point exceeds -40°F. ISA standard quality air shall be provided to instruments.

19.3. Starting Air Compressors

19.3.1. Starting air supply shall be from two - 50 percent capacity air compressors. The compressors shall be sized for the total capacity requirements for the starting air as specified in Appendix
C. The system shall be complete with compressor inlet filters, after cooler, one 100-percent ASME code air receiver tank, TEFC motor, controls, automatic condensate trap, piping and valves.

19.3.2. Starting Air Bottles

a. The EPC Contractor shall provide starting air bottles as specified in Appendix C.

20.0 EFFLUENT WATER DISPOSAL SYSTEM

20.1. General

The waste water system shall be divided into storm water runoff, sanitary waste, and process waste water.

20.2. Storm Water

All storm water collection systems shall be designed so that if evidence of hydrocarbon contamination is noted, flow to the infiltration basin can be intercepted by closing valves to prevent soil contamination.

a. Each oil/water/sand/grit separating drainage tank shall be sized for 110-percent of expected flow during a 100-year, 24-hour storm event.

b. Storm water shall be directed to ditches and/or stabilized vegetated swale(s). The ditches and vegetative swales shall be designed for 120-percent of the expected flow rate from a 100-year, 24-hour storm event from all of the drainage sources.

20.3. Roadways and Paved Areas

20.3.1. Water drainage from the site access roads shall be routed to each side of each road into infiltration trenches designed to accept the anticipated volume of water from a 100-year storm event of 8 inches in a 24-hour period.

20.3.2. Excess water drainage from asphalt parking areas shall be routed to vegetative swale for conveyance off Site.

20.4. Native Soil Area Drainage

20.4.1. All native soil areas must be stabilized with either vegetative cover and/or gravel w/filter fabric underlay to prevent erosion. All drainage, except for contaminated areas shall be surface drainage.

20.5. Ammonia Tank Spill Enclosure

20.5.1. The ammonia tank spill enclosure shall be sized to contain 110-125 percent of the volume of all tanks combined. It shall have a drain isolation valve. Rainwater collection shall be considered in the design of the enclosure.

20.6. Sanitary Waste Water

20.6.1. The sanitary waste shall be the stream from the Project restrooms and kitchen and shall be drained to an on-site septic system. Design will comply with all local and State of Kentucky requirements. EPC Contractor is responsible for obtaining all State and local approvals as applicable for the design and installation.

20.7. Process Waste Water (if needed)

20.7.1. Process water shall discharge to the on-site evaporation pond. EPC Contactor

shall size the evaporation pond based on the worst-case process water discharge and a 100-year, 24-hour rainfall.

20.7.2. The pond shall be sized to evaporate the maximum process water discharge plus a 100-year, 24-hour rainfall without any off-Site discharge.

20.7.3. The evaporation pond shall be lined and shall include a berm around the entire pond and shall comply with design criteria for new surface water impoundments for industrial wastewater facilities.

20.8. Waste Stream Calculations

20.8.1. EPC Contractor shall submit detailed calculations based on the Project equipment and raw water quality. The calculation shall describe each waste stream's characteristics including but not limited to average flow, maximum flow, pH, conductivity, TDS, TSS and mineral content.

21.0 RAW WATER SYSTEM

21.1. General

21.1.1. EPC design should include a tie into available city water & sewer utilities.

22.0 WATER TREATMENT SYSTEM

22.1.1. EPC Contractor shall be responsible for providing a water treatment system that supplies process water which meets the engine supplier's water quality requirements as specified in Appendix G.

22.1.2. A Water Treatment System shall be provided to provide polished water to the radiator cooling system and the Potable Water System. The Water Treatment System shall include polished water transfer pumps, piping, valves, and instrumentation. The system shall be designed for using leased cation, anion, and or mixed bed polishing bottles depending on the raw water quality determined by the EPC Contractor.

22.1.3. The Water Polishing System shall include isolation valves and flanges for tie-in to a trailer mounted reverse osmosis (RO) system.

22.1.4. EPC Contractor shall provide to Owner a list of proposed chemicals that will be used to treat the raw water for Owner's review and approval prior to finalizing the design of the system.

22.1.5. Operation and Controls

a. The Water Treatment System shall be completely automatic such that it can be controlled and monitored from the control room. The entire system shall be automatically and manually controllable from either the control room or locally. The chemicals shall be loaded into feed tanks manually. All chemical feeds shall be controlled from the control room.

b. Audible and visual alarms shall sound in the control room from the PC-based operator station when water chemistry exceeds any of the working requirements. Sample lines shall be provided to collect grab samples for other critical parameters.

c. Feedback from the Project control PCS system concerning water level in the storage tank controls the associated pumps that fill the Polished Water Storage Tank.

d. The system shall be designed for on-off operation based on the Polished Water Tank level.

22.2. Polished Water Storage Tank

22.2.1. The Polished Water Storage Tank shall include Tank level which shall be capable of being monitored in the control room.

22.3. Potable Water System

22.3.1. The potable water system shall use make up from the raw water system. Sand filters and chemical cleanup of the raw water as necessary to meet drinking standards in accordance with State and federal requirements.

22.3.2. Potable water shall be provided to the control room area, kitchens, administration building, restrooms, locker rooms, maintenance area, and warehouse.

22.3.3. The system shall include a 2,000-gallon potable water storage tank, pumps, piping, valves and control system to provide a continuous potable water supply to the users.

23.0 SERVICE WATER SYSTEM

23.1. General

23.1.1. The purpose of the service water system is to supply filtered raw water to the various systems requiring non-potable water at the facility. The service water system shall be sized to supply restroom flushing water, laboratory cooling water, engine generator lube oil cooling water.

23.1.2. The service water system shall incorporate two, 100-percent capacity pumps in a lead-lag control scheme to maintain system wide design pressure under conditions of full flow to all service water supplied systems simultaneously.

23.1.3. Service water system materials shall be specified that are chemically resistant to corrosion. Dissimilar metals shall not be used unless isolated from each other by dielectric fittings. All buried piping shall be buried in fill designed to adequately support buried piping, with adequate compaction and void fill. Piping to be installed under roadways or traffic areas shall be adequately protected from excessive loading or flexing. Alarms shall sound locally and in the control room.

23.1.4. All above grade piping shall heat traced, insulated, jacketed and sealed to prevent freezing or UV deterioration.

24.0 FIRE PROTECTION AND DETECTION SYSTEM

24.1. General

24.1.1. The Project fire protection loop and subsystems shall be designed to NFPA 850 or the Uniform Fire Code as required for personnel and equipment protection. Underground piping shall be constructed of polyethylene and aboveground piping shall be carbon steel. Firewalls or appropriate spacing shall be used for the large power transformers.

24.1.2. EPC Contactor shall develop a hazards list for each area and room to determine the appropriate fire protection for each area/room

24.2. Control Room Fire Protection

24.2.1. Interior finish materials including the suspended ceilings shall be Class A, limited combustible, and have a flame spread rating of 25 or less.

24.2.2. The control room area shall be separated from all adjacent areas by fire barriers with a fire resistance rating of two (2) hours.

24.2.3. Smoke detectors shall be provided in all control room areas. An outdoor air pressurization system shall be provided for the control room area for operation in the event of a fire in the adjacent generation area.

24.3. Engine Hall Fire Protection

24.3.1. Automatic sprinkler protection should be provided in the engine halls on wet-pipe sprinkler systems.

24.3.2. Sprinkler heads shall be FM Approved, non-storage, K-factor 11.2 sprinkler heads.

24.3.3. Sprinkler system design shall be in accordance with FM Global Data Sheet Fire Protection Water Demand and designed based on a hazard category of HC-3. Design shall be based on the maximum roof height of the engine hall.

24.3.4. Engine halls shall be separated from surrounding areas by a minimum 2-hour fire rated wall. All the doors into the halls shall be fire rated in accordance with the wall rating and provided with automatic closures.

24.3.5. Fire detection shall be provided for each engine according to the following:

a. Combination photoelectric and ionization (P/I) detectors.

b. Gas level detectors – one per engine; mounted in ceiling above the engine and interlocked to shut down the unit and shutoff the unit's fuel supply.

c. Infrared/ultra-violet detector; one per engine; sighted along the engine centerline.

d. Combination fire alarm horn/strobe located in Engine Hall with a signal from the fire alarm control panel.

24.4. Fire Pump House

24.4.1. The fire pump house shall be a single-story, insulated, pre-engineered metal enclosure supported on a reinforced concrete foundation. Roof and wall insulation and facing shall be UL listed, limited combustible, with a flame spread rating of 25 or less.

24.4.2. The fire pump house shall contain one (1) electric motor-driven jockey pump, one (1) electric motor-driven fire pump, and one (1) diesel engine driven fire pump with diesel storage tank, pump controllers, and accessories. Fire water shall be supplied from the Fire Water Storage Tank. The Raw Water Storage Tank shall provide a backup water supply. The building shall be provided with heating and ventilating equipment. The backup diesel powered fire pump shall be provided with a diesel fuel storage tank located inside the enclosure. The design shall be such that no external fuel pump is required to feed the fuel to the engine.

24.4.3. The diesel engine driven fire water pump shall be certified per the requirements of 40 CFR Part 60, Subpart IIII. Owner's approval is required if diesel engine is over 150 horsepower.

24.4.4. Fire barriers shall be provided to separate the diesel driven fire pump and the diesel storage tank from the rest of the building.

24.4.5. Local Authority Review

a. The fire detection and protection system shall be subject to the review and approval of the local authority having jurisdiction.

24.4.6. Owner's Insurance Owner Review

a. The fire detection and protection system shall be subject to the review and approval of the Owner's insurance company.

24.4.7. Fire Hydrant Protection

a. Fire hydrants shall be protected from vehicular traffic if subject to mechanical damage. The means of protection shall be arranged in a manner, which shall not interfere with the connection to or operation of hydrants.

24.4.8. Post Indicator Valve Protection

a. Post indicator valves shall be properly protected against mechanical damage.

24.4.9. Pipe Flushing

a. Underground mains and lead-in connections to building(s), etc., shall be flushed thoroughly before any connection is made to headers and risers inside the building. Velocity for flushing mains shall be according to the NFPA Code.

25.0 EXHAUST SYSTEM

25.1. General

25.1.1. See the DOR for items to be supplied by EPC Contractor. In general, the EPC Contactor scope of work includes but is not limited to:

25.1.2. Structural steel for emissions system work includes:

a. Install casing

b. Install casing insulation

c. Painting of exterior surfaces

d. Engine discharge exhaust stacks

e. Supply and install two (2) cooling air mixing fans, (with inlet air filters) 100% capacity each, adequate to cool the exhaust to suitable temperature entering the catalyst.

f. Supply and install EPA stack test ports in the stacks as required per federal requirements.

g. Supply and install pressure test ports at the inlet to the CO catalyst and at the outlet of the SCR

h. Supply and install cooling air mixing fans

i. Supply and install valves and instruments

j. Supply and install hot dipped galvanized miscellaneous support steel for all items furnished.

k. Supply and install hot dipped galvanized platforms, stairs, walkways, and

ladders as required for emergency egress and routine maintenance and operation of stack ports.

l. Installation of Ammonia injection skid and associated components

26.0 HVAC SYSTEM

26.1. Engine hall HVAC to be designed in accordance with data listed in Wartsila scope of supply.

26.2. General Requirements

26.2.1. The HVAC system design basis for the various facilities shall be as shown in Table 8.

Table 8 HVAC System Design Basis

Location: Hopkins County, KY	**Design Basis (Summer / Winter)**		
Elevation: 430 ft	DB (°F)	RH (%)	Notes
Seasonal Extreme Temperatures	110°F / -20°F	80%	
Seasonal Design Temperatures	105°F / 20°F	40%	
Control and DCS Room	72°F / 68°F	55%	Non-Condensing
IT / Electrical Breaker Room(s)	72°F / 68°F	55%	Non-Condensing
Warehouse:	80°F / 60°F	N/A	Summer: mech ventilation Winter: heating
Maintenance Shop	80°F / 60°F	N/A	Summer: mech ventilation Winter: heating
Office	72°F / 68°F	N/A	
Toilets/Lockers	72°F / 68°F	N/A	Exhaust
Storage Area, Water Treatment Building, Firewater Pump Building	Min. 50°F	N/A	Summer: mech ventilation Winter: heating
Ventilate areas as needed per ASHRAE 62-2008			

26.1.1. The HVAC system shall account for heat loads provided by the engine supplier along with heat loads from the EPC Contractor's equipment. Engine supplier preliminary heat loads are provided in Appendix C.

26.1.2. The engine halls shall be designed to be maintained at 0.25 inches of water positive pressure with respect to atmospheric pressure.

27.0 AMMONIA OFF-LOADING, TRANSFER, STORAGE, AND SUPPLY SYSTEM

27.1. General Requirements

27.1.1. The Ammonia System shall be capable of handling and storing 19 percent aqueous ammonia.

27.1.2. The System shall include truck off-loading; one off-loading transfer pump; one stainless steel storage tank (size TBD EPC Contractor); stainless steel piping and valves, controls; and a vaporization skid.

28.0 FRESH LUBRICATING OIL OFF-LOADING, STORAGE AND TRANSFER SYSTEM

28.1. General Requirements

28.1.1. The New Lubricating Oil System will include truck off-loading (off-loading pump skid is provided by engine supplier), two TBD gallon each fresh oil storage tanks, system dedicated piping, valves, and controls to be provided by the EPC Contractor.

29.0 SERVICE LUBRICATING OIL STORAGE AND TRANSFER SYSTEM

29.1. General Requirements

29.1.1. The Service Lubricating Oil System shall include 2 service oil transfer pumps (provided by engine supplier), two TBD gallon storage tank, system dedicated piping, valves, and controls (provided by EPC Contractor) to transfer lubricating oil from engines for storage during maintenance.

30.0 USED LUBRICATING OIL TRANSFER, STORAGE, AND LOAD-OUT SYSTEM

30.1. General Requirements

30.1.1. The Used Lubricating Oil System shall include truck load-out, one load-out transfer pump (pump provided by engine supplier), 2 used oil transfer pumps, one TBD gallon storage tank, system dedicated piping, valves, and controls for transfer, storage, and load-out of used lubricating oil.

31.0 MAINTENANCE WATER TRANSFER AND STORAGE SYSTEM

31.1. General Requirements

31.1.1. The Maintenance Water System shall include 2 maintenance water transfer pumps, four TBD gallon storage tanks, system dedicated piping, valves, and controls to transfer and store engine cooling water during engine maintenance. The system shall have the capability to transfer cooling water to and from each engine.

32.0 PROJECT SECURITY AND ACCESS

32.1. General

32.1.1. A Project security and access system shall be provided to monitor, control, and record access through the main gate and all access doors in the Project control room. The system shall have the following features:

32.1.2. Installation provisions for owner supplied card-reader controlled access on the main gate and all access doors on all buildings.

32.1.3. Network cable or fiber optic cable depending on distance installed to support owner supplied networked pan-tilt-zoom (PTZ) cameras at each plant entrance gate, the engine halls, and at critical locations around the site.

32.1.4. Physical and cyber security system design must be in accordance with applicable NERC CIP requirements. The Project is to be designed as a Bulk Electric System "Critical Asset" as required in the applicable version of the NERC CIP-002-4 standard.

32.1.5. EPC Bidder to evaluate increased plant cost for 75MW verses 112MW with regard to NERC CIP Compliance.

32.1.6. Segregation and deterministic isolation of data networks.

33.0 START-UP AND TESTING

33.1. Commissioning of EPC Contractor Supplied Systems and Equipment

33.1.1. General

a. EPC Contractor shall furnish all supervision, technical personnel, labor, normal and special test instruments, tools, equipment, spare parts and consumables and materials required to perform the electrical, instrumentation and mechanical checkout and testing of components and equipment to verify the initial operation of the systems and equipment in the EPC Contractor's scope.

b. The EPC Contractor shall perform and successfully complete Commissioning Tests on systems and equipment in the EPC Contractor's scope of supply to demonstrate the safety, operability and reliability of the systems and equipment within specified design limits according to the contract, engineering drawings, documents and specifications. All normal and necessary tests shall be conducted using written test procedures.

33.1.2. Tests

a. The EPC Contractor shall be responsible for testing the equipment and systems within his scope. The tests shall include:

b. Hydrostatic Testing per B31.1, NFPA, etc.

c. System Flushing

d. Vibration and Alignment Testing

e. Grounding System Testing

f. Megger Tests

g. High Pot Tests

h. Generator Step-up Transformer Tests

i. High-Voltage System Equipment Tests

j. Functional Tests of all Controls, Protection Relays and Interlocks

k. Functional tests of all Safety Devices & Alarms (Excluding Rupture Discs

l. Safety Valves

m. AC/DC Motor Tests

n. Battery and UPS Test

o. Switchgear Test

p. Black Start Diesel Generator Testing

q. Control Circuit Checkout

r. Instrument and Loop Calibration

s. Fire protection flow test

t. Deionized Water Quality Test

u. Additional required procedures include:

v. Start-up Program Organizational Procedure

w. Safety Tagging Procedure

x. Confined Space Entry Procedure

y. Boundary Identification & Turnover Procedure

z. EPC Contractor shall support the engine generator supplier in commissioning equipment supplied by the engine generator supplier.

aa. Schedule

bb. The engine generator supplier will provide and maintain the commissioning, startup and testing schedule. The EPC Contractor shall provide input to this schedule. EPC Contractor shall schedule EPC Contractor's scope of work to support the engine suppliers commissioning, startup, and testing schedule.

33.1.3. **Performance Testing**

a. General

b. The EPC Contractor shall be responsible for demonstrating that the all systems in the EPC Contractor's Scope of Work meet the design requirements. The EPC Contractor shall also provide support to the engine generator supplier during provisional and final performance tests which are shown in Tables 9 and 10.

c. Following commissioning and startup, the following test (Provisional Acceptance Tests) shall be conducted at the Project Site to demonstrate compliance with the engine supplier's performance guarantees. Coordination and conductance of the Project Site testing shall the responsibility of the engine generator supplier with support from the EPC Contractor. The engine generator supplier is responsible for meeting the Provisional Acceptance Tests requirements.

d. For all Provisional Acceptance and Final Acceptance Tests the testing tolerance/margins and measurement uncertainties shall be zero (0) percent.

e. All measurement instruments and systems used in Provisional Acceptance Tests and Final Acceptance Tests shall be calibrated prior to beginning the tests and shall have calibration certificates demonstrating calibration.

f. For tests that require more than one test as shown in the table below (with the exception of the Air Emission Compliance Test, the Startup Emission Test, the Oxidation Pressure Drop Test, and the Oxidation Catalyst Inlet Temperature Range Test), the results can be averaged together to

determine the final result so long as the trend from the first test to the last test for each test does not show a steady decline in performance.

g. Provisional Acceptance Tests shall be adjusted to Summer Design Conditions. Table 9 provides a list of Provisional Performance Tests that will be performed by the engine generator supplier.

Table 9 Provisional Performance Tests

Test	Number of Repeat Tests	Test Duration for Each Test	Comments
Electrical Output (each engine gen set) with necessary auxiliaries in operation	1	4 hour	Shall be conducted concurrently with Net Heat Rate Test and Air Emissions Test
Net Heat Rate (each engine gen set) with necessary auxiliaries in operation	1	4 hour	Shall be conducted concurrently with Net Electrical Output Test and Air Emissions Test
Air Emission Compliance (each engine gen set)	1	4 hour	Shall be conducted concurrently with Net Electrical Output and Net Heat Rate Tests
Warm Startup time to air emission compliance (each engine gen set)	3	Need to reach within guaranteed time	
Warm Startup time to full electrical load (each engine gen set)	3	Need to reach within guaranteed time	
Hot Startup time to air emission compliance (each engine gen set)	3	Need to reach within guaranteed time	
Hot Startup time to full electrical load (each engine gen set)	3	Need to reach within guaranteed time	
Minimum Turndown Test (Each engine gen set)	3	NA	
Frequency Response each engine gen set	1		Must meet requirements for maximum droop and frequency dead-band

Noise limit (each engine gen set)	1	NA	
Noise limit (Each radiator)	1	NA	
Startup Air Emission Compliance	3	NA	
Oxidation catalyst pressure drop across oxidation catalyst	1	4 hour	To be conducted at the same time as air emission compliance test
Oxidation catalyst inlet temperature range	1	4 hour	To be conducted at the same time as air emission compliance test

33.1.4. Final Tests to be adjusted to Summer Design Conditions. Net plant electrical output and net plant heat rate shall include balance of plant auxiliary loads which will be provided by the construction contractor.

Table 10 Final Tests

Test	Number of Repeat Tests	Test Duration for Each Test	Comments
Plant Availability	1	120 hours	
Far Field Noise	1	NA	
All Engines Synchronized to Grid at 100% power output	3	1 hour	Shall be conducted concurrently with Net Heat Rate Tests

34.0 PROJECT TURNOVER

34.1. General

34.1.1. The EPC Contractor shall establish system turnover boundaries and provide a turnover package for each Project system within the EPC Contractor's scope.

34.2. Turnover Package

34.2.1. The turnover packages shall include the following:

a. System Turnover Forms

b. System Turnover Punch List

c. Electrical Checkout Verification Drawings

d. Instrument Device Calibration Records

e. Instrument Loop Calibration Records

f. System P&IDs Marked Up As-Built

g. All Mechanical Test Data Sheets

h. All Electrical Test Data Sheets

i. Alignment and Lubrication Record Sheets

j. Chemical Cleaning and Flushing Reports

k. Vendor Inspection and Test Records

l. Vibration Data Record Sheets

m. Instrument Set Point Documents

35.0 TRAINING & PROCEDURES

35.1. General

35.1.1. The EPC Contractor shall provide a training program procedures for operating and maintenance personnel for the systems provided by the EPC Contractor. The EPC Contractor shall conduct training classes over a one-week period to familiarize personnel with each of the various operating systems, the major equipment and control systems.

35.2. Training Topics and Program

35.2.1. The following general topics shall provide the basis for training:

a. Introduction

b. Basic Theory of Operation

c. Equipment

d. System Description and Operation

e. Control System

f. Safety Systems

g. Start-up/Shutdown

h. General Maintenance

35.2.2. The EPC Contractor shall employ on-the-job training by using the Owner's Project operators as part of the system checkout and commissioning activities.

35.3. Procedures

35.3.1. EPC will develop procedures for all plant systems.

36.0 MAINTENANCE AND SPARE PARTS

36.1. General

36.1.1. The EPC Contractor shall provide, receive, store, and distribute start-up spare parts, materials, test equipment, instruments, tools, and consumables required for start-up and operation of the systems and equipment within his scope until turnover to the Owner. The EPC Contractor shall provide one set of special tools, test instruments and computer programs, as applicable, required for operation and maintenance of the systems and equipment within his scope.

36.1.2. The EPC Contractor shall provide all lubricants, fluids, and chemicals for chemical cleaning for his systems. This includes the initial charge and subsequent operational and maintenance requirements of all Project equipment until turnover to the Owner.

37.0 CONSTRUCTION

37.1.1. Construction Noise

a. The EPC Contractor shall maintain noise during construction within local ordinance requirements for day work.

b. Night construction will only be allowed if approved by the Owner. Noise generated during night time construction shall be maintained within local ordinance requirements.

37.1.2. Liquid and Solid Waste

a. The EPC Contractor shall be responsible for prompt removal of liquid and solid waste from construction activities and shall maintain good housekeeping and safe conditions. This includes oil used during construction, oily rags, any hazardous waste, including chemical cleaning waste, and water used to flush and hydrostatically test piping and vessels. Waste shall be disposed in accordance with State and federal requirements.

b. Prior to disposal of any RCRA hazardous waste, EPC Contractor shall coordinate with Owner for proper disposal.

37.1.3. Hazardous Materials

a. EPC Contractor shall manage and dispose of all hazardous materials in accordance with local, State, and Federal requirements.

37.1.4. Explosives

a. Explosives are not allowed on the Project Site.

38.0 SAFETY

38.1. General

38.1.1. Safety is a critical component of the successful implementation of this Project. The EPC Contractor shall be responsible for developing a written safety program and policies to provide safe working conditions and methods during construction of the Project. EPC Contractor's personnel and Subcontractors shall be trained in these procedures.

39.0 DIVISION of RESPONSIBILITIES

39.1.1. Refer to KYMEA RFP No. 2023-3 Attachment 1 – Division of Responsibilities