REQUEST FOR PROPOSALS AND STATEMENT OF QUALIFICATIONS

FOR THE PRE-SELECTION OF A

UV DISINFECTION SYSTEM

For the Oak Creek Water and Sewer Utility

2016 Water Treatment Plant Improvements Project

Prepared By:

CH2MHILL®

JANUARY 2015

For Information Regarding This Project, Contact: Tony Myers, CH2M HILL, 135 S. 84th Street, Suite 400, Milwaukee, WI 53214, Phone: (414) 847-0238, Email: Tony.Myers@ch2m.com

OAK CREEK WATER AND SEWER UTILITY

OAK CREEK, WISCONSIN

REQUEST FOR PROPOSALS
AND
STATEMENT OF QUALIFICATIONS

For the Pre-Selection of a

UV DISINFECTION SYSTEM

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JANUARY 2015

Project No. 653463

SECTION 00 11 15
PROPOSALS AND STATEMENT OF QUALIFICATIONS

Sealed proposals and statement of qualifications for the 2016 Oak Creek Water Plant Treatment Improvements Project, UV Disinfection System, addressed to the Oak Creek Water and Sewer Utility, 170 W. Drexel Ave., Oak Creek, WI 53154, will be received at the office of the Oak Creek Water and Sewer Utility, (Owner), until 2:00 p.m., local time, on the 6th day of February, 2015. Any Proposals received after the specified time will not be considered. The cost of the UV system will then be publicly opened and read aloud.

Proposal envelope to: 1) identify project, 2) identify bidder, and 3) be marked "PROPOSAL AND STATEMENT OF QUALIFICATIONS." Proposal envelope not properly marked will be cause for rejection. Project is identified as:

PRE-SELECTION OF A
UV DISINFECTION SYSTEM
FOR THE OAK CREEK WATER AND SEWER UTILITY
2016 WATER TREATMENT PLANT IMPROVEMENTS PROJECT

Proposals and statement of qualifications shall include required forms furnished by the Owner in the Request for Proposals and Statement of Qualifications (RFP-SOQ). Paper copy or electronic PDF file of the RFP-SOQ must be requested through the Owner's Engineer: CH2M HILL, 135 S. 84th Street, Suite 400, Milwaukee, WI, 53214, Attn: Sharon Laurent, (414) 847-0231, Sharon.Laurent@ch2m.com. Paper copies may be picked up at the CH2M HILL office between 8am and 3pm, Monday through Friday. Limit one (1) paper copy and one (1) electronic copy per bidder.

Address correspondence to:

CH2M HILL
Attn: Sharon Laurent
135 S. 84th Street, Suite 400
Milwaukee, WI 53214

No proposal shall be received unless accompanied by a certified check or a bid bond equal to five percent of the cost of the UV System (Item A1 in the Bid Form), payable to the Oak Creek Water and Sewer Utility as a guarantee that if the proposal is accepted, the bidder will execute and file the proper contract and bond with the Installing Contractor. If the bidder fails to file such contract and bond within the time set by the Owner, the check or bid bond shall be forfeited to the Owner as liquidated damages.

In order to perform public work, Successful Bidder and Subcontractors prior to contract award shall hold or obtain such licenses and registrations as required by State Statutes and Codes, and federal and local Laws and Regulations.

Bidders are required to comply with requirements of WSA 111.321 concerning discrimination in employment.

For information concerning the proposed Work, contact Tony Myers at CH2M HILL, email Tony.Myers@ch2m.com or telephone 414-847-0238.

For an appointment to visit the Site, contact Mr. Pat Francis at the water plant, telephone 414-768-7060.Site visits will be scheduled on Wednesdays, during the Bid period.

Owner's right is reserved to reject all Bids or any Bid not conforming to the intent and purpose of the Bidding Documents.

Dated this ____ day of _____, 20_____.

OAK CREEK WATER AND SEWER UTILITY

By _____
Ron J. Pritzlaff, P.E.
Utility Engineer

END OF SECTION

SECTION 00 11 57

REQUEST FOR PROPOSALS AND STATEMENTS OF QUALIFICATIONS

Oak Creek Water and Sewer Utility
UV Disinfection System

1. INTRODUCTION

The Oak Creek Water and Sewer Utility (Owner) is advertising this Request for Proposals and Statements of Qualifications for qualified Suppliers to furnish and deliver the following equipment: UV Disinfection System (UV System) suitable for potable water disinfection for installation at the existing Oak Creek Water and Sewer Utility Water Treatment Plant.

Unless otherwise specified, the Supplier shall be responsible for the provision of all engineering, labor, equipment, and materials as required for the manufacture, provision and delivery of a fully functional UV System as described in these Specifications. It is anticipated the UV System will be purchased by the Installing Contractor selected separately by the Oak Creek Water and Sewer Utility, to construct the 2016 Water Treatment Plant Improvements Project.

2. PRIMARY PROJECT CONTACT

Ron J. Pritzlaff, P.E.
Utility Engineer
Oak Creek Water & Sewer Utility
170 W. Drexel Avenue
Oak Creek, WI 53154
rpritzlaff@water.oak-creek.wi.us
(414) 570-8200 x24
(414) 570-8215 (fax)

Tony Myers, P.E.
Senior Project Manager
CH2M HILL
135 S. 84th Street, Suite 400
Milwaukee, WI 53214
Phone: (414) 847-0238
Email: tony.myers@ch2m.com

3. UTILITY PRE-SELECTION PROCESS

Selection and execution of any agreement for equipment and services will be accomplished in accordance with the Owner's policies and procedures. The Owner will pre-select the UV system which best serves the interest of the Owner long-term with consideration for the proposed UV System that meets all the specifications, meets the minimum experience requirements, has a competitive net present value estimation, minimizes capital expenditures on ancillary building and electrical systems, and offers the most long term benefits/flexibility to the Owner. It is anticipated the UV System will be purchased by the Installing Contractor selected separately by the Owner for the construction of the 2016 Water Treatment Plant Improvements Project.

3.1. Instruction for Responding Suppliers

1. Review the Request for Proposals and Statement of Qualifications in its entirety and become familiar with its contents. Incomplete or incorrect responses or proposals may be discounted or disqualified.

2. Specifications are attached hereto. All responses must be specific and directly related to the project's Specifications.

3. Responding Suppliers must respond to all items and include any additional material required by this Request for Proposals and Statement of Qualifications.

4. Additional information may be requested from the Suppliers during the Bid Evaluation period.

5. The Owner shall not be liable for any cost incurred by any Supplier in response to this solicitation or any requests for information from the Owner or Engineer as defined in General Conditions.

6. The Owner expressly reserves the right to reject any and all proposals and to not enter into agreement with the Supplier, if the Owner determines, in its sole judgment that such action is in the Owner's best interest.

7. Refer to 00 72 10, General Conditions for a list of definitions and acronyms used in this Request for Proposals and Statement of Qualifications.

3.2. Submittals

To be considered, respondents must deliver Proposal to the address stated herein on or before the deadline, and in the number of copies indicated below.

1. PROPOSAL DEADLINE: As shown in the Advertisement. Proposals not received by the deadline, regardless of cause, will not be considered.

2. SUBMIT PROPOSALS TO:

   Ronald J. Pritzlaff, P.E.
   Utility Engineer
   Oak Creek Water and Sewer Utility
   170 West Drexel Avenue
   Oak Creek, WI 53154

3. MARK PROPOSALS AS FOLLOWS:

   Project:

   PRE-SELECTION OF A
   UV DISINFECTION SYSTEM
   FOR THE OAK CREEK WATER AND SEWER UTILITY
   2016 WATER TREATMENT PLANT IMPROVEMENTS PROJECT

   Bidder:

   Name and address of the Bidder

   Proposal and Statement of Qualifications

   Due Date: *As listed in Advertisement*

4. REQUIRED COPIES OF SUBMITTALS: Five (5) copies.

3.3. Requests for Information

Any Supplier with questions, exceptions, objections, qualifications or clarifications on the technical requirements and content of this Request for Proposals and Statement of Qualifications must submit them in writing to both of the primary project contacts. Acceptable formats for question submission shall include E-mail and Letter. E-mail with return confirmation is the preferred method.

The project contacts will compile these questions and periodically distribute summaries of the submitted questions and responses by Addendum to all Suppliers under consideration for this project. The Addenda distributed to the Suppliers will be done via E-mail. The final date for submitted questions shall be five (5) working days before the proposal due date. All addenda will be incorporated into the final Request for Proposals and Statement of Qualifications.

3.4. Assignment of Contract

The Work hereunder will be assigned by the Owner to an Installing Contractor at the time the construction contract (under which the equipment and materials specified herein will be installed) is executed.

In the application of the terms and conditions of these Contract Documents after the Work has been assigned to the Installing Contractor, Supplier shall function as a subcontractor or a supplier to the Installing Contractor and all obligations of Supplier to the Utility shall, after assignment, become obligations of Supplier to Installing Contractor.

Risk of loss as it relates to the equipment and materials provided hereunder shall be borne by Supplier until delivery to the project site and acceptance by the Installing Contractor, and thereafter shall be borne by the Installing Contractor until final acceptance by the Owner.

3.5. Bid Security

Proposals must be accompanied by bid bond, or a certified check in an amount of 5 percent of the cost of the UV System (Item A1 of Bid Form) payable to the Oak Creek Water and Sewer Utility. This bid security shall be given as a guarantee that the Bidder will not withdraw his Proposal for a period of 365 days after bid opening, and that if selected for the Work, the successful Bidder will execute a subcontract with the Installing Contractor within that period of time.

3.6. Selection of Supplier

Within 30 calendar days after the opening of Proposals, the Owner will select one of the Proposals in accordance with Section 6 – Proposal Evaluation. The selection of the Proposal will be by written notice of selection via electronic or paper mail to the office/location designated in the Proposal from the UV Supplier. In the event of failure of the selected Supplier to sign an agreement to supply the proposed UV System to the Owner’s Installing Contractor, the Owner may select the second ranked responsible Supplier. Selection of the Proposal does not guarantee assignment to the Installing Contractor.

3.7. Return of Bid Security

Within 30 days after selection of Supplier, the Owner will return the bid securities to all Bidders whose Proposals are not to be further considered in selecting the Work. All other retained bid securities will be held until the subcontract with the Installing Contractor has been finally executed, after which all bid securities, other than Bidders' bonds and any guarantees which have been forfeited, will be returned to the respective Bidders whose Proposals they accompanied.

3.8. Failure to Execute Subcontract

It is anticipated the UV System will be purchased by the Installing Contractor selected by the Owner. The selected Supplier who fails to promptly and properly execute a subcontract with the Installing Contractor shall forfeit the bid security that accompanied his bid, and the bid security shall be retained as liquidated damages by the Owner, and it is agreed that this said sum is a fair estimate of the amount of damages the Owner will sustain in case the Supplier fails to enter into a subcontract with the Installing Contractor.

3.9. Performance Bond

The Supplier whose bid has been accepted will be required to furnish a bond in the amount of One Hundred percent (100%) of the total bid amount listed in Item A4 on the Bid Form within three (3) business days from the date of the service of a notice to that effect, delivered to it or them in person, or mailed to the address given in the bid. In the case of failure to do so, it or they will be deemed to have abandoned the contract, and the amount of the bid bond made by it or them will be forfeited to and retained by the Oak Creek Water and Sewer Utility as liquidated damages for such failure, but if it or they shall execute the contract and bond within the time aforesaid, the amount of its or their bid bond will thereupon be returned to him or them.

4. SCOPE OF SERVICES

Services of the Supplier shall include, but not necessarily be limited to, those described in the Specifications. Cost of these services shall be included in the capital cost in Section 00 41 13, Bid Form in Item A1.

5. PROPOSAL CONTENT

Suppliers wishing to offer their equipment and services must submit Proposals and Statements of Qualifications to the Owner to be considered. The proposal must contain the following information.

5.1. Acknowledgment of Terms and Conditions

The Proposing Supplier shall acknowledge and accept all terms and conditions contained in the Request for Proposals and Statement of Qualifications and its attachments. Any exceptions or qualifications must be submitted in writing prior to Proposal submission, as described in Section 3.3 – Requests for Information. Any exceptions of the bid not addressed by Addenda could result in disqualification of the proposal if, in the judgment of the Owner or its Engineer, the exception does meet the intent of the terms and conditions contained in the Request for Proposals and Statement of Qualifications and its attachments.

Complete the Non-Collusion Affidavit provided in Bid Form Supplement.

5.2. Compliance with General Criteria

General criteria regarding proposal content is defined below:

1. Refer to Specification, 44 44 73, UV Disinfection System, for the required UV System to be provided by the Supplier. Supplier Proposals shall address the items listed in all specification sections. Suppliers should note that it is suggested that the Proposals be presented in such a manner as to allow the reviewer to expeditiously learn the key features of the Supplier's system. Concise answers to all questions are desired.

2. Suppliers may submit multiple proposals with different UV Systems. Each proposal shall be a stand-alone document meeting all the requirements of this Request for Proposals and Statement of Qualifications.

3. Proposals without sufficient submittal data to provide a complete evaluation will not be considered.

4. Use of information provided: The Supplier shall agree that any and all information provided in the Proposal shall serve as the basis for evaluation of Proposals and all or portions of the proposal can be shared with any approving agency.

5. Selection of Supplier does not constitute approval of any materials or deviations from the Specifications.

6. Each Supplier is required to describe and provide details on their proposed product and services for the Owner.

7. The Supplier shall present any objections or exceptions to any provision of this Request for Proposals and Statement of Qualifications and its attachments not addressed by Addenda.

8. UV System must fully meet all State of Wisconsin code requirements and also meet all state and federal regulatory requirements for the disinfection of filtered surface water for a municipal potable water supply.

9. Any deviation from Specification, 44 44 73, UV Disinfection System MUST be noted in detail, and submitted in writing and attached to the Bid Form. Completed specifications should be attached for any substitutions offered, or when amplifications are desirable or necessary. The absence of the specification deviation statement and accompanying specifications will hold the Supplier strictly accountable to the specifications as written herein. Failure to submit this document of specification deviation, if applicable, shall be grounds for rejection of the item when offered for delivery. If specifications or descriptive papers are submitted with Proposals, the Supplier's name should be clearly shown on each document.

5.3. Compliance with Technical Specifications

The following table summarizes the technical information to be provided in the Proposal to indicate compliance with the Specifications, 44 44 73, UV Disinfection System. Failure to provide technical information regarding the proposed UV System may result in rejection of the Submittal from further consideration and evaluation.

Section 44 44 73 Paragraph Reference	Description
1.03 A.1	List mechanical components of UV system, including control panels, PLCs, HMIs and automatic cleaning system components.
1.03 A.2	Detailed UV reactor information including make/model, pressure rating, flange size, headloss curve, min/max validated and allowable flow rate, min/max validated and allowable UVT, min/max RED, min/max log inactivation, reactor support requirements, quantity/location of UV lamps and intensity sensors, cooling water requirements, lamp cool-down/warm-up requirements, and air-release/drain line connection details.
1.03 A.3	Provide summary calculations to show compliance with the minimum required UV dose MS2 RED basis at the worst-case design conditions that were utilized as the basis for the capital sizing of the UV System. Include the estimated action spectra correction factor (ASCF) based on latest published validation test results and UV reactor CFD modeling or lookup tables following 2014 WRF Guidance. Provide letter and/or executive summary of validation report identifying the dates validation testing was completed. The full validation report is not required to be submitted with proposal.
1.03.A.4	Provide maximum flowrate capacity for an individual UV reactor to achieve 2-log virus inactivation at 90%, 92.5%, 95%, and 97.5% UVT, including estimated ASCF based on 2014 WRF Guidance.
1.03.A.5, 1.03.A.6	Drawings showing plan layout, cross-sections, dimensions, critical clearances, installation requirements, and all interconnections and interface requirements (power, controls, instrumentations, etc.). Identify separately-mounted components, connections to other work, critical clearance requirements, interconnections and interface requirements, and the validated hydraulic configuration. Provide all UV Equipment weights (dry and wet) and equipment anchoring criteria for design of structural support by Engineer.
1.03.A.7. 1.03.A.8	Summary of UV System control strategy including UV dose equation or calculations as a function of flow, UVT, Validation Factor, target organism inactivation, lamp age/sleeve fouling factors, and action spectra correction factor. Provide graph or table of min/max RED as a function of flow, UVT, S/So, and ballast intensity. Detailed description of instrumentation and control system, including a list of all functions monitored, controlled, and alarmed.

Section 44 44 73 Paragraph Reference	Description
1.03.A.9	Input power voltage, frequency, and phase requirements, total system maximum power load, power quality thresholds, and ballast turndown capabilities. Include estimated heat load generated by each power/control panel at maximum power draw.
1.03.A.13	Complete description of the automatic lamp sleeve cleaning process and its maintenance requirements.
1.03.A.14	Complete description of UVT analyzer. Include operation and maintenance requirements, spare parts, layout diagram, and interconnection piping and electrical requirements.
1.03.A.16	Provide 3rd-party end of lamp life certification to support values used in Bid Form calculations (if applicable).
1.04, 2.11	Provide list of spare parts and safety equipment provided.
3.08, 3.09	Provide list of UV Supplier support during design, testing, and start-up phases of project.

5.4. Compliance with Mandatory Experience Criteria

Failure to comply with any of these mandatory experience criteria may result in rejection of the Proposal from further consideration and evaluation.

1. UV System proposed meets performance criteria of the Technical Specifications and all federal and State of Wisconsin code and regulatory requirements.

2. Experience of Supplier. The Supplier shall have a minimum of 5 years' experience in the design, fabrication, assembly, and operation of equipment that is the same size and model to that specified. The Supplier must have a minimum of 5 similar operating public utility drinking water systems in North America. Similar systems shall use the same model equipment (may be a different number of lamps). Minimum facility treatment capacity with similar equipment to be counted towards experience is 20 mgd. Provide 10-year experience list for similar systems. Include facility location, installation date, treated flow rate, validation approach, and number of reactors provided at each facility.

3. References. Provide references from three similar operating public utility drinking water systems in North America, including the contact's name, company, title, address, telephone number, and email address. At least one system needs to be running for a minimum of 5 years.

4. System proposed shall be completely functional and operable within specified design conditions, as identified in Request for Proposals and Statement of Qualifications Part 4 - Specifications.

5. System proposed shall be fully compliant with the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and the guidelines of the 2006 Ultraviolet Disinfection Guidance Manual (UVDGM).

5.5. Project Cost

For purposes of consistent evaluation, the Utility requires that all Suppliers present their costs in the same format. **Project Costs shall be submitted in the Bid Form included in Part 1 of this Request for Proposals and Statement of Qualifications, Section 00 41 13.** If Supplier is selected for further negotiation with the Owner, this Bid Form will be used as the basis for negotiations.

1. The contract for services requested by this Request for Proposals and Statement of Qualifications shall be administered using procurement regulations of the Owner.

2. By signing the **Bid Form** (**00 41 13)** the Supplier certifies that if selected the Supplier will sign the Agreement provided in the Request for Proposals and Statement of Qualifications.

5.6. Supportive Information (as Appendix to Proposal)

Submittal of this information is optional and may include graphs, charts, photos, resumes, firm profiles, etc. Information included in the supportive information section will be considered in the evaluation of the submittals. The Owner requests that respondents keep this section brief and relevant.

6. PROPOSAL EVALUATION

The UV Supplier and equipment pre-selection will consider the following factors:

1. Compliance with technical specifications and minimum experience criteria, as specified in Section 5 – Proposal Content.

2. Non-monetary and monetary criteria as listed below.

Non-Monetary criteria included in the UV System Proposal, including:

1. Electrical requirements.

2. Size/layout of system.

3. UV system operating characteristics.

4. Flexibility to accommodate future higher flowrates and virus disinfection requirements.

5. Service network, experience and location of technicians.

6. Past performance and references.

Monetary criteria included in Section 00 41 13, Bid Form, will be considered, including:

1. Capital cost of the initial UV System equipment, as submitted in Section 00 41 13, Bid Form Item A1.

2. Estimated capital cost of the future UV System expansion, as submitted in Section 00 41 13, Bid Form Item A2.

3. Estimated operating and maintenance costs, as submitted in Section 00 41 13, Bid Form Item A3 and A4.

4. Estimated net present value (NPV) as tabulated in Section 00 41 13, Bid Form Item A5.

It is the intention of the Owner that the UV System pre-selection will be based on compliance with the technical specifications, mandatory experience criteria, project references, capital and operating costs, and UV system characteristics.

The Owner reserves its right to reject any and all Proposals, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Proposals. The Owner further reserves the right to reject the Proposal of any Supplier whom it finds, after reasonable inquiry and evaluation, to be nonresponsive. The Owner may also reject the Proposal of any Supplier if the Owner believes that it would not be in the best interest of the Owner to make an award to that Supplier.

In evaluating Proposals, the Owner will consider whether or not Proposals comply with prescribed requirements, and such alternatives, unit prices and other data, as may be requested in Proposal Form or may be requested from Suppliers prior to a Notice of Award.

In evaluating Proposals, the Owner will consider the qualifications of the Suppliers and their proposed UV reactor models.

The Owner may conduct such investigations it deems necessary to establish responsibility, qualifications, and financial ability of Supplier’s proposed subcontractors, suppliers, individuals, or entities to furnish parts of Goods and Special Services in accordance with the Request for Proposals and Statement of Qualifications. Supplier references will be contacted

and poor performance on operation, maintenance and support Services can disqualify a proposer from award.

The Owner's evaluation results will be final. The Owner is not obligated to further explain or clarify the evaluation results.

7. PROPOSED PROJECT SCHEDULE

The UV System will be pre-selected by the Owner in advance of final design of the project. The project will be designed to accommodate the pre-selected UV system which will be installed by the Installing Contractor. The schedule below provides a general guideline for the project but does not constitute contractually binding dates. Milestone and equipment delivery dates will be negotiated between the Supplier and Installing Contractor. The dates included in the schedule above should be used as a basis for the purposes of preparing the bid. The Supplier will be responsible for coordinating Work activities with the Installing Contractor at that time.

Proposal Due Date/Bid Opening	As stated in Advertisement
Estimated date of Proposal Selection	February 16, 2015
Estimated Installing Contractor Construction Contract Award	October 15, 2015
UV Equipment Submittals Due	2-3 months after Construction Contract Award
Delivery of UV System	6-8 months after Construction Contract Award
Substantial Project Completion	March, 2017
Final Project Completion	July, 2017

END OF SECTION

SECTION 00 21 14
BIDDER'S CHECKLIST

I. GENERAL:

Bidders are advised that notwithstanding any instructions or implications elsewhere in this Request for Proposals and Statements of Qualifications the documents shown and detailed on this sheet need be submitted with and made part of their bid. Other documents may be required to be submitted after bid time, but prior to award. Bidders are hereby advised that failure to submit the documents shown and detailed on this sheet may be justification for rendering the bid nonresponsive.

II. REQUIRED DOCUMENTS FOR BID:

The checklist provided below is for assistance in compiling the bid proposal. A detailed description of all items required in the bid package is provided in Section 00 11 57, Request for Proposals and Statements of Qualifications.

_____ Completed Bid Form (Section 00 41 13).

_____ Erasures or other changes made to the Bid Form must be initialed by the person signing the bid.

_____ Non-collusion Affidavit.

_____ All addenda issued shall be acknowledged in the space on the Bid Form.

_____ Bid Bond or certified check shall be submitted with the bid in the amount indicated.

_____ Manufacturer's Experience and 3 References.

_____ UV System Technical Information Required with Proposal.

_____ 3rd Party Certification for end of lamp life aging and quartz sleeve fouling factors (if used).

_____ Completed UVDGM Checklists (Supplement to this Section).

_____ Supporting Information (Optional).

END OF SECTION

Checklist 5.1 UV Reactor Documentation (Page 1 of 2)

Does UV reactor documentation contain the following elements?

Yes	No	
		General
☐	☐	Technical description of the reactor's UV dose-monitoring strategy, including the use of sensors, signal processing, and calculations (if applicable).
☐	☐	Dimensions and placement of all wetted components (e.g., lamps, sleeves, UV sensors, baffles, and cleaning mechanisms) within the UV reactor.
☐	☐	A technical description of lamp placement within the sleeve.
☐	☐	Specifications for the UV sensor port indicating all dimensions and tolerances that impact the positioning of the sensor relative to the lamps. If the UV sensor port contains a monitoring window separate from the sensor, specifications giving the window material, thickness, and UV transmittance should be provided.
		Lamp specifications
☐	☐	Technical description
☐	☐	Lamp manufacturer and product number
☐	☐	Electrical power rating
☐	☐	Electrode-to-electrode length
☐	☐	Spectral output of new and aged lamps (specified for 5 nm intervals or less over a wavelength range that includes the germicidal range of 250 – 280 nm and the response range of the UV sensors)
☐	☐	Mercury content
☐	☐	Envelope diameter
		Lamp sleeve specifications
☐	☐	Technical description including sleeve dimensions
☐	☐	Material
☐	☐	UV transmittance (at 254 nm for LP and LPHO lamps, and at 200 – 300 nm for MP lamps with germicidal sensors)
		Specifications for the reference and the duty UV sensors
☐	☐	Manufacturer and product number
☐	☐	Technical description including external dimensions
☐	☐	Data and calculations showing how the total measurement uncertainty of the UV sensor is derived from the individual sensor properties. (See Table D.1 for an example of the calculation of UV sensor measurement uncertainty from the uncertainty that arises due to each UV sensor property.)

Checklist 5.1 UV Reactor Documentation (Page 2 of 2)

Does UV reactor documentation contain the following elements?

Yes	No	
		Sensor measurement properties
☐	☐	Working range
☐	☐	Spectral and angular response
☐	☐	Linearity
☐	☐	Calibration factor
☐	☐	Temperature stability
☐	☐	Long-term stability
		Installation and operation documentation:
☐	☐	Flow rate, head loss, and pressure rating of the reactor
☐	☐	Assembly and installation instructions
☐	☐	Electrical requirements, including required line frequency, voltage, amperage, and power
☐	☐	Operation and maintenance manuals that include cleaning procedures, required spare parts, and safety requirements. Safety requirements should include information on electrical lockouts, eye and skin protection from UV light, safe handling of lamps, and mercury cleanup recommendations in the event of lamp breakage.

5.11.2 Validation Test Plan

A validation test plan should document the key components of UV reactor testing. Recommended components of a validation test plan are provided in Checklist 5.2. This list is not meant to be all-inclusive; engineers should document any factors they believe are important for validation testing in their Validation Test Plan.

Checklist 5.2 Key Elements of the Validation Test Plan (Page 1 of 1)

Does the validation test plan contain the following elements?

Yes	No	
☐	☐	Purpose of Validation Testing. General description of why the tests are being done and how the data will be used.
☐	☐	Roles and Responsibilities. Key personnel overseeing and performing the full-scale reactor testing and collimated beam testing, including their qualifications. This section should include contact names and telephone numbers.
☐	☐	Locations and Schedule. Location for conducting full-scale reactor testing and collimated beam testing. Planned schedule for conducting the tests and performing the data analyses.
☐	☐	Challenge Microorganism Specifications. Specifications for the challenge microorganism to be used during validation that include the protocols required for growth and enumeration, the expected UV dose-response, and suitability for use in validation testing.
☐	☐	Plan for state review (if applicable).

Design of the Biodosimetry Test Stand/On-site Testing Facilities

☐	☐	Inlet/outlet piping design, including backflow prevention
☐	☐	Mixing
☐	☐	Sample ports
☐	☐	Pumps
☐	☐	Additives (Material Safety Data Sheets for UV-adsorbing chemical, quenching agent)

Collimated Beam Testing Apparatus

☐	☐	Lamp type
☐	☐	Collimating tube aperture
☐	☐	Distance from light source to sample surface
☐	☐	Radiometer make and model

Monitoring Equipment Specifications and Verification of Equipment Accuracy for the following:

☐	☐	Flow meters
☐	☐	UVT analyzers (if used)
☐	☐	UV Spectrophotometers
☐	☐	Power measurement
☐	☐	UV sensors
☐	☐	Radiometer make, model, and calibration certificates

Experimental Test Conditions including, but not limited to:

☐	☐	Number of tests, UVT, flow rate, lamp power, and lamp status for each test condition
☐	☐	Lamp fouling factor, use of new or aged lamps
☐	☐	Influent concentration of challenge microorganisms for each test condition
☐	☐	QA/QC Plan

5.11.3 Validation Report

The validation report should provide detailed documentation of all validation testing results. The report should also include all elements of the Validation Test Plan and a summary of the field-verified UV reactor properties.

EPA recommends that the report begin with an executive summary with key information that can be used by states and water systems to assess inactivation credit for the target pathogen(s). The executive summary should include, at a minimum,

- The validated dose or range of validated doses,
- The log credit achieved for the potential target pathogens by the UV reactor, and
- Validated operating conditions (i.e., flow rate, UVT if the Calculated Dose approach is used).

If the UV Intensity Setpoint approach is used, the executive summary should provide the UV intensity setpoint (or setpoints) for the validated dose. If the reactor uses the Calculated Dose Approach as its dose monitoring strategy, the dose-monitoring equation should be provided.

In addition to the items listed above, the executive summary should include the following:

- A brief description of the validated reactor,
- The assumed fouling/aging factors for the reactor and indication if new or aged lamps were used during validation testing,
- A summary of the validation test conditions, including but not limited to the flow rate, UVT, and lamp power for each test condition,
- Key validation test results used to derive the dose, including but not limited to the RED values for each test condition, the UV dose-monitoring equation from collimated beam testing, and the VF,
- A summary of QA/QC checks and results, including UV sensor and radiometer reference checks,
- A description of the validation facilities,
- The organizations conducting the validation test, and
- Names and credentials of the individuals/organizations providing third party oversight.

Recommended contents for the detailed validation report are listed in Checklist 5.3. Note that these recommendations are not intended to be all-inclusive. Engineers should document any test characteristics or outcomes they believe are important in the Validation Report.

Checklist 5.3 Key Elements of the Validation Report (Page 1 of 1)

Does your validation report contain the following elements?

Yes No

General

☐ ☐ Detailed reactor documentation (see Checklist 5.1), including drawings and serial numbers, and procedures used to verify reactor properties.

☐ ☐ Validation test plan (either a summary of key elements, or the test plan can be attached to the validation report along with documentation of any deviations to the original test plan)

Full-scale reactor testing results, with detailed results for each test condition evaluated. Data should include, but are not limited to:

☐ ☐ Flow rate

☐ ☐ Measured UV intensity

☐ ☐ UVT

☐ ☐ Lamp power

☐ ☐ Lamp statuses

☐ ☐ Inlet and outlet concentrations of the challenge microorganism

Collimated beam testing results, including detailed results for each collimated beam test used to create the UV dose-response equation:

☐ ☐ Volume and depth of microbial suspension

☐ ☐ UV Absorption of the microbial suspension

☐ ☐ Irradiance measurement before and after each irradiation

☐ ☐ Petri factor calculations and results

☐ ☐ Calculations for UV dose

☐ ☐ Derivation of the UV dose-response equation, including statistical methods and confidence intervals (i.e., calculation of U_{DR})

QA/QC Checks:

☐ ☐ Challenge microorganism QA/QC, including blanks, controls, and stability analyses

☐ ☐ Measurement uncertainty of the radiometer, date of most recent calibration, results of reference checks

☐ ☐ Measurement uncertainty of UV sensors and results of reference checks

☐ ☐ Measurement uncertainty of the flow meter, UV spectrophotometer, and any other measurement equipment used during full-scale testing

Calculation of the validated dose, log inactivation credit, and validated operating conditions:

☐ ☐ RED for each test condition

☐ ☐ Calculation of the VF

☐ ☐ Setpoints if the reactor uses the UV Intensity Setpoint Approach

☐ ☐ Dose-monitoring equation if the reactor uses the Calculated Dose Approach

☐ ☐ Log inactivation credit for target pathogens (e.g., *Cryptosporidium*, *Giardia*, and viruses)

☐ ☐ Validated operating conditions (e.g., flow rate, lamp status, UVT)

5.12 Guidelines for Reviewing Validation Reports

State engineers and water systems purchasing pre-validated reactors should review the validation report to confirm the following:

- Validation testing meets the minimum regulatory requirements as summarized in Table 5.1.
- EPA's recommended validation protocol was followed and any deviations from the protocol are adequately justified.
- Validated doses achieved by the UV equipment meet or exceed the target pathogen log inactivation desired.
- QA/QC criteria were met during validation testing.

Checklist 5.4 summarizes the QA/QC recommendations presented throughout this chapter and in Appendix C. If a QA/QC plan was prepared prior to validation, reviewers should request a copy of the plan and make sure it is consistent with industry standards.

Checklist 5.5 contains key elements that should be verified by state or water system personnel when reviewing validation reports. States and systems should keep documentation that these key validation criteria were met.

Checklist 5.4 Review for Quality Assurance/Quality Control (Page 1 of 1)

Yes No

Uncertainty in Measurement Equipment (See Section 5.5 and C.2.2 for more information)

☐ ☐ **Flow Meter:** Is the measurement uncertainty < 5 percent?

☐ ☐ **UV Spectrophotometer:** Is the measurement uncertainty ≤ 10 percent?

☐ ☐ **UV Sensors:** Did duty sensors operate within 10 percent of the average of two or more reference sensors? If not, was uncertainty in sensor measurement incorporated into the VF?

☐ ☐ **Radiometer:** (for collimated beam testing only). Do lamp output measurements vary by no more than 5 percent over exposure time? Was the accuracy of the radiometer verified with another radiometer?

QA/QC of Microbial Samples (See Section 5.6.4 for more information)

☐ ☐ **Reactor controls:** For influent/effluent samples taken with the UV reactor lamps turned off, does the change in log concentration correspond to a change in RED that is within the measurement error of the minimum RED measured during validation (typically ≤ 3 %)?

☐ ☐ **Reactor blanks:** For DAILY influent/effluent samples taken with NO challenge microorganisms injected, are the measured concentrations of the challenge microorganism negligible?

☐ ☐ **Trip Controls:** For an UNTESTED sample bottle of challenge microorganism stock solution that travels with tested samples between the laboratory and the reactor, is the change in the log concentration of the challenge microorganism within the measurement error. (I.e., the change in concentration over the test run should be negligible. This is typically on the order of 3 to 5%.)

☐ ☐ **Method Blanks:** For sterilized reagent grade put through the challenge microorganism assay procedure, is the challenge microorganism concentration non-detectable?

☐ ☐ **Stability Samples**: For influent/effluent samples at low and high UVT, are the challenge microorganism concentrations within 5 percent of each other?

Uncertainty in Collimated Beam Testing Data (See Appendix C for more information)

☐ ☐ Do the uncertainties in the terms in the UV dose calculation meet the following criteria:

- Depth of suspension (d) ≤ 10 percent
- Incidence irradiance (E_s) ≤ 8 percent
- Petri factor (P_f) ≤ 5 percent
- L/(d + L) ≤ 1 percent
- Time (t) ≤ 5 percent
- $(1 - 10^{-ad})/ad$ ≤ 5 percent

☐ ☐ Is the **uncertainty in dose-response** (U_{DR}), as calculated using equation C.6, less than or equal to 30 percent? If not, was U_{DR} incorporated into the VF?

Checklist 5.5 Review for Key Validation Report Elements (Page 1 of 2)

Yes	No	
☐	☐	Does the validation testing meet QA/QC criteria (see Checklist 5.4)?
☐	☐	For full-scale testing, does the mixing and location of sample ports follow recommendations provided in Sections 5.4.3 and 5.4.4, respectively?
☐	☐	If the reactor was validated off-site, do inlet/outlet piping conditions at the water treatment plant result in a UV dose-delivery that is **the same or greater than** the UV dose delivery at the off-site testing facility? (See Section 3.6 for recommended inlet/outlet piping configurations and Section D.6 for considerations for CFD modeling.)
☐	☐	Were collimated beam tests and full-scale reactor tests performed on the same day for a given test condition and using the same stock solution of challenge microorganisms? (See Section 5.7 for experimental testing guidelines.)
☐	☐	Is the UV sensitivity of the challenge microorganism and the overall shape of the UV dose-response curve consistent with the expected inactivation behavior for that challenge microorganism? See Appendix A of this manual for published UV dose-response curves for MS2 and *B. subtilis*.
☐	☐	Does the validation test design account for lamp fouling and aging, minimum UVT, and maximum flow rate expected to occur at the water treatment plant? (See Section 5.6 for recommended test design.)
For UV Reactors Using MP Lamps		
☐	☐	Is the UV reactor equipped with a germicidal sensor? New UV reactors should have germicidal sensors. If an installed reactor uses an MP lamp and a non-germicidal sensor, is a polychromatic bias factor incorporated into the derivation of the VF? (See Section D.4.3 for guidance on the polychromatic bias factor.)
☐	☐	Was validation testing conducted using a challenge microorganism other than MS2 or *B. Subtilis*? If yes, was the need for a correction factor assessed and was that factor applied based on the outcome? (See Sections 5.3 and D.4.1 for more information)
For UV Reactors Using the UV Intensity Setpoint Approach		
☐	☐	Were the minimum test conditions performed as specified in Section 5.6.1?
☐	☐	Is the UV intensity setpoint low enough to account for combined conditions of minimum UVT and maximum lamp fouling/aging at the water treatment plant (See Section 5.6.1 for guidance)
☐	☐	Was the **minimum RED** selected for calculating the validated dose? (See Section 5.8.1 for additional guidance.)
☐	☐	Does the VF calculation include both the B_{RED} and U_{SP}? (See Section 5.9 for additional guidance.)

Checklist 5.5 Review for Key Validation Report Elements (Page 2 of 2)

Yes	No	
For UV Reactors Using the UV Intensity Setpoint Approach (continued)		
☐	☐	If U_S and/or U_{DR} did not meet the QA/QC criteria, were they also included in the VF calculation?
☐	☐	Is the validated dose greater than or equal to the required dose for the water system's target pathogen and log inactivation level?
For UV Reactors Using the Calculated Dose Approach		
☐	☐	Was the minimum number of test conditions evaluated as specified in Section 5.6.2?
☐	☐	Was the empirical equation developed using standard statistical methods (e.g., multivariate linear regression)? (See Section 5.8.2 for additional guidance.)
☐	☐	Does the validation report include an analysis of goodness of fit and bias for the dose-monitoring equation? (See 5.8.2 for additional guidance.)
☐	☐	Does the VF calculation include both the B_{RED} and U_{IN}? (See 5.9.)
☐	☐	If U_S and/or U_{DR} did not meet the QA/QC criteria, were they also included in the VF calculation?
☐	☐	For the range of UVT values and flow rates expected to occur at the water system, is the validated dose greater than or equal to the required dose for the system's target pathogen and log inactivation?

NOTE TO BIDDER: Use typewriter or BLACK ink for completing this Bid Form.

BID FORM

To:	Oak Creek Water and Sewer Utility (Owner)
Mailing Address:	Attn: Ron J. Pritzlaff, P.E., Utility Engineer Oak Creek Water and Sewer Utility 170 West Drexel Avenue Oak Creek, WI 53154
Project Identification:	UV Disinfection System for the Oak Creek Water and Sewer Utility 2016 Water Treatment Plant Improvements Project

1. BIDDER'S DECLARATION AND UNDERSTANDING

1.1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over the Utility.

1.2. In submitting this Bid, Bidder certifies Bidder is qualified to do business in the State of Wisconsin as required by laws, rules, and regulations at the time the Bid Form is submitted to the Utility.

1.3. In this section, the Bidder shall provide values for specific performance parameters for the UV Disinfection System (UV System). The Bidder understands and agrees that the values stated in this section for the associated performance parameters will be compared to the performance standards required in the Technical Specifications. Bidders understand and agree to guarantee the performance values stated herein for the UV System in accordance with the guidelines specified in the Technical Specifications. The definition of each performance parameter used in the net present value comparison is as defined herein.

BIDDER’S NAME _____

1.4. The undersigned Bidder understands and agrees that this Proposal shall form the basis for a subcontract with the Installing Contractor that is selected by the Owner. Therefore, the undersigned agrees to enter into an agreement to perform and furnish all Work as specified or indicated in these Specifications for the amount indicated in this Bid Form and in accordance with the other terms and conditions of this Request for Proposal and Statement of Qualifications.

1.5. The undersigned accepts all of the terms and conditions of this Request for Proposals and Statement of Qualifications including, without limitation, those dealing with the disposition of Bid security, and the penalties that may be imposed based on results from the Performance Testing. This Proposal shall remain subject to acceptance for a period of 90 days after the day of Bid opening.

1.6. The Bidder understands and agrees that the Owner may assign all of its rights and obligations under these Contract Documents to the Installing Contractor for the installation of the UV System.

1.7. The Bid Price of the selected Supplier will be assigned by the Owner to the Installing Contractor.

1.8. Notwithstanding this assignment, the guarantees and warranties specified in the Contract Documents are intended for the benefit of the Owner and the Installing Contractor, and may be enforced by either party.

2. CONTRACT EXECUTION

2.1. The undersigned Bidder agrees, if this Bid is accepted, to enter into an Agreement with the Installing Contractor to perform and furnish Work as specified or indicated in the Bidding Documents for the Contract Price derived from the Bid, and in accordance with the other terms and conditions of the Bidding Documents.

2.2. Bidder accepts the terms and conditions of the Bidding Documents.

3. INSURANCE

3.1. Bidder further agrees that the Bid amount(s) stated herein includes specific consideration for the specified insurance coverages.

4. ADDENDA

4.1. Bidder hereby acknowledges that it has received Addenda

Nos. _____, _____, _____, _____,

BIDDER'S NAME _____

(Bidder shall insert number of each Addendum received) and agrees that Addenda issued are hereby made part of the Bidding Documents, and Bidder further agrees that this Bid includes impacts resulting from said Addenda.

5. STATE AND LOCAL SALES AND USE TAXES

5.1. Taxes shall not be included in this Bid Form.

6. BID SCHEDULE

6.1. Bidders shall use only the Bid Schedule provided. All blank spaces in the Bid Schedule must be filled in, preferably in BLACK ink, in both words and figures where required. No changes shall be made in the phraseology of the forms. Written amounts shall govern in case of discrepancy between the amounts stated in writing and the amounts stated in figures.

6.2. Prices quoted shall be f.o.b. with freight and full insurance paid by Bidder, to the Oak Creek Water and Sewer Utility Water Treatment Plant, 9325 S. 5th Avenue, Oak Creek, WI 53154.

6.3. Bidder shall provide required information by filling in all blanks following the Bid Schedule (begins next page).

6.3.1. The net present value period for the purposes of the cost evaluation of the UV System is defined as 20 years.

6.3.2. The interest rate for purposes of the cost evaluation of the UV System is defined as 5 percent (based on an 8 percent rate of return and 3 percent inflation rate).

6.3.3. The net present value of recurring annual costs over a 20-year life cycle is defined as the annual cost multiplied by 12.46.

6.3.4. The guarantees for component lifetimes shall be in terms of calendar time based on the average usage conditions identified herein.

BIDDER'S NAME _____

BID SCHEDULE
1. Manufacturer:_____
2. UV Reactor Model: _____
3. Total Number of UV Reactors (duty plus standby): _____
4. Installed Number of Lamps per UV Reactor: _____
5. Maximum RED (MS2) at Design Conditions: _____ mJ/cm2
6. Maximum design flowrate per reactor at max plant flow (current and future): _____ mgd, each
7. Guaranteed maximum UV Reactor Headloss at max reactor flow (current or future): _____inches, each
8. Guaranteed maximum UV Reactor Power Draw @100% power level: _____kW, each

Report all costs in terms of US Dollars.	
A1. <u>Cost of the UV System in Whole Dollar Amount</u> Cost of the UV System including type and quantity of UV reactors provided in lines 1 through 7 above designed to meet all specified requirements of this Request for Proposals and Statement of Qualifications to provide UV disinfection under the specified design conditions. Cost shall include time for required manufacturer support services as stated in these documents herein (e.g., design support, performance testing, training, etc.) and spare parts as required in Specifications.	$

BIDDER'S NAME _____

Report all costs in terms of US Dollars.	
A2. Guaranteed Additional **Cost of UV System Components in Whole Dollar Amount** Additional cost for the expansion of the UV System from 35 mgd to 75 mgd, designed to meet all specified requirements of this Request for Proposals and Statement of Qualifications. Owner reserves the right to purchase the additional UV Disinfection System equipment at the priced listed in this Bid Item A2 for a period of up to 365 days from the date of the advertised UV RFP Section 00 11 15.	$

BIDDER'S NAME _____

A3. Annual Electric Power Cost in Whole Dollar Amount

The Average Power Consumption calculation shall assume that the system will operate at a validated dose (Dval) greater than 12 mJ/cm^2 to achieve a minimum of 3.0 log *Cryptosporidium* inactivation, assuming an Action Spectra Correction Factor (ASCF) following 2014 WRF Guidance. Power requirements of all equipment supplied under this Request for Proposals and Statement of Qualifications, including the UV disinfection system and all associated equipment will be included in the electric power cost calculation. The operating conditions identified in A3.1 shall serve as the basis for calculation of the Average Power Consumption on an annual basis. The calculated Average Power Consumption will be validated based on readings taken during the Performance Testing. **Assume an average unit power cost of $0.05/kWh.**

BIDDER'S NAME _____

A3.1 Average Power Consumption

A3.1.a Design Factors

Indicate values for the items requested in the following table that should be used to calculate the reactor power setting and power consumption:

Item	Description	Value
End of Lamp Life Aging factor (ELAF)	Bidder to provide third-party certified ELAF for the proposed UV System, Max=0.95. If no 3rd-party certification is submitted, assume 0.90. If data supports a value less than 0.90, substitute with the more conservative value.	
Quartz Sleeve Fouling Factor (QSFF)	Bidder to provide third-party certified QSFF for the proposed UV System, Max=0.90.	
Design Fouling-Aging Factor (DFAF)	This factor is used to determine design UV dose. Multiply ELAF x QSFF.	
Average Fouling-Aging Factor (AFAF)	This factor is used to determine average power consumption. Average of 1.0 and DFAF	
Operating Safety Factor (OSF)	This safety factor is applied to adjust the operating target of the UV System to reflect actual operating conditions. Min OSF = 5%. Multiply 1.05 * 3.0 log Cryptosporidium inactivation to determine the operating setpoint.	
Action Spectra Correction Factor (ASCF)	The safety factor applied to the UV dose to account for low wavelength bias. Value shall be set based on 2014 WRF Guidance for proposed UV reactor.	

BIDDER'S NAME _____

A3.1.b. The proposed system will operate at a validated dose (Dval) greater than 12 mJ/cm2 to achieve a minimum of 3.0 log Cryptosporidium inactivation times the Operating Safety Factor (OSF) and ASCF as listed in A2.1.a.

For each of the following conditions, indicate how many lamps will be used, and at what power setting. The Average Fouling-Aging Factor (AFAF) calculated in A2.1.a should be used to calculate the power setting.

	UVT	Total Plant Flow (mgd)	Time[1] (%)	No. of Reactors Online[2]	No. of Lamps on per reactor	Lamp Power Setting (kW)	Total System Power Draw (kW)
(1)	90	6	20%				
(2)	95	15	60%				
(3)	95	24	20%				

1. The water quality and flow conditions (1) through (3) are expected to be encountered in the proportions listed here over the course of a typical year (365 days total).
2. Assume even flow split between UV Reactors.

A3.1.c. Calculate Average Power Consumption by multiplying the total system power consumption (kW) for each condition shown in the table above by its expected condition.

[Power Consumption (1) * 20%] + [Power Consumption (2) * 60%] + [Power Consumption (3) * 20%] * 365 days/year * 24 hrs/day

A3.1.c Calculated Average Power Consumption (kWh/year)

A3. Average Annual Power Cost [A3.1.c * ($0.05/kWh)]	$

BIDDER'S NAME _____

A4. Annual Maintenance Costs

Annual maintenance costs will be calculated based on guaranteed life and cost data provided by the supplier for lamps, ballasts/transformers, quartz sleeves, UV intensity sensors and cleaning system. UV equipment operating conditions shall be based on validated design UV dose for minimum of 3.0 log Cryptosporidium inactivation times the OSF, ASCF, and AFAF at average flow rate of 8 mgd, average UVT of 93 percent,.

A4.1 Annual Lamp Cost Determine cost by [LMC * LPY] from Item A4.1.a, below.	$

A4.1.a. Lamp information.

Item	Description	Value
Number of Lamps in Service (LS)	Number of Lamps in Service (LS) in operating reactor(s).	
Guaranteed Lamp Life (GLL)	Expressed in hours, for the given conditions and reactor in service.	
Lamp Material Cost (LMC):	Guaranteed not-to-exceed replacement cost for one UV lamp including return of spent lamp, expressed in dollars.	$
Number of Lamps Replaced Per Year (LPY):	Number of Lamps in Service divided by Guaranteed Lamp Life multiplied by 24 hours per day multiplied by 365 days per year. [(LS / GLL) * 24 * 365]	

BIDDER'S NAME _____

A4.2 Annual Ballast/Transformer Replacement Cost Determine cost by [BRC * BRY] from Items A4.2.a and A4.2.b, below.	$

A4.2.a. Ballast/transformer information.

Item	Description	Value
Ballasts/transformers in Service (BS)	Total number of ballasts/transformers (BS) in all reactor(s) (including standby)	
Guaranteed Ballast/transformer Life (GBL)	Guaranteed Ballast/Transformer Life (GBL), expressed in years.	
Ballast/transformer replacement cost (BRC)	Guaranteed not-to-exceed replacement cost per ballast/transformer expressed in dollars (BRC).	$

A4.2.b. Ballast/transformer replacement calculations:

The number of ballast/transformer replacements is annualized by dividing the total number of ballasts/transformers in all reactor(s) (including redundant) by the guaranteed ballast/transformer life. It is assumed that 10% of ballasts in service will fail prematurely during their life.

[1.1 * BS / GBL]

Calculated Ballast/Transformer Replacements per Year (BRY)

BIDDER'S NAME _____

A4.3 Annual Quartz Sleeve Replacement Cost Determine cost by [QRC * QRY] from Items A4.3.a and A4.3.b, below.	$

A4.3.a Quartz sleeve information.

Item	Description	Value
Total number of quartz sleeves (QS)	Total number of quartz sleeves (QS) in all reactor(s) (including standby)	
Guaranteed Quartz sleeve Life (GQL)	Guaranteed Quartz Sleeve Life (GQL), expressed in years.	
Quartz sleeve replacement cost (QRC)	Guaranteed not-to-exceed replacement cost per quartz sleeve expressed in dollars (QRC).	$

A4.3.b. Quartz sleeve replacement calculations:

The number of quartz sleeve replacements is annualized by dividing the total number of quartz sleeves in all reactor(s) (including standby) by the guaranteed quartz sleeve life. It is assumed that 10% of quartz sleeves in service will be replaced prematurely during their life.

[1.1 * QS / GQL]

Calculated Sleeve Replacements per Year (QRY)

BIDDER'S NAME _____

A4.4 Annual Duty Sensor Replacement Cost Determine cost by [SRC * SRY] from Items A4.4.a and A4.4.b, below.	$

A4.4.a Duty UV intensity sensor information.

Item	Description	Value
Total number of duty UV intensity sensors (SS)	Total number of duty UV intensity sensors (SS) in the all reactor(s) (including redundant)	
Guaranteed duty UV intensity Sensor Life (GSL)	Guaranteed Sensor Life (GSL), expressed in years.	
Guaranteed duty UV intensity Sensor calibration frequency (GSC)	Guaranteed duty UV intensity Sensor calibration frequency (GSC), expressed in weeks.	
Duty UV intensity Sensor replacement cost (SRC)	Guaranteed replacement cost per UV intensity sensor expressed in dollars (SRC).	$

A4.4.b. Duty UV intensity sensor replacement calculations:

The number of duty UV intensity sensor replacements is annualized by dividing the total number of duty UV intensity sensors in all reactor(s) (including redundant) by the guaranteed sensor life. It is assumed that 10% of duty UV intensity sensors in service will be replaced prematurely during their life.

[1.1 * SS / GSL]

Calculated Sensor Replacements per Year (SRY)

BIDDER'S NAME _____

A4.5 Annual Reference UV Sensor Calibration Cost Annual cost for reference UV intensity sensor calibration. Assume re-calibration of all reference sensors (3) each year.	$
A4.6 Annual UVT Analyzer Maintenance Cost Annual cost for two (2) UVT analyzer replaceable components. Annualize replaceable components with replacement frequencies less than once per year.	$
A4.7 Annual Automatic Cleaning System Replacement Cost Annual cost for automatic cleaning system replaceable components. Annualize replaceable components with replacement frequencies less than once per year.	$
A4. Total Operating Cost of the UV System [A4.1 + A4.2 + A4.3 + A4.4 + A4.5 + A4.6 + A4.7]	$

BIDDER'S NAME _____

A5. Net Present Value of Initial and Annual Costs in Whole Dollar Amounts The net present value of initial and annual costs is calculated based on a 20-year design life and a 5 percent interest rate.	
A5.1 Total Initial Costs: [A1] + [A2]	$
A5.2 Total Annual Costs (TAC): [A3 + A4]	$
A5.3 Net Present Value of Total Annual Costs: [A5.2 * 12.46]	$
A5. Net Present Value System Cost: [A5.1 + A5.3]	$

BIDDER'S NAME _____

A6. Guaranteed Daily Billing Rate (For Reference Only; Do not include in cost calculations)	
Supplier shall guarantee that they will provide up to 80 hours of additional technical services, including additional programming, training, or regulatory assistance. This billing rate shall be guaranteed for a minimum of 2 years following Final Payment of the UV Disinfection System Contract. Do not include item A6 in the NPV calculation (Item A4).	
A6. Guaranteed Daily Billing Rate (US dollars per 8-hr Workday)	$

BIDDER'S NAME _____

A7. Lead Time for Submittal of Shop Drawings and Work Delivery:	
Supplier shall provide the lead time required for submittal of shop drawings and equipment delivery. These values are not included in the cost calculations for A5.	
A7.1. Lead time for Submittal of Shop Drawings:	Within_____days after Notice to Proceed
A7.2. Lead time for Equipment Delivery: Note: Actual equipment delivery may be later if requested by the Installing Contractor to accommodate the construction schedule.	_____ days after the Date for Delivery is established or after final approval of Shop Drawings

BIDDER'S NAME _____

7. GUARANTEES

7.1. Performance: Supplier shall guarantee that the UV system will provide the validated UV dose and MS2 RED over the full range of design flowrates and UVT while accounting for the appropriate correction factors as stated in Section 44 44 73, UV Disinfection System. After installation, the Supplier will conduct Performance Testing to confirm performance as described in Section 44 44 73, UV Disinfection System. In addition, the Supplier will provide a validation report for the UV system and calculations to show compliance at the worst-case design conditions utilized as the basis for the capital sizing of the UV system. Third party certification for ELAF, QSFF, and CFD modeling for ASCF estimation shall be included.

7.2. Power Consumption: Supplier shall guarantee that the system's power utilization and total connected load will not exceed the amounts specified in the Bid Schedule as guaranteed by Supplier. After installation and Performance Testing, the total connected load and system power consumption will be measured under a number of conditions. If either or both of these quantities exceed the guaranteed amounts for any of the tested conditions, Supplier shall pay the Owner a Power Penalty. The amount of the Power Penalty shall be equal to the net present value of the calculated difference in actual and guaranteed electricity costs for the 20-year design life (based on a 5 percent discount rate, flow frequency, and the power costs listed in the Bid Form).

7.3. UV System Inlet and Outlet Configuration: The UV System pipe layout will provide at least five straight pipe diameters upstream of the UV reactor's upstream flange, as described in the USEPA 2006 Final Ultraviolet Disinfection Guidance Manual. UV System manufacturer shall identify any additional straight pipe requirements.

7.4. The costs of replacements for all system components shall be guaranteed by the Supplier for a period of 5 years from system acceptance date. The guaranteed replacement costs shall be the lower of either the costs listed in the Bid Schedule or future market prices. After 5 years, the cost of the replacement parts identified in this paragraph may be adjusted on an annual basis to account for inflation based upon the U.S. Department of Labor's Producer Price Index (PPI) as follows:

$$\text{Component Unit Replacement Cost (year 2020)} = \text{Base Unit Price} \times \frac{\text{PPI (year 2020)}}{\text{PPI (year 2015)}}$$

7.5. Lamps, Ballasts, Quartz Sleeves and UV Intensity Sensors: Supplier shall guarantee average life as listed in the Bid Schedule. If these Replacement Parts do not last for the guaranteed life, Supplier shall pay the Owner for the cost of replacement, adjusted proportional to the actual life. In addition, UV lamps shall be guaranteed at their full

BIDDER'S NAME _____

replacement cost up to a minimum of 1,000 hours of operation and prorated henceforth. For example, if the lamps last 4,000 hours but are guaranteed for 5,000 hours (or their intensity declines below the guaranteed end of lamp life output), one penalty shall be (5,000 – 4,000)/(5,000-1,000) times the initial cost. The guaranteed life shall apply to all original and replacement parts provided by the Supplier within a 20-year period and terminate only when the part has reached its guaranteed life, whichever is later. Supplier's not-to-exceed cost shall include receiving and disposing of spent lamps. The proposer-nominated guaranteed life and replacement cost for each replaceable component will be used to estimate life-cycle costs for the system.

7.6. Billing Rate for Allowance for Additional Technical Services: Supplier shall guarantee that they will provide up to 80 hours of additional technical services, including additional on-site programming, training, or regulatory assistance, as listed in Bid Form. This billing rate shall be guaranteed for a minimum of 2 years following Final Payment of the UV Disinfection System Contract.

8. SURETY

8.1. If Bidder is awarded the Work from this Bid, the surety providing the Performance Bond is:

_____ whose address is

_____

Street City State Zip

BIDDER'S NAME _____

9. BIDDER

SUBMITTED on _____, 2013.

State Contractor License No. _____. (If applicable)

If Bidder is:

An Individual

Name *(typed or printed)*: _____

By *(signature)*: _____

Doing business as: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

A Partnership

Partnership Name: _____(SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

BIDDER'S NAME _____

A Corporation

Corporation Name: _____(SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability):_____

By: _____
(Signature – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title:_____ (CORPORATE SEAL)

Attest: _____
(Signature of Corporate Secretary)

Business address: _____

_____

Phone No.:_____ FAX No.:_____

Date of Qualification to do business is: _____

A Joint Venture

Joint Venturer Name: _____(SEAL)

By: _____
(Signature of joint venture partner – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title:_____

Business address: _____

_____

Phone No.:_____ FAX No.:_____

BIDDER'S NAME _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Phone and FAX Number, and Address for receipt of official communications:

_____

_____

END OF SECTION

BIDDER'S NAME _____

SECTION 00 41 13
NON-COLLUSION AFFIDAVIT

OAK CREEK WATER AND SEWER UTILITY
OAK CREEK, WISCONSIN

_____(Bidder), first being duly sworn, on his oath says that the bid above submitted is a genuine and not a sham or collusive bid, or made in the interest or behalf of any person not herein named, and he further says that the said bidder has not directly or indirectly induced or solicited any bidder on the above work or supplies to put in a sham bid, or any other person or corporation to refrain from bidding; and that said bidder has not in any manner sought by collusion to secure to _____self an advantage over any other bidder or bidders.

_____
BIDDER

Subscribed and sworn to before me this _____day of _____, 2015

_____
NOTARY PUBLIC

My Commission Expires: _____

END OF SECTION

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

Oak Creek Water and Sewer Utility
170 West Drexel Avenue
Oak Creek, WI 53154

BID

Bid Due Date:

Project (Brief Description Including Location):

BOND

Bond Number:
Date (Not later than Bid due date):

Penal sum (Five percent of net present value of UV System shown on Bid Form) _____ (Words) _____ (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER	SURETY
_____(Seal)	_____(Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest: _____	Attest: _____
Signature and Title	Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Request for Proposals and Statement of Qualifications (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Request for Proposals and Statement of Qualifications and any performance and payment bonds required by the Request for Proposals and Statement of Qualifications.

3. This obligation shall be null and void if:

3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Request for Proposals and Statement of Qualifications (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Request for Proposals and Statement of Qualifications and any performance and payment bonds required by the Request for Proposals and Statement of Qualifications, or

3.2. All Bids are rejected by Owner, or

3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Request for Proposals and Statement of Qualifications (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 180 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION

PERFORMANCE BOND
CONTRACT NO. _____

KNOW ALL MEN BY THESE PRESENTS, that we,

_____

_____

("Principal") and

_____

("Surety"), hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns, to pay the Oak Creek Water and Sewer Utility, State of Wisconsin (Owner), the sum of

_____DOLLARS
($_____), in United States currency.

WHEREAS, the Principal has, by means of a written agreement dated _____, 20__, entered into contract with the Owner for furnishing and delivering the Ultraviolet (UV) Disinfection System, which contract is by reference made a part hereof the same as though fully set forth herein (the "Contract");

NOW, THEREFORE, the conditions of this obligation are as follows:

FIRST. Principal shall (1) honor all claims for defective workmanship and materials on the UV lamps, intensity sensors, quartz sleeves, and ballasts/transformers made within the warranty period after acceptance of the foregoing Contract, and (2) pay over, make good and reimburse to the Owner, all loss or damage which the Owner may sustain by reason of failure or default on the part of the Principal.

SECOND. Principal shall (1) honor all claims for defective workmanship and materials on all items other than the UV lamps, ballasts/transformers, quartz sleeves, and intensity sensors made within two (2) years after acceptance of the foregoing Contract, and (2) pay over, make good and reimburse to the Owner, all loss or damage which the Owner may sustain by reason of failure or default on the part of the Principal.

THIRD. Principal shall honor all Guarantees listed in Article 7 of the Bid Form including costs for additional services and equipment, and replacement parts and consumables for the UV Disinfection System.

If all the above conditions are fully satisfied, this obligation shall be null and void; otherwise it shall remain in full force and effect.

For value received, Surety further agrees that, any Contract provision to the contrary notwithstanding, Surety's obligations hereunder shall not be affected in any way by any of the following and expressly waives notice of the same:

1. Any extension of time granted to Principal in which to perform the Contract.

2. Any change in the Plans, Drawings, Specifications, Contract or other Contract Documents.

An action on the warranty provisions of this bond may be brought by the Owner or any person entitled to the benefits of this bond at any time within 1 year from the date of final settlement of the Contract.

Principal and Surety are jointly and severally liable under the provisions hereof and actions against either or both may proceed without prior action against the other, and both may be joined in one action.

SIGNED AND SEALED THIS _____ day of _____, 20_____.

IN THE PRESENCE OF:

WITNESS: (as to Individual)

_____
Principal

_____
Attest: (as to Corporation)

By:

_____
Name

_____
Secretary

_____
Title

(CORPORATE SEAL)

_____
Surety

By:_____
Attorney-in-Fact

Give local address and phone number.

_____

_____

_____

(SEAL OF SURETY)

NOTE: The Surety named on this bond shall be one who is licensed to conduct business in the State of Wisconsin. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act for the Surety at the time of signing of this Bond.

END OF SECTION

SECTION 00 72 10
GENERAL CONDITIONS

1. DEFINITIONS

1.1. Action Spectra Correction Factor (ASCF): Correction factor incorporated into the VF for medium-pressure UV reactors to account for differences in response between surrogate test organisms and target organisms across low wavelengths of UV (<240 nm).

1.2. Bidder: The person or persons, partnership, firm, or corporation submitting a Proposal for the Work specified in these Contract Documents.

1.3. Contract Documents: “Contract” or “Contract Documents” shall include the BIDDING REQUIREMENTS, CONTRACT FORMS, CONDITIONS OF THE CONTRACT, SPECIFICATIONS, and DRAWINGS, including all modifications and Addenda thereof incorporated into the Documents before execution of the Contract, and including subsequent Change Orders issued by the Owner, and all other requirements incorporated in these Documents by specific reference thereto. These form the Contract.

1.4. Days: Unless otherwise specifically stated, the term “days” shall be understood to mean calendar days.

1.5. Dosimeter: Term used to describe process control logic used to operate the UV System at the specified UV dose.

1.6. Engineer: CH2M HILL Engineers, located at 135 South 84th Street, Suite 400, Milwaukee, WI, 53214, Attention: Tony Myers, P.E., Project Manager.

1.7. Execution of Contract: Shall mean the signing of the Contract by the authorized representatives of both Owner and Supplier (Owner’s signature date is the Notice to Proceed date).

1.8. HMI: Human Machine Interface.

1.9. Installing Contractor (Contractor): The party under separate contract with Owner who installs, and assists with testing and start-up of the product(s) furnished under this Contract.

1.10. Intensity: Shall indicate the power passing through a unit area perpendicular to the direction of propagation. UV describes the magnitude of UV light measured by UV sensors in a reactor and with a radiometer in bench-scale UV experiments. The units of intensity are milliwatts per square centimeter (mW/cm^2).

1.11. Manufacturer: Shall be synonymous with UV Supplier or UV Manufacturer. Manufacturer shall be the Bidder as defined in these General Conditions.

1.12. NSF: National Sanitation Foundation.

1.13. Or Equal: The term “or equal” shall be understood to indicate that the “equal” product is the same or better than the products named in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by Engineer.

1.14. Owner: Oak Creek Water and Sewer Utility, Oak Creek, WI, its agents, officers, and employees. Shall be synonymous with Utility.

1.15. Person-day: Person-day shall be 8 working hours (8 a.m. to 5 p.m.) in a 24-hour period.

1.16. Proposal: Supplier’s Response to this solicitation for Request for Proposals and Statement of Qualifications. Proposal shall be synonymous with Bid or Statement of Qualifications for the purposes of these Contract Documents.

1.17. Reduction Equivalent Dose (RED): The UV dose derived by entering the log inactivation measured during full-scale reactor validation testing into the UV dose-response curve that was derived through collimated beam testing. RED values are always specific to the challenge microorganism used during experimental testing and the validation test conditions for full-scale reactor testing. Shall indicate the dose necessary, with the full scale UV System to provide a level of inactivation of a specific organism (e.g. MS-2 bacteriophage) equivalent to the level of inactivation for the same organism achieved in a laboratory, using a collimated beam apparatus with a low pressure lamp producing UV energy at a wavelength of 254 nanometers, on a water sample collected at the same time.

1.18. Request for Proposals and Statement of Qualifications: The contents of these Contract Documents intended to solicit Suppliers to furnish and deliver the following equipment: UV Disinfection System suitable for potable water disinfection for installation at the existing Oak Creek Water and Sewer Utility Water Treatment Facility.

1.19. Supplier: Shall be synonymous with UV Supplier and Manufacturer. Supplier shall be the Bidder as defined in these General Conditions.

1.20. UVDGM: USEPA’s November 2006 Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (EPA-815-R-06-007).

1.21. UV Dose (Fluence): Shall indicate the UV energy per unit area incident on a surface, typically reported in millijoules per square centimeter (mJ/cm^2). The UV dose received by a waterborne organism in a reactor vessel accounts for the effects on UV intensity of the absorbance of the water, absorbance of the quartz sleeves, reflection and refraction of light from the water surface and reactor walls, and the germicidal effectiveness of the UV wavelengths transmitted.

1.22. UV System: Shall be synonymous with UV Disinfection Equipment or UV Disinfection System, which includes all related equipment, materials, control systems and appurtenances.

1.23. UV Transmittance (UVT): Shall indicate the transmittance of ultraviolet light at a wavelength of 254 nanometers through the water across a path length of 1 centimeter. UVT shall be expressed as a percentage.

1.24. Validation Factor (VF): As defined by the UVDGM, an uncertainty term that accounts for the uncertainty and bias associated with validation testing and the full-scale installation.

1.25. Validated Dose (Dval): RED divided by VF as described in the UVDGM.

1.26. Work: Shall include all equipment, materials and appurtenances, manufacturing of equipment, delivery of equipment, and specified services necessary for the Supplier to perform and complete the Contract, including items not specifically indicated or described which are reasonably considered in good practice as belonging to the equipment specified.

2. CONTRACT DOCUMENTS

2.1. Contract Documents include the BIDDING REQUIREMENTS, CONTRACT FORMS, CONDITIONS OF THE CONTRACT, SPECIFICATIONS, and DRAWINGS, including all modifications and Addenda thereof incorporated into the Documents before execution of the Contract, and including subsequent Change Orders issued by the Owner, and all other requirements incorporated in these Documents by specific reference thereto.

2.2. The Drawings are supplemental and represent the preliminary drawings of the design as developed by the Engineer. The final design drawings will be revised to reflect the selected UV System. The requirements in the Specifications shall be considered complete and accurate and shall take precedent over the supplemental drawings, which depict the project scope and design intent. The supplemental drawings shall be considered as reference only.

2.3. Discrepancies and Omissions:

2.3.1. Should anything which is necessary for a clear understanding of the Work be omitted from the Specifications and Drawings, or should it appear that various instructions are in conflict, the Supplier or Contractor shall secure written instructions from Engineer before proceeding with the Work affected by such omissions or discrepancies. It is understood and agreed that the Work shall be performed according to the true intent of the Contract Documents.

2.3.2. It is understood and agreed that the written terms and provisions of the Contract Documents shall supersede all verbal statements of representatives of Owner, and verbal statements shall not be effective or be construed as being a part of this Contract.

3. INSPECTION/ACCEPTANCE

3.1. All material and equipment shall be subject to inspection and testing by Owner, Installing Contractor, or its designee at Supplier's plant and at the project site. Notwithstanding any inspection at Supplier's plant, final inspection and acceptance of the material and equipment shall be at Owner's project site.

3.2. If inspection and tests, whether preliminary or final, are made on Supplier's premises, Supplier shall furnish all reasonable facilities and assistance for safe and convenient inspection and tests required by Owner. Inspection by Owner or failure to inspect by Owner shall not relieve Supplier of any responsibility or liability with respect to such material and equipment and shall not be interpreted in any way to imply acceptance by Owner.

3.3. Owner and Installing Contractor reserves the right to reject nonconforming material and equipment. Owner and Installing Contractor shall have the option either to require Supplier to promptly remove and replace rejected material and equipment at Supplier's expense; or to cancel this order pursuant to Article Termination/Cancellation and require Supplier to promptly remove rejected material and equipment at Supplier's expense.

3.4. Owner reserves the right to revoke acceptance of material and equipment if Owner accepted same on the reasonable assumption that the nonconformity would be cured by Supplier and has not been reasonably cured, or without discovery of such nonconformity if acceptance was reasonably induced either by the difficulty of discovery before acceptance or by Supplier's assurances.

4. CHANGES

4.1. Owner shall have the right (by written supplement hereto, including revised drawings, specifications, and other transmittals), to make changes in the specifications of material and equipment ordered.

4.2. If any change affects the price or delivery date of such material and equipment, Supplier shall forthwith so notify Owner in writing; and shall, within 30 days of the date such supplement is mailed or otherwise delivered to Supplier, submit a written claim for adjustment of price and/or delivery date. If Supplier fails to do so, Supplier waives any claim for such adjustment.

4.3. Supplier shall not suspend performance while Owner and Supplier are in the process of making such changes and any related adjustments.

4.4. Payment or credit for any changes shall be determined by lump sum agreement, in writing, between Supplier and Owner before starting extra work.

5. SUPPLIER

5.1. The relationship of Supplier to Owner shall be that of an independent contractor. Supplier shall have no contractual relationship with the Engineer as a result of its contract with Owner. Nothing contained in this Contract shall create any contractual relation between any subcontractor of Supplier and Owner or Engineer.

5.2. The work hereunder will be assigned by the Owner to an Installing Contractor at the time the construction contract (under which the equipment and materials specified herein will be installed) is executed.

5.3. In the application of the terms and conditions of the Contract Documents after the Work has been assigned to the Installing Contractor, Supplier shall function as a subcontractor or a Supplier to the Installing Contractor and all obligation of Supplier to the Utility shall, after assignment, become obligation of Supplier to Installing Contractor.

5.4. Risk of loss as it relates to the equipment and materials provided hereunder shall be borne by Supplier until delivery to the project site and acceptance by the Installing Contractor, and thereafter shall be borne by the Installing Contractor until final acceptance by the Owner after all on-site testing has been completed and accepted by the Owner and Engineer.

6. MATERIALS AND EQUIPMENT

6.1. General: All materials and equipment furnished shall conform to applicable Specifications and shall be new, unused, and undamaged when installed or otherwise incorporated in Owner's project. No such material or equipment shall be used by Supplier for any purpose other than that intended or specified, unless such use is specifically authorized by Owner in each case.

6.2. Codes, Laws, and Regulations: All material, equipment, and services provided hereunder shall comply with all applicable codes, laws, regulations, standards, and ordinances, including potable water NSF requirements, National Electrical Code, and UL listing mark or label requirements.

7. FIELD PERFORMANCE TESTING

7.1. Operating equipment and systems will be performance tested by the Supplier in the presence of Engineer to demonstrate compliance with the specified requirements. Performance testing will be conducted under the specified design operating conditions or under such simulated operating conditions as recommended or approved by Engineer.

7.2. In the event of malfunction or failure to perform as specified, and it is determined by Engineer that the equipment or system furnished under this Contract is in nonconformance with the Contract Documents, Supplier shall bear all cost for repair, replacement, retesting, and other damages resulting from noncompliance with these Contract Documents. If the failure of the Supplier's equipment results in any fines, penalties by the Federal Government or State of Wisconsin, or corrective actions by the Owner, Supplier shall reimburse the Owner for the amount of those fines, penalties, or corrective actions.

8. WARRANTY

8.1. Except as stated in the BID FORM, all material and equipment supplied shall be warranted by Supplier to Owner as follows:

8.1.1. All Work, including mechanical and electrical components of material and equipment, and/or packaged control systems which are furnished as components of the materials and equipment specified hereinafter, shall be warranted against defects in materials and workmanship for a period of two (2) years following acceptance of performance testing by Owner and Engineer.

8.1.2. Warranty period shall commence after successful completion of Performance Testing and approval by the Owner and Engineer.

8.1.3. All material and equipment shall be guaranteed as merchantable and suitable for the purpose intended and shall provide the results required by the Drawings and Specifications.

8.1.4. Supplier shall make all repairs or replacements necessitated by defects in materials or workmanship that become evident within the warranty period.

8.1.5. Supplier also agrees to hold Owner harmless from liability of any kind arising from damage due to said defects. Supplier shall make all repairs and replacements promptly upon receipt of written orders for same from Owner. If within 10 days after Owner has notified Supplier of a defect, Supplier has not started to make the necessary corrections, Owner is hereby authorized to make the corrections or to order the Work to be done by a third party, and the cost of the corrections shall be paid by Supplier.

9. RELATED SERVICES

9.1. Whenever Supplier furnishes personnel for installation supervision, startup, testing, inspection, related services, or maintenance (the Work), the following provisions shall apply, in addition to other applicable provisions of this order including compensation:

9.1.1. Representation by Supplier: Supplier represents that Supplier, its agents, and employees, are qualified and competent to perform the Work and that all tools and equipment furnished by Supplier in its performance of the Work are, and shall be, kept in good working order.

9.1.2. Supplier's Responsibility: Supplier asserts that the Work shall be performed in accordance with accepted standards and shall conform to the requirements of this Contract. Any Work not so performed or not in conformity herewith shall be corrected by Supplier. If such deficiencies are not immediately corrected, Owner may cause the same to be corrected for the account of Supplier. The above-described remedy is in addition to any other remedies, in law or equity, available to Owner.

9.1.3. Completion and Acceptance: When Supplier deems the Work completed, Supplier shall give Owner notice thereof in writing. Within a reasonable time after receipt of such notice, Owner will determine if the Work has been completed to its satisfaction; if so, Owner will advise Supplier, in writing, of its final acceptance thereof; if not, Owner will notify Supplier of its lack or failure of performance and Supplier will take remedial action as described in this Article and will repeat the procedure stated herein until the Work has been satisfactorily completed and accepted.

10. DELIVERY/DELAYS

10.1. Delivery milestones will be established and incorporated into the agreement between the Installing Contractor and Supplier.

10.2. Since material and equipment covered hereby will be incorporated into a construction project, the submittal and delivery dates must be met by Supplier, and be subject to liquidated damages, as defined in the AGREEMENT between the Installing Contractor and Owner, if dates are not met.

10.3. Supplier shall not be responsible for delays resulting from occurrences beyond its control which it could not have reasonably anticipated and provided for. In such event, Supplier shall give Installing Contractor written notice within 5 days of such occurrence. Installing Contractor shall notify Owner of delay within 5 days subsequent to notification from Supplier. Owner shall determine an equitable extension of time for delivery. Supplier's failure to notify Installing Contractor of such delay shall constitute a waiver of Supplier's right to a time extension. There shall be no price adjustment by virtue of any such time extension.

11. TERMINATION/CANCELLATION

11.1. Owner shall have the right to terminate all or any part of this Contract for its convenience. Upon termination, Supplier shall be reimbursed for its reasonable and necessary costs resulting therefrom which are substantiated by evidence satisfactory to Owner. Supplier shall receive no profit on unperformed Work. Owner shall be entitled to immediate possession of plans and Work for which it has paid.

11.2. Any failure by Supplier to perform its obligations under this order which is deemed substantial by Owner, shall be a grounds for Owner to cancel this order or the affected portion hereof. Supplier shall not be entitled to any compensation pursuant to such cancellation, except for the reasonable value of material and equipment delivered by Supplier and accepted by Owner prior to cancellation, which amount shall not exceed the Contract Price. Owner reserves all rights it may have against Supplier as a result of Supplier's failure to so perform.

11.3. Owner's obligations under Article Warranty shall survive termination or cancellation.

12. SUSPENSION OF WORK

12.1. Owner reserves the right to suspend and reinstate execution of the whole or any part of the Work without invalidating the provisions of the Contract. Orders for suspension or reinstatement of the Work will be issued by Owner to Supplier in writing. The time for completion of the Work will be extended for a period equal to

the time lost by reason of the suspension. Supplier may request a cost escalation to be reviewed by Owner for suspensions of work extending beyond 6 months.

13. PAYMENT

13.1. Supplier shall invoice Installing Contractor on a complete and accurate payment request form in the percent complete amounts as described below. Installing Contractor will make payment within 30 days of Engineer's approval of the Supplier's payment request:

13.1.1. Ten (10) percent of the contracted price will be paid by Installing Contractor after the complete set of submittals, including shop drawings, acceptable to Engineer and Owner have been returned to Supplier.

13.1.2. Seventy (70) percent of the contracted price will be paid by Installing Contractor after the complete set of O&M Manuals acceptable to Engineer and Owner have been returned to Supplier and after receipt of the complete order at the Oak Creek Water and Sewer Utility Water Treatment Plant indicated by a bill of lading, provided requirements of 13.1.1 have been fully met.

13.1.3. Fifteen (15) percent of the Contract amount shall be paid by Installing Contractor upon successful completion of testing, startup and training, and fulfillment of all contractual obligations concerning installation, startup services and training of Owner’s personnel. During this time, Installing Contractor may make payments based upon satisfactory progress of this Work.

13.1.4. The remaining five (5) percent will be paid upon final acceptance of the Work.

13.1.5. Acceptance by Supplier of the final payment shall be a release to Owner from all claims and liability hereunder for anything done or furnished in connection with the Work, or for any act or neglect of Owner or of any person relating to or affecting the Work.

14. INSURANCE REQUIREMENTS

14.1. For PRODUCTS or SERVICES requiring Supplier’s presence on any Owner property, the Supplier shall, during the term of this project and until completion thereof, provide and maintain the coverages required by the Installing Contractor.

15. HOLD HARMLESS AGREEMENT

15.1. The Supplier agrees to protect, defend, indemnify and hold harmless the Oak Creek Water and Sewer Utility and CH2M HILL, and their officers and employees (subject to any customary exclusion regarding professional liability) from any and all claims and damages of every kind and nature made, rendered or incurred by or in behalf of every person or corporation whatsoever, including the parties hereto and their employees that may arise, occur, or grow out of any acts, actions, work or other activity done by the Supplier, its employees, subcontractors or any independent contractors working under the direction of either the Supplier or subcontractor in the performance of this contract.

16. LAWS AND REGULATIONS

16.1. All applicable State of Wisconsin and federal laws, ordinances, licenses and regulations of a governmental body having jurisdiction shall apply to the award throughout as the case may be, and are incorporated here by reference.

17. FORCE MAJEURE

17.1. For the purpose hereof, force majeure shall be any of the following events: acts of God or the public enemy; compliance with any order, rule, regulation, decree, or request of any governmental authority or agency or person purporting to act therefore; acts of war, public disorder, rebellion, terrorism, or sabotage; floods, hurricanes, or other similar unusual storms; strikes or labor disputes; or any other cause, whether or not of the class or kind specifically named or referred to herein, not within the reasonable control of the party affected.

17.2. A delay in or failure of performance of either party shall not constitute a default hereunder nor be the basis for, or give rise to, any claim for damages, if and to the extent such delay or failure is caused by force majeure.

17.3. The party who is prevented from performing by force majeure (i) shall be obligated, within a period not to exceed fourteen (14) days after the occurrence or detection of any such event, to give notice to the other party setting forth in reasonable detail the nature thereof and the anticipated extent of the delay, and (ii) shall remedy such cause as soon as reasonably possible.

END OF SECTION

SECTION 01 04 00
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS - PROCEDURES

A. Direct submittals to Installing Contractor, unless specified otherwise.

B. Number of Copies:

1. Shop Drawings: 4 copies and 1 electronic submittal.
2. Informational Submittals: 2 copies and 1 electronic submittal.
3. Operation and Maintenance data: As required below.

C. Electronic Submittals: Submittals may be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the document.
3. PDF files shall be set to open “Bookmarks and Page” view.
4. Add general information to each PDF file, including title, subject, author, and keywords.
5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch or 11-inch by 17-inch. No other paper sizes will be accepted.
6. Submit new electronic files for each resubmittal.
7. Include a copy of the Transmittal of Submittal form with each electronic file.
8. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.

D. Transmittal of Submittal:

1. Supplier shall: Review each submittal and check for compliance with Contract Documents.
2. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.

b. Project title and Engineer's project number.
c. Date of transmittal.

3. Identify and describe each deviation or variation from Contract Documents.

E. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Supplier's submittal and transmit response to Supplier not later than 20 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

F. Resubmittals: Clearly identify each correction or change made.

G. Submittal Dispositions: Engineer will review, comment, stamp, and distribute as noted:

1. Approved: Supplier may incorporate product(s) or implement Work covered by submittal.
2. Approved as Noted: Supplier may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
3. Partial Approval, Resubmit as Noted:
   a. Make corrections or obtain missing portions, and resubmit.
   b. Except for portions indicated, Supplier may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
4. Revise and Resubmit: Supplier may not incorporate product(s) or implement Work covered by submittal.

1.02 SUBMITTALS - GENERAL

A. Complete Supplier's specifications, including material description.

B. Recommended spare parts and spare parts cost information.

C. List of special tools/instruments furnished with the equipment.

D. List of materials and supplies furnished with the equipment.

E. Approximate shipping weight of the equipment and, if shipped unassembled, the number of components and approximate weight of each.

F. Shipping method(s) to Oak Creek, WI from point of manufacture.

G. Recommended handling method.

H. Requirements for storage and protection prior to installation.

I. Requirements for storage and protection following installation, but prior to startup.

J. Submittals as required by the specific Specification Section.

1.03 SHOP DRAWINGS

A. Supplier shall submit such shop drawings and/or catalog cuts required for the fabrication and installation of the equipment. These drawings shall be accurate in every detail, and shall contain all information necessary to relate the equipment to the Drawings and Specifications.

B. Where the installation of the equipment requires coordination with work performed by others, such as installation of required embedded items furnished either by Supplier or by others, such coordination shall be clearly identified and indicated on the shop drawings.

C. Each shop drawing and/or catalog cut shall have been thoroughly checked by Supplier for compliance with the Drawings and Specifications. Supplier shall submit at least four sets of shop drawings to Engineer. Two sets will be returned to Supplier after review by Engineer within 20 days of receipt.

D. No work shall be performed in connection with the fabrication or manufacture of materials and equipment, nor shall any accessory or appurtenance be purchased until the shop drawings and data have been reviewed and returned to Supplier as being approved or otherwise accepted, except at Supplier’s own risk and responsibility.

E. Should Supplier propose any item on his shop drawings, or incorporate an item into the work, and that item should subsequently prove to be defective or otherwise unsatisfactory, (regardless of Engineer’s review), Supplier shall, at his own expense, replace the item with another item that will perform satisfactorily.

1.04 SAMPLES AND TEST SPECIMENS

A. Where required in the Specifications, and as determined necessary by Engineer, test specimens or samples of materials, and fittings to be used or offered for use in connection with the work shall be submitted to Engineer at

Supplier's expense, with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination and tests to establish the quality or equality thereof, as applicable.

1.05 INFORMATIONAL SUBMITTALS

A. Certificates:

1. General:
   a. Provide notarized statement that includes signature of entity responsible for preparing certification.
   b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual specification sections.
3. Manufacturer's Certificate of Compliance.
4. Manufacturer's Certificate of Proper Installation.
5. Special Guarantee: Supplier's written guarantee as required in individual specification sections.

B. Test, Evaluation, and Inspection Reports:

1. General: Shall contain signature of person responsible for test or report.
2. Factory:
   a. Identification of product and specification section, type of inspection or test with referenced standard or code.
   b. Date of test, Project title and number, and name and signature of authorized person.
   c. Test results.
   d. If test or inspection deems material or equipment not in compliance with Contract Documents, Supplier shall identify corrective action necessary to bring into compliance.
   e. Provide interpretation of test results, when requested by Engineer.
   f. Other items as identified in individual specification sections.
3. Field:
   a. As a minimum, include the following:
      1) Project title and number.
      2) Date and time.
      3) Record of temperature and weather conditions.
      4) Identification of product and specification section.
      5) Type and location of test, Sample, or inspection, including referenced standard or code.

6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
8) Provide interpretation of test results, when requested by Engineer.
9) Other items as identified in individual specification sections.

C. Testing and Startup Data: In accordance with Section 44 44 73, UV Disinfection System.

D. Training Data: In accordance with Section 44 44 73, UV Disinfection System.

1.06 OPERATION AND MAINTENANCE (O&M) MANUALS

A. Definitions:

1. Preliminary Data: Initial and subsequent submissions for Engineer's review.
2. Final Data: Engineer-accepted data, submitted as specified herein, within 20 days of receipt.

B. Sequencing and Scheduling:

1. Preliminary Data:
   a. Do not submit O&M Manual until Shop Drawings for equipment or system have been reviewed and approved by Engineer. Review to be within 20 days of receipt.
   b. Submit three (3) copies not less than 90 days prior to equipment shipment date.
2. Final Data: Submit Instructional Manual Formatted data not less than 60 days prior to installation of equipment or system. Submit six (6) copies of compilation formatted and electronic media formatted data at least 90 days prior to substantial completion of project.

C. Data Format:

1. Prepare preliminary data in data compilation format.
2. Prepare final data in data compilation format and on electronic media.

D. Data Compilation Format:

1. Compile all Engineer-accepted preliminary O&M data into a hard-copy, hard-bound set.

2. Each set shall consist of the following:
   a. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
   b. Cover: Identify each volume with typed or printed title "OPERATION AND MAINTENANCE DATA, VOLUME NO. ___ OF ___", and list:
      1) Project title.
      2) Owner's and Engineer's name.
      3) Contractor's name, address, and telephone number.
      4) If entire volume covers equipment or system provided by one Supplier include the following:
         a) Identity of general subject matter covered in manual.
         b) Identity of equipment number and Specification section.
   c. Provide each volume with title page and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.
   d. Table of contents neatly typewritten, arranged in a systematic order:
      1) Include list of each product, indexed to content of each volume.
      2) Designate system or equipment for which it is intended.
      3) Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
   e. Section Dividers:
      1) Heavy, 80 pound cover weight, tabbed with numbered plastic index tabs.
      2) Fly-Leaf:
         a) For each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment.
         b) List with Each Product:
            (1) Name, address, and telephone number of subcontractor, supplier, installer, and maintenance contractor, as appropriate.
            (2) Identify area of responsibility of each.
            (3) Provide local source of supply for parts and replacement.
         c) Identity of separate structure as applicable.
   f. Assemble and bind material, as much as possible, in same order as specified in the Contract Documents.

E. Electronic Media Format:

1. Portable Document Format (PDF):
   a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD media.
   b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
   c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.
2. Word and Excel Documents: All O&M documents and data files shall also be submitted in Word or Excel format on CD media.

F. Each instruction manual shall include, but not be limited to, the following:

1. Diagrams and illustrations.
2. Detailed description of the function of each principal component of the system.
3. Performance and nameplate data.
4. Installation instructions.
5. Procedure for starting.
6. Proper adjustment.
7. Test procedures.
8. Procedure for operating.
9. Shutdown instructions.
10. Emergency operating instructions and troubleshooting guide.
11. Safety precautions.
12. Maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, parts list, instructions for ordering spare parts, and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.
13. Procedures for calibrating equipment as appropriate.
14. MSDS for each item as appropriate.
15. Contact information for requesting assistance from Supplier.
16. Contact information for ordering spare parts.

G. The manual shall be complete in all respects for all equipment, accessories, and associated appurtenances. Incomplete manuals will be returned to Supplier within 20 days of receipt for corrections and resubmittal. If more than two resubmittals are required Supplier shall reimburse Owner for the additional Engineer’s review time at a rate of $150/hour.

1.07 SUPPLIER'S SERVICES DURING CONSTRUCTION

A. Competent and experienced technical representatives shall represent the Suppliers of all equipment and systems as may be necessary to resolve assembly or installation problems at the worksite which are attributable to, or associated with, the equipment furnished.

B. A Supplier's representative shall certify in writing stating that the system has been installed in accordance with the Supplier's recommendation and has been inspected by a Supplier's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed and that the proper electrical and mechanical connections have been made.

C. Where functional or performance testing is called for in the Technical Specifications, the Supplier's representative shall assist with the initial test. Initial equipment and system adjustment and calibrations shall be performed in the presence of, and with the assistance of, the Supplier's representative. The above-mentioned Supplier's certification shall include the statement that proper adjustments have been made, and that the equipment or system is ready for plant startup and operation.

D. Where training is called for in the Technical Specifications, the Supplier's representative shall furnish detailed instructions to Owner's personnel for operation of the specified equipment. These training services shall include pre-startup classroom and onsite equipment instruction and/or post-startup classroom and onsite equipment instruction, as stated in the Technical Specifications.

1.08 SCHEDULE REQUIREMENTS

A. Within 14 days of Execution of Contract, provide Engineer with bar chart graphic schedule showing expected start date, duration, and completion date for the following:

1. Shop drawing submittal.
2. O&M manual submittal.
3. Meetings with Engineer.
4. Start of manufacture.
5. Factory testing.
6. Shipment.
7. Field services.

B. The following forms, bound at the end of this section, shall be used to report progress relative to schedule:

1. Notice of Start of Manufacturing.
2. Shipment of Equipment (enclose bill of lading).
3. Schedule Impact.

C. Supplier shall assist Engineer in determining the latest available schedule information on the Contract items, including whether Supplier is on schedule or delayed. These requirements apply fully to telephone inquiries, personal visits, letters, or other communications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION FOR SHIPMENT

A. Insofar as is practical, equipment shall be factory assembled. The equipment parts and assemblies that are, of necessity, shipped unassembled shall be furnished with an assembly plan and instructions. The separate parts and assemblies shall be match-marked or tagged in a manner to facilitate field assembly of the equipment.

B. Generally, machined and unpainted parts subject to damage by the elements shall be protected with an application of a strippable protective coating.

C. Equipment shall be packaged or crated in a manner that will protect equipment from damage during shipping (including by barge), handling, and storage.

D. The outside of the package or crate shall be adequately marked or tagged to indicate its contents by equipment name, Contract number, and equipment number if applicable; approximate weight; state any special precautions for handling; and indicate the recommended requirements for storage prior to installation.

3.02 PACKAGING AND DELIVERY OF SPARE PARTS AND SPECIAL TOOLS

A. Spare parts and special tools shall be properly marked to identify the associated equipment by name, equipment, and part number. Parts shall be packaged in a manner for protection against damage from the elements during shipping, handling, and storage. Spare parts and special tools shall be shipped in appropriately sized, hinged-cover, wood or metal boxes. The boxes shall be marked to indicate the contents and use. Delivery of special tools shall be

made prior to the time the associated equipment is scheduled for the initial test run.

3.03 UNLOADING EQUIPMENT AT POINT OF RECEIPT

A. Unloading equipment at the jobsite shall be by Installing Contractor. Installing Contractor, Owner and Engineer will require a 15-day advance notice of delivery day followed by a 48-hour notice prior to the expected delivery time at the designated location. The 48-hour notice must include the approximate hour of delivery which shall be during regular daytime working hours at the Oak Creek Water and Sewer Utility Water Treatment Facility site, Monday through Friday, 7:30 am to 3:00 pm.

3.04 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this Specification.

1. Notice of Start of Manufacturing.
2. Notice of Shipment of Equipment.
3. Notice of Schedule Impact.

END OF SECTION

NOTICE OF START OF MANUFACTURING

DATE:_____

TO: Oak Creek Water and Sewer Utility
170 West Drexel Avenue
Oak Creek, WI 53154
ATTENTION: Ron J. Pritzlaff, P.E.

CC: Tony Myers. P.E.
CH2M HILL
135 South 84th Street, Suite 400
Milwaukee, WI 53214

RE: Equipment Contract No.:_____

Name of Contract:_____

Type of Equipment:_____

Quantity:_____

Scheduled Completion of Assembly:_____

Scheduled Date of Shipment:_____

NOTE: Delay to the above schedule which will affect shipment date by 5 days or more must be reported on the SCHEDULE IMPACT form.

By:_____ Date:_____

Title:_____

ACTUAL MANUFACTURING AGENT:

Name:_____

Address:_____

City:_____ State:_____ Zip:_____ Telephone:_____

NOTICE OF SHIPMENT OF EQUIPMENT

DATE:_____

TO:

Oak Creek Water and Sewer Utility
170 West Drexel Avenue
Oak Creek, WI 53154

ATTENTION: Ron J. Pritzlaff, P.E.

CC: Tony Myers, P.E.
CH2M HILL
135 South 84th Street, Suite 400
Milwaukee, WI 53214

RE: Equipment Contract No.:_____

Name of Contract:_____

Type of Equipment:_____

_____

QTY, DESCRIPTION (Include Equipment Numbers) SERIALS (If Applicable):

_____

_____

_____

_____

_____

ATTACH BILL(S) OF LADING FOR ALL SHIPMENTS TO THIS FORM:

Date of Shipment:_____

By:_____

Title:_____

ACTUAL MANUFACTURING AGENT:

Name:_____

Address:_____

City:_____ State:_____ Zip:_____ Telephone:_____

NOTICE OF SCHEDULE IMPACT

(Send this form to Owner and Engineer if delay is over 5 days)

DATE:_____

TO:

Oak Creek Water and Sewer Utility
170 West Drexel Avenue
Oak Creek, WI 53154

ATTENTION: Ron J. Pritzlaff, P.E.

CC: Tony Myers, P.E.
CH2M HILL
135 South 84th Street, Suite 400
Milwaukee, WI, 53214

RE: Equipment Contract No.:_____

Name of Contract:_____

Type of Equipment Affected:_____

Nature of Delay Description:_____

_____

_____

New Estimated Date for Final Shop Drawings:_____

New Estimated Date for Start of Manufacture:_____

New Estimated Date for Finish Manufacture:_____

New Estimated Date for Shipment:_____

New Estimated Date for Arrival at Jobsite:_____

By:_____

Title:_____

ACTUAL MANUFACTURING:

Name:_____

Address:_____

City:_____ State:_____ Zip:_____ Telephone:_____

SECTION 44 44 73
UV DISINFECTION SYSTEM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of the references which may be found in this Section:

1. American Water Works Association (AWWA): F110-12 Ultraviolet Disinfection Systems for Drinking Water.
2. American National Standards Institute (ANSI).
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
4. U.S. Environmental Protection Agency (USEPA): Final UV Disinfection Guidance Manual (UVDGM) - 2006 UVDGM.
5. Water Research Foundation (WRF): Guidance Document for Testing Medium Pressure UV Inactivation of Viruses. Project Number 4376 (2014 Draft Under Review, Pending Publication).
6. National Fire Protection Association (NFPA): 70, National Electric Code (NEC).
7. National Science Foundation (NSF) / ANSI:
    a. Standard 60: Drinking Water Treatment Chemicals – Health Effects.
    b. Standard 61: Drinking Water System Components – Health Effects.
    c. NSF/ANSI 372, Drinking Water System Components - Lead Content.
8. Underwriters Laboratory, Inc. (UL):
    a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
    b. 50E, Enclosures for Electrical Equipment, Environmental Considerations.
    c. 508, Industrial Control Equipment.
    d. 508A, Industrial Control Panels.

1.02 DEFINITIONS

A. As listed in 00 72 10, General Conditions.

B. Definitions of Ultraviolet (UV) Reactor/Component Failure:

1. UV Lamps shall be deemed to have failed when:
   a. UV Lamp fails to light when powered.
   b. UV Lamp fails to achieve performance requirements for disinfection specified herein.
   c. UV Intensity falls below UV Supplier's guaranteed end of life output (with UV Transmittance (UVT) $\geq$ design value; sleeves cleaned by the UV Reactor's automatic cleaning system).
2. UV Sleeves shall be deemed to have failed when:
   a. UV Sleeve breaks or leaks water while operating within the conditions specified herein.
   b. UV Sleeve output falls below UV Supplier's guaranteed end of life output immediately after sleeve cleaning by the UV Reactor's automatic cleaning system.
3. UV Ballasts shall be deemed to have failed when: UV Ballasts fail to properly operate UV lamps.
4. UV Intensity Sensors shall be deemed to have failed when:
   a. UV Intensity Sensors are not able to be calibrated at the factory.
   b. Duty Sensors drift out of calibration more than twice per month when checked with the reference intensity sensor per USEPA guidelines. Duty sensors shall be deemed out of calibration if intensity value at 100 percent lamp power differs from reference sensor intensity value by more than 20 percent absolute value.
5. UVT Analyzer shall be deemed to have failed when:
   a. UVT Analyzer drifts out of calibration more than once per week when checked weekly against a bench-top spectrophotometer per USEPA guidelines. UVT analyzer shall be deemed out of calibration if UVT analyzer reading differs from bench-top UVT reading by more than 2 percent UVT% value.
   b. UVT Analyzer fails to operate properly.
6. UV Reactor shall be deemed to have failed when: Minimum required Reduction Equivalent Dose (RED) or log inactivation, as specified herein, cannot be achieved under conditions that include flow, UVT, and lamp and sleeve life within design values.

1.03 SUBMITTALS

A. Shop Drawing:

1. List mechanical components of UV System and provide complete catalogue information, descriptive literature, specifications, and identification of materials of construction, including spare parts.

2. Detailed UV reactor information including make/model, pressure rating, flange size, headloss curve, min/max validated and allowable flow rate, min/max validated and allowable UVT, min/max RED, min/max log inactivation, reactor support requirements, quantity/location of UV lamps and intensity sensors, cooling water requirements, lamp cool-down/warm-up requirements, and air-release/drain line connection details.
3. Provide summary calculations to show compliance with the minimum required UV dose MS2 RED basis at the worst-case design conditions that were utilized as the basis for the capital sizing of the UV System. Include the estimated action spectra correction factor (ASCF) based on latest published validation test results and UV reactor CFD modeling or lookup tables following 2014 WRF Guidance.
4. Provide maximum flowrate capacity for an individual UV reactor to achieve 2-log virus inactivation at 90, 92.5, 95, and 97.5 percent UVT, including estimated ASCF based on 2014 WRF Guidance.
5. Drawings showing plan layout, cross-sections, dimensions, critical clearances, installation requirements, and all interconnections and interface requirements (power, controls, instrumentations, etc.). Identify separately-mounted components, connections to other work, critical clearance requirements, interconnections and interface requirements, and the validated hydraulic configuration.
6. Provide all UV Equipment weights (dry and wet) and equipment anchoring criteria for design of structural support by Engineer.
7. Summary of UV System control strategy including UV dose equation or calculations as a function of flow, UVT, Validation Factor, target organism inactivation, lamp age/sleeve fouling factors, and action spectra correction factor. Provide graph or table of min/max RED as a function of flow, UVT, S/So, and ballast intensity.
8. Detailed description of instrumentation and control system, including a list of all functions monitored, controlled, and alarmed.
9. Input power voltage, frequency, and phase requirements, total system maximum power load, power quality thresholds, and ballast turndown capabilities. Include estimated heat load generated by each power/control panel at maximum power draw.
10. Specifications for all interconnecting cables between the UV equipment, including voltage ratings, insulation type, conductor material and cable/conductor outside diameter, maximum cable length, and cable terminator type and quantity.

11. A list of all replaceable system components along with their expected replacement frequencies, duration of life warrantees, guaranteed replacement prices, and calibration frequencies. Include a list of special tools required for checking, testing, parts replacement, and maintenance.
12. Lamp data including watt rating, initial lumen output, lamp aging factors, and average lumens.
13. Complete description of the automatic lamp sleeve cleaning process and its maintenance requirements.
14. Complete description of UVT analyzer. Include operation and maintenance requirements, spare parts, layout diagram, and interconnection piping and electrical requirements.
15. Validation Testing: Full, detailed report with third party signature, raw data, and documentation of all reactor performance validation testing per the 2006 Final UVDGM. Include completed versions of Checklists 5.1 through 5.5 of the 2006 Final UVDGM. Checklists shall be signed and dated by the UV Supplier. Provide summary of deviations from the 2006 Final UVDGM. Report shall be available for review by Engineer, Owner, and Wisconsin Department of Natural Resources Project Engineer.
16. Third-party certification of lamp aging factor and fouling factor.
17. Details of duty and reference UV intensity sensors including sensor traceability and uncertainty from linearity, temperature response, spectral response, angular response, and long-term drift. Include calibration requirements necessary for compliance with UVDGM requirements.
18. Process and instrumentation diagrams and description of all functions monitored, controlled, and alarmed.
19. Control system block diagram(s) including the Human Machine Interface (HMI(s)), Programmable Logic Controller (PLC(s)), and control networks. Proposed layouts and development of all HMI screens for control of the UV disinfection system.
20. Preliminary PLC ladder logic listings, input/output (I/O) printouts, and cross-referenced printouts documenting programmable controller software program.
21. Provide native format electronic copies of the software installed in UV Supplier’s PLC and HMIs, annotated to carefully detail all program instruction functions and purposes. Minimum control, monitoring and alarm signals/information are detailed in the Functional Requirements paragraph in this Section.
22. Details of control and power panels including internal and external panel layouts, dimensions, access requirements, materials of construction, bill of materials, electrical schematics, and wiring diagrams. Include software and hardware component details.
23. Equipment delivery, storage, and installation requirements.

24. Preliminary Operation and Maintenance Manual.
25. Preliminary Operator Training Materials.

B. Quality Control Submittals:

1. Factory Acceptance Test Plan.
2. Final Factory Acceptance Test data sheets and witness report.
3. UV Supplier's Certificate of Proper Delivery for all UV Supplier supplied equipment.
4. UV Supplier's Certificate of Proper Installation for all UV Supplier supplied equipment.
5. Functional Test Plan: Provide a narrative of the test plan and data to be recorded and analysis to be completed, including all forms for recording data during the test.
6. Functional Testing Report: Provide a narrative and data summary of the Functional Testing discussing each element requiring testing, the tests performed, and the results. Functional Testing is not complete until this report is submitted and accepted by the Engineer.
7. Performance Test Plan: Provide a narrative of the test plan and data to be recorded and analysis to be completed, including all forms for recording data during the test.
8. Performance Testing Report: Provide a narrative and data summary of the Performance Testing discussing each element requiring testing, the tests performed, and the results. Performance Testing is not complete until this report is submitted and approved by the Engineer.

C. Contract Closeout Submittals:

1. Final Operation and Maintenance Manuals as specified in the General Requirements.
2. Final Operator Training Materials.
3. List of all original equipment by model and part number (detailed bill of materials). List manufacturer names, addresses, and phone numbers.
4. Provide Final PLC and Operator Interface programs on DVD in Rockwell Automation native format.
    a. Fully documented ladder logic listings, function listing for function blocks not fully documented by ladder logic listings, cross-reference listings and operator interface configuration documentation.
5. Service records for maintenance or calibration reports for calibration performed during construction or testing activities.

1.04 EXTRA MATERIALS

A. Provide the following spare parts:

1. UV Lamps: One complete set for one reactor.
2. Sleeves: One complete set for one reactor.
3. Ballasts: One complete set for one reactor.
4. Ballast Cooling Fans: One complete set for one reactor.
5. Duty UV Sensors: One complete set for one reactor.
6. Reference UV Sensors: Three (3) Sensors total for facility.
7. Complete set of cleaning system wiper assemblies for one reactor.
8. Complete set of special tools to disassemble or adjust the UV System.
9. Complete set of O-rings seals for one reactor.
10. One year's supply of cleaning chemicals or cleaning system parts, (if applicable).
11. Spare parts for 1 year's operation of the UVT analyzer including two spare lamps and 100 percent UVT calibration solution.
12. Spare Fuses: One of each size and type provided.
13. Spare parts for programmable controllers:
    a. One of PLC processor used.
    b. One of each type of I/O module used.
    c. One of each type of mounting chassis used.
    d. One of each type of communications module used.
14. Provide Industrial Ethernet network switches as needed in each panel for Ethernet communications between PLCs and HMIs.
15. Three (3) pairs of eye protective goggles and gloves.

PART 2 PRODUCTS

2.01 GENERAL

A. Products that will be in contact with potable water shall have NSF 61 certification. Chemicals used by the UV Supplier shall have NSF 60 certification.

B. The complete electrical assembly shall meet all requirements of the National Electrical Code (NEC), the National Electrical Manufactures Association (NEMA), the National Fire Protection Association (NFPA), and all applicable local electrical codes.

C. Components, including equipment, coatings and other parts of the UV System, shall comply with American Water Works Association (AWWA) standards, unless specified otherwise.

D. All terminal point connections shall be ANSI standard flanges.

2.02 DESIGN CRITERIA

A. The existing water treatment system at the Oak Creek Water and Sewer Utility Water Treatment Plant includes conventional coagulation, sedimentation, and filtration. The raw water is pumped from Lake Michigan, Wisconsin.

B. The UV System will be located downstream of the granular media filtration process and may be subjected to low levels of free chlorine (e.g. < 5 ppm).

C. The UV System will be installed downstream of conventional sedimentation/filtration inside of a new intermediate pump station building. The UV Control and Power Panels (CPPs) will be installed in a new electrical room in a climate controlled environment, and the UV reactors and piping will be installed in the pump room. The temperature inside the electrical room is expected to be maintained between 50 and 90 degrees F. The temperature inside the pump and UV reactor room is expected to be maintained between 50 and 100 degrees F. The estimated maximum length between the UV reactors and UV power/control panels is 72 feet.

D. Provide UV System meeting the following design basis:

1.	Total Number of UV Reactors:	2 active reactors plus 1 standby. Space for a future fourth reactor.
2.	Current UV System Flow:	Minimum: 4 mgd Average: 15 mgd Maximum: 35 mgd
3.	Future UV System Flow	Maximum: 75 mgd
4.	Reactor Flange Size:	24-inch or 30-inch only
5.	Water Temperature Range:	32.5 to 75 degrees F
6.	Total Hardness (mg/L as $CaCO_3$):	Average: <140
7.	Iron (mg/L as Fe):	Average: < 0.1
7.	Turbidity (NTU):	Maximum: < 0.3
9.	Design UV RED:	As required to meet pathogen performance
10.	UV Transmittance @ 254 nm:	Minimum: 90 percent Average: 95 percent Maximum: 99 percent
11.	Pathogen Performance:	3.0 LOG Inactivation (min) *Cryptosporidium* 3.0 LOG Inactivation (min) *Giardia*

E. Under the USEPA 2006 Final UVDGM, UV reactor shall be validated to provide minimum pathogen inactivation requirement over the full range of flows, UV dose, and water characteristics at the end of lamp life and under fouled quartz sleeve conditions. Validated operating conditions for each UV reactor shall include UVT less than or equal to 70 percent, flowrate greater than or equal to 20 mgd, and log inactivation of *Cryptosporidium* and *Giardia* greater than or equal to 3.0.

F. Validation Testing shall be compliant with the 2006 Final UVDGM and testing shall be completed, with Validation Test Report available, at the time of bid opening. As required per the Bid Form, Checklists 5.1 through 5.5 of the 2006 Final UVDGM shall be submitted to show level of compliance with the 2006 Final UVDGM.

G. The UV System shall be programmed, consistent with the 2006 Final UVDGM, such that UVT greater than the maximum validated UVT shall be considered equal to the maximum validated UVT and flowrates less than the minimum validated flowrate shall be considered equal to the minimum validated flowrate in the UV System programming and dose calculations. No extrapolation of system performance shall be allowed.

H. UV Design Dose for UV System Sizing:

1. Reactors must produce a Validated Dose (Dval) equal to or greater than 12 mJ/cm^2. The calculated Reduction Equivalent Dose (RED) at the design conditions must be greater than the product of the required dose (e.g., 12 mJ/cm^2 for 3.0-log *Cryptosporidium*) and the validation factor (VF) calculated per the 2006 Final UVDGM for *Cryptosporidium* based on MS-2 bacteriophage.
2. Each UV reactor shall be sized to meet the minimum disinfection requirements for all design conditions below:
    a. Flowrate of 20 mgd or greater at 90 percent UVT, including ASCF based on 2014 WRF Guidance.
    b. Flowrate of 20 mgd or greater at 95 percent UVT, including ASCF based on 2014 WRF Guidance.
    c. Flowrate of 20 mgd or greater at 97 percent UVT, including ASCF based on 2014 WRF Guidance.
3. The product of the end of lamp life aging factor (ELAF) and the quartz sleeve fouling/aging factor (QSFF) shall be incorporated into the UV design dose.

4. The ELAF provided by the UV Supplier shall be based on the 3rd party verified lamp output as a fraction of specified new lamp output after 100 hours of operation. The maximum ELAF allowed is 0.95. If no 3rd party certification is submitted the ELAF shall be no higher than 0.90.
5. If an alternate end of lamp aging factor is used, third-party certification (signed by a registered professional engineer) of the factor and the conditions under which it was determined shall be provided.
6. The QSFF shall be no greater than 0.90 for UV Systems with automatic cleaning mechanism. Third-party certification (signed by a registered professional engineer) of the factor and the conditions under which it was determined shall be provided.
7. The ASCF for any surrogate organism used in validation of a medium pressure lamp reactor shall be based on 2014 WRF Guidance for initial UV System sizing. The ASCF based on 2014 WRF Guidance shall be used to calculate the guaranteed operating costs of the UV System, as described in the 00 41 13, Bid Form. Supporting documentation shall be provided to show ASCF estimation using CFD basis, consistent with 2014 WRF Guidance. If estimation of the ASCF based on 2014 WRF Guidance is not provided, a default value of 1.50 shall be used for all conditions.

I. UV Reactor Headloss: Maximum of 24 inches measured from inlet to outlet flange at maximum reactor design flow rate.

J. Input Voltage: 480 Volts Alternating Current (VAC), 60 Hz, 3-phase, 3-wire. UV System shall be capable of operating during a 30 percent voltage drop from nominal, without shutting down. UV System shall be capable of operating during an 8 millisecond voltage drop without shutting down.

K. All reactor components shall be designed to handle pressures of up to 150 psig and shall be fully assembled and hydrotested at 1.5 times the design pressure at the factory prior to shipment.

L. The UV System shall be comprised of the following components:

1. UV Reactor(s) including lamps, quartz sleeves, and appurtenances.
2. Calibrated UV Intensity sensor(s):
    a. One (1) duty intensity sensor required per lamp for medium-pressure UV Systems.
    b. Reference UV sensor: refer to Section 1.04, Extra Materials. The UV System shall be able to continue providing disinfection while the UV intensity sensor is being calibrated or checked for calibration.

3. Automatic Cleaning System:
   a. One required per UV reactor.
   b. The UV System shall be able to continue providing disinfection while the automatic cleaning system is in operation.
4. Local UV Reactor Control/Power Panel(s):
   a. One required per UV reactor.
   b. Includes lamp ballasts, controller, remote I/O panels, HMI, and interconnecting power and control wiring between UV reactor and local control/power panel.
5. Remote UV Reactor HMI(s):
   a. One (1) required per UV reactor.
   b. Provides an additional operator interface near the UV reactor.
   c. Located adjacent to UV reactor affixed to an independent support panel as shown on Contract Drawings.
6. UV System Supervisory Control Panel:
   a. One (1) required for the UV System.
   b. Shall determine the number of UV trains required, monitor the UV transmittance and send it to the UV trains, control the UV train inlet/outlet valve operation, and determine the UV train lead/lag and alternation operation.
   c. Supports up to four UV trains.
   d. Include HMI on panel.
   e. Located near the local UV reactor control/power panels as shown on Contract Drawings.
7. UV Transmittance (UVT) Monitor:
   a. Two (2) required.
   b. As specified herein to provide continuous UVT measurement for UV dose control.
   c. Located in UV reactor room as shown on Contract Drawings.

2.03 UV SUPPLIERS

A. Materials, equipment and accessories specified in this section shall be products of:

1. Trojan Technologies (London, ON); UVSWIFT Series.
2. Calgon Carbon Corporation (Pittsburg, PA); SENTINEL Series.
3. Or Engineer approved equal.

2.04 UV SUPPLIER SCOPE OF SUPPLY

A. The UV System shall be furnished by the UV Supplier, complete with all validated UV reactors, UV reactor power supplies, power cables between the power panels and the reactors, power supply line filters (if required), transient voltage surge suppressors (if required), lamp power ballasts, power supply transformers (if required), lamps, quartz sleeves, calibrated duty and reference UV sensors, automatic cleaning system, cleaning chemicals (if applicable), electrical and control wiring and programmable controllers within the UV reactor and power/control cabinet(s), UV transmittance analyzers and flow elements, UV reactor temperature and level switches, UV reactor remote HMIs, UV system master control panel/HMI for a complete and operable UV System.

2.05 SCOPE OF SUPPLY FOR INSTALLING CONTRACTOR

A. Installing Contractor shall be responsible for supplying and installing all the necessary materials, equipment and appurtenances not supplied as part of the scope of supply for the UV System, but required for a complete, functional and operational UV System including, but not limited to:

1. Structural supports required to install the UV reactors, piping, and remote UV system HMIs.
2. UV reactor and UV train air relief valves, isolation valves, pressure gauges, and associated piping as shown on Contract Drawings.
3. All the hardware, fasteners, anchor bolts, nuts, plates and angles necessary for the installation of the UV System. All hardware, fasteners, anchor bolts, nuts, plates, angles, etc., shall be Type 316 stainless steel.
4. All mating flanges, insulating flanges, couplings, gaskets, bolts, nuts, and all necessary piping specialties to install the reactors, and analyzers, supplied by the UV Supplier. Mating flanges shall be as required in the pipe schedule. All bolts, nuts shall be Type 316 stainless steel. Gaskets shall be ethylene propylene diene monomer rubber (EPDM).
5. All conduit, fittings, supports, hubs and wiring including wire terminations and terminators necessary for the complete installation of the UV reactors, CPPs, instruments, analyzers, devices and HMIs supplied as part of the UV System. This includes any additional length of conduit/wiring required to meet actual installation requirements, beyond what was included in UV Supplier scope of supply as part of the UV RFP package.

6. All the equipment supports, U-bolts, piping/valves and all necessary hardware to install all the ancillary equipment supplied by the UV Supplier. Ancillary equipment shall include UVT analyzers, control and power panels, and other equipment needed for a fully functional and validated UV System.
7. Provide on-site assistance to UV Supplier during Functional Testing and Performance Testing as defined in the Performance Test Procedures developed by the UV System Supplier and approved by the Engineer. Develop UV System testing schedule that is compatible with overall projects needs for which UV Supplier shall follow. Coordinate with Owner regarding availability of process water and flowrate.

B. Installing Contractor shall refer to the UV Supplier's Submittal's for additional requirements.

2.06 UV REACTOR

A. General Requirements:

1. Materials of Construction: The UV reactor shall be welded Type 316L stainless steel, pickled, passivated, and bead blasted for uniform external finish. Final external reactor finish shall be a No. 4 finish as defined by the Specialty Steel Industry of North America. Each reactor shall be supplied with American National Institute (ANSI) Class 150 flanged inlet/outlet connections. All metal parts in the reactor shall be constructed of Type 316L, pickled and passivated stainless steel. All nonmetallic materials in the reactor shall be suitable for continuous exposure to UV light.
2. Quartz sleeves shall be high purity, rated for maximum possible UV transmittance, and accounted for in UV dose and validation.
3. Each lamp shall be enclosed in an individual quartz sleeve, sealed with compressed O-rings.
4. Each quartz sleeve shall be independently sealed within the reactor.
5. The UV reactor shall be designed such that the Utility operating personnel can change the lamps without draining the reactor.
6. The UV reactor shall be provided with an access port for easy maintenance of the quartz sleeves, cleaning system, and sensor calibration and maintenance.

B. UV Lamps:

1. The UV lamps shall be medium pressure (MP).
2. The filament shall be rugged to withstand shock and vibration.
3. The lamp bases shall be resistant to UV.

4. The lamps shall be operated by electronic or electromagnetic ballasts with multiple power settings ranging from at least 40 percent to 100 percent maximum power using at least 2 percent power steps as validated conditions.
5. The UV lamps shall be guaranteed for a minimum number of operation hours prior to lamp output reaching the ELAF. A minimum of four on/off cycles shall be allowable for the lamps every 24 hours. At the end of guaranteed lamp life, lamp output weighted for the germicidal emission spectrum (using a weighting equivalent to that used by the UV Supplier's intensity sensor), shall be greater than or equal to 90 percent of new lamp output, as measured in the field by the Utility using the UV System's UV intensity reference sensors. Thus, lamp life shall be determined by field tests based on intensity sensor readings. At the highest power setting, if the intensity reference sensor reading (or average of all reference sensors) for a clean lamp is less than or equal to 90 percent of the intensity sensor reading(s) for a new lamp, then the end of lamp life shall be considered to have been achieved. If the UV Supplier submits an alternative ELAF, then the submitted value shall replace "90 percent" in the previous text.
6. Manufacturer's unit cost for replacement lamps shall include cost to accept and properly dispose of used lamps.

C. UV Lamp Quartz Sleeves:

1. Manufacturer:
   a. General Electric Type 214, fully annealed clear fused quartz tubing.
   b. General Electric Type 021A, dry synthetic clear fused quartz tubing.
   c. General Electric Type 219, doped quartz tubing.
   d. Or equal.
2. The open end(s) of the lamp sleeve shall be sealed by means of an O-ring and Type 316 stainless steel compression plate.
3. The UV lamp sleeves shall be guaranteed for a number of operation years, as provided in section 00 41 13, Bid Form. At the end of guaranteed sleeve life, sleeve output shall be greater than or equal to 90 percent of new sleeve output immediately after sleeve cleaning.

D. UV Intensity Sensor(s):

1. Only germicidal UV sensors, as defined in the UVDGM, shall be allowed.
2. A minimum of one duty UV sensor is required per MP lamp.
3. "Wet" Intensity Sensors shall not be used.

4. Supplier shall guarantee the duty UV intensity sensor calibration interval as listed in the Bid Form. If the time between calibrations for a duty UV intensity sensor is less than the guaranteed calibration interval, Supplier shall calibrate the sensor at no cost to the Utility, and shall pay for all sensor shipping charges to and from the Owner. Determination of a sensor requiring calibration shall be according to the Supplier's standard operating procedures. This guarantee shall apply for a period of 20 years, or until UV intensity sensors that meet the guaranteed calibration interval are provided by Supplier, whichever is later.

E. Automatic Lamp Sleeve Cleaning System:

1. Each UV reactor shall be equipped with an automatic quartz sleeve cleaning system.
2. The cleaning system shall provide cleaning abilities for the lamp sleeves and UV sensor.
3. Automatic cleaning systems shall be:
   a. Fully operational while still providing disinfection.
   b. Complete with an automatically initiated and controlled cleaning cycle.
   c. Field adjustable timing via the operator interface.
   d. Manual cleaning system operator control shall be available through the operator interface.
4. Cleaning system components used shall be NSF 60 approved.

2.07 UV SYSTEM CONTROL PANELS

A. General:

1. All panels shall be pre wired to the maximum extent possible, requiring only field connections for power and field devices. For communication circuits, provide cable and connectors per device manufacturer's recommendations. Provide measurements to certify that lead length limitations on communication circuit cabling have not been exceeded.
2. Control Panel Fabrication:
   a. UL Listing Mark for Control Panels: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.
   b. Panel construction and interior wiring in accordance with NFPA 70 (NEC), state and local codes, NEMA, ANSI, UL, and ICECA.
   c. All electrical components are to be isolated from all wetted parts.
   d. The components shall be arranged in the enclosure such that failure of any component requires the removal of the failed component only. Systems where groups of components are enclosed and serviced as a sub-system will not be permitted.

e. Panels shall be constructed to accommodate all necessary accessories such as instrument air, power, power supplies, mounting hardware, terminal blocks and any signal conditioning or conversion equipment that may be necessary to make operational all monitored and controlled equipment mounted in the enclosure.
f. Panel layout and equipment spacing shall be constructed to allow for device removal, calibration and maintenance without disassembly of adjacent devices.
g. Removable "eye" bolts shall be provided to facilitate sling handling of each panel. In lieu of eye bolts, the panels can be mounted to a single frame that can be lifted by a sling. If used, eyebolt mounting shall be a part of the structural support bracing to distribute stresses and enclosure weight while sling handling enclosures during installation.
h. All panels shall have sufficient structural reinforcements to ensure a plane surface, limit vibration and to provide rigidity during shipment, installation and operation without distortion or damage to the control panel enclosure or injury to any mounted instruments.
i. All panel seams shall be continuously welded and ground smooth to be undetectable after painting.
j. All enclosures shall be provided with flush hinges and an automotive-type latch.
k. Enclosure doors shall have three point latch assemblies, or quarter turn latches.
l. All control panels containing PLCs or HMIs shall be supplied with print pockets, located on the inside bottom of the control panel enclosure door. Make and color of the print pocket shall be the same as the control panel enclosure interior.
m. There shall be no devices installed on the side plates of the control panel enclosure.
n. Devices mounted on the front door of the control panel enclosure front door shall be installed rigidly and within view level heights. The center of the HMI shall be installed at approximately 5 feet above surrounding floor for ease of operation. Other devices such as selector switches, pushbuttons and indicating devices arranged below it.
o. Instruments or devices furnished for mounting on the front of the control panels shall be suitable for this application and selected to match each other and present a coordinated aesthetically pleasing functional arrangement. The arrangement of devices is to be as symmetrical as possible and shall functionally group devices to

enable operators to easily locate groups of devices or individual devices to control the process.

p. All control panels should have a total clearance of not less than 2 inches from the face of any backplate mounted devices to the rear of any door mounted devices.

q. Other than the control panel front, under no circumstances shall an enclosures external surface be perforated for the purpose of mounting enclosure components (both internal and external) without the express prior permission of the Engineer. Enclosure components requiring such fixation shall utilize fusion welded capacitor discharge type studs.

r. Control wiring within each panel shall be segregated within the panel based on voltage. All voltages above 120V shall be separated by a solid metal barrier. Analog and discrete control wiring shall be kept separate from 120V ac and 480V ac and higher. Wiring shall be, minimum, No. 14 AWG for 120V ac control wiring and No. 16 AWG for analog wiring. In all cases, size wire for connected loads and include calculations for verification, showing appropriate derating, where needed.

s. All control panel doors shall open through 180 degrees without restriction.

t. Internal back panel is to be removable type, mounted 2 inches clear from rear of the panel.

u. Digital, analog and power devices such as relays, terminals and wire must be separated and clearly marked.

3. Control Panel Wiring:

a. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.

b. Arrange wiring neatly, cut to proper length, and remove surplus wire.

c. Abrasion protection for wire bundles which pass through holes or across edges of sheet metal.

d. Connections to Screw Type Terminals:

1) Locking-fork-tongue or ring-tongue lugs.

2) Use manufacturer’s recommended tool with required sized anvil to make crimp lug terminations.

3) Wires terminated in a crimp lug, maximum of one.

4) Lugs installed on a screw terminal, maximum of two.

e. Connections to Compression Clamp Type Terminals:

1) Strip, prepare, and install wires in accordance with terminal manufacturer’s recommendations.

2) Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.

f. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.
g. All terminal blocks, relays and other wiring and devices shall be installed on the panel backplate.
h. Terminal blocks shall be supplied and installed for all used and spare PLC I/O points.
i. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.
j. Separate voltages higher than 120 V ac in separate wire ducts or conduit.
k. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
l. All internal control panel wiring shall run through plastic wire ducts. Do not exceed manufacturer's fill recommendation.

4. Internal Panel Lights for Control Panels:
   a. Type: 120 V ac Switched LED with door switch.
   b. Quantity: One light for every 4 feet of panel width.
   c. Mounting: Inside and in the top of back-of-panel area.
5. Service Outlets for Control Panels:
   a. Type: Three-wire, 120 volt, 15 ampere, GFCI duplex receptacles in ivory or white, with 5 ampere circuit breaker branch protection.
   b. Quantity: One outlet for every 4 feet of panel width.
   c. Mounting: Evenly spaced along back-of-panel area.
6. UPS:
   a. Type: true-online, double conversion type. Line-interactive or stand-by type is not acceptable.
   b. Quantity: One for the System Supervisory Control Panel, and one for each Local Control/Power Panel. The remote panels will be powered by their respective CPP.
   c. Performance:
      1) Capacity: 150 percent of connected load.
      2) Backup Runtime:
         a) Full Load: 15 minutes minimum.
         b) Half Load: 30 minutes minimum.
      3) Continuous no-break power with no measurable transfer time.
   d. Features:
      1) Bypass: Built-in.
      2) User replaceable batteries.
      3) Discrete Output: One SPDT contact, rated at 5 amps continuous, at 120V ac for Common Alarm.
   e. In control panels, as a minimum, feed UPS power to PLC, I/O racks, OIT, network components, 24 VDC power supplies, and

digital input excitation to ensure that the panels can continue to perform communications, data manipulation, calculations, monitoring, and process data archiving during a complete or partial interruption of incoming line power. The control panel light and any convenience receptacles shall not be fed from UPS power.

f. A UPS that provides power to a PLC shall be provided with a common alarm output to be monitored by the PLC. A separate relay shall be provided to detect a loss of power in the incoming power ahead of the UPS and monitored by the PLC.

g. A UPS failover relay shall be provided that is powered by the UPS and installed in the control panel. The purpose of the relay is to monitor the UPS for output power and if not present switch from UPS output power to incoming panel power.

h. The UPS may be installed inside a control panel on a dedicated shelf above the bottom of the panel, provided that adequate ventilation is provided. If adequate ventilation cannot be provided the UPS shall be installed in a separate ventilated enclosure rated for the environment.

i. UPS powered duplex or single outlets shall be orange.

j. Manufacturers and Products:
   1) EATON; Powerware 9 Series.
   2) APC: SmartUPS RT series.
   3) Or approved equal.

7. Control Panel Cooling and Heating:
   a. Maximum Temperature: All control panels shall have ample cooling to prevent high temperatures from shortening the life of the equipment mounted inside. No location within the control panel or the interior of the equipment mounted inside shall reach temperatures higher than 104 degrees Fahrenheit.
   b. Minimum Temperature: All control panels shall have sufficient electric heating to prevent low temperatures from causing condensation on and/or freezing of equipment mounted inside. No location within the control panel or the interior of the equipment mounted inside shall reach temperatures below 41 degrees Fahrenheit.
   c. Ventilated Panels:
      1) Furnish with louvers and forced ventilation as required to prevent temperature buildup from equipment mounted inside panel or on panel.
      2) Louver Construction: Stamped sheet metal.
      3) Ventilation Fans:
         a) Furnish where required to provide adequate cooling.
         b) Create positive internal pressure within panel.

c) Fan Motor Power: 120V ac, 60 Hz, thermostatically controlled.

4) Air Filters (if provided): Washable aluminum, Hoffman Series A FLT, or Engineer approved equal.

d. Cooling Without Air Exchange: Control panels in areas of heavy particulate contamination shall be cooled without air exchange between the interior and the exterior of the control panel. Either solid-state cooling equipment or refrigeration must be used to cool the control panel. The heat dissipation portion of the cooling unit shall be designed for use in areas with heavy particulate contamination and shall be capable of running extended periods without cleaning.

B. Local Control/Power Panels (CPP):

1. All electrical components are to be housed in painted steel, NEMA 12 or greater rated enclosures.
2. All control panel enclosure exterior surfaces to be factory finished, powder coated ANSI/NSF 61 grey. Control panel enclosure interiors and sub-panel shall be gloss white.
3. Coordinated breaker protection required from UV System control and power panel sections.
4. All CPPs shall be provided with electrical safety interlocks, which prevent the panel from being opened when the main panel electrical disconnect is closed (providing power to the panel). Alternatively, an interlock may be provided to disconnect power from the panel when the door is opened. Safety interlock shall be Cutler-Hammer Flex Shaft, or Engineer approved equal.
5. Provided electrical safety interlocks shall be in full compliance applicable panel ratings (e.g., ULc), local ordinances and requirements, and any additional Oak Creek Water and Sewer Utility safety rules.
6. Emergency stop pushbuttons: Each CPP is to have a push-to-stop, pull-to-reset, large diameter red mushroom head, heavy-duty, NEMA 12 pushbutton.
   a. Manufacturer: Allen Bradley Type 800T.
7. Power distribution and control for each UV reactor shall be through the associated CPP. The CPP shall house all power supplies and control hardware for the reactor.
8. Electrical cables must have jackets that will not degrade after prolonged exposure to UV light.
9. Provide cables for connecting the UV reactor to its associated CPP. Cable shall be rated for the proper power and temperature operating conditions. CPPs and reactors shall be installed in the same building, as shown in preliminary design drawings. Cables will be routed between

UV reactors and CPPs via exposed cable trays and/or conduits. Maximum cable length is estimated to be 72 feet each. If conduit length exceeds 72 feet, Installing Contractor is responsible for providing the additional length required to complete the installation.

10. The CPP shall include all control power transformers for all required voltages. Provide a complete power distribution system for the ballasts/lamps and ancillary equipment associated with each reactor. The electrical system shall comply with all local electrical code requirements.
11. Total harmonic distortion, both voltage and current, shall not exceed 5 percent from root-mean-square, and individual harmonics do not exceed 3 percent from root-mean-square, at the input terminals of the panel.

C. Remote Control Panel:

1. All electrical components are to be housed in 316 stainless-steel, NEMA 4X or greater rated enclosures. Control panel enclosure interiors and sub-panel shall be gloss white.
2. Emergency stop pushbuttons: Each remote control panel is to have a push-to-stop, pull-to-reset, large diameter red mushroom head, heavy-duty, NEMA 4X pushbutton.
   a. Manufacturer: Allen Bradley Type 800H.

D. System Supervisory Control Panel:

1. Overall control of the UV System shall be provided through a System Supervisory control panel.
2. All electrical components are to be housed in painted steel, NEMA 12 or greater rated enclosures. All control panel enclosure exterior surfaces to be factory finished, powder coated ANSI/NSF 61 grey. Control panel enclosure interiors and sub-panel shall be gloss white.

3. Provide cables for connecting the UV reactor CPPs to the System Supervisory control panel. Cable shall be rated for the proper power and temperature operating conditions. UV System Supervisory control panel shall be installed in the same building, as shown in preliminary design drawings.
4. The System Supervisory control panel shall provide overall control logic for UV system including UV train isolation valve control, UV train flow monitoring, UV system UVT monitoring, number of UV reactors online, UV reactor status, target UV dose/log inactivation, and flow rate per UV reactor.

2.08 PLANT SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) PLC

A. Remote control of the UV System shall be allowed through the plant SCADA PLC. The following functions shall be provided through the plant PLC:

1. Digital Control: UV System Run (Request), UV System Stop (Request), Lead/Lag UV Train Selections, Sequence Mode Selection, along with general functions (general warning alarm reset, etc.).
2. Analog Control: Required Flow and Required UV Dose.
3. Communication: UV System communication to and from the UV System Supervisory control panel.

B. The plant SCADA controller shall be interconnected to the UV System Supervisory control panel through the plant Ethernet control network.

2.09 INSTRUMENTATION AND CONTROL

A. Instrumentation and Controls - General:

1. One CPP is provided for each UV reactor. All control hardware and software for a given reactor is contained within the associated CPP.
2. Provide instrumentation and control for the UV System, which allows for the UV disinfection process to be fully automated and deliver the required UV dose under conditions of varying flow rates, UV lamp intensity and varying UV transmittance.

B. Make all program functions, I/O addresses and internal registers within PLCs accessible by plant SCADA system. Coordinate all register units, ranges and conventions with Installing Contractor’s System Integrator to facilitate data exchange. The graphic display screens for the UV System HMIs shall match the color usage configuration of the plant SCADA workstations for valve and equipment status. The color green shall be used to indicate a valve is opened or equipment is running. The color red shall be used to indicate a valve is closed or equipment is stopped. The color yellow shall be used indicate a

valve is mid travel. General formatting and screen navigation shall be manufacturer standard.

C. Programmable Logic Controllers (PLCs):

1. A controller consists of a power supply, rack, processor module, communication module, I/O modules, removable terminal blocks, slot fillers, and other hardware, as required for a complete and functional system.
2. Quantity:
    a. One (1) controller shall be mounted in each local CPP.
    b. One (1) controller shall be mounted in the system supervisory control panel.
3. Communications Modules: Provide 100/1000 Mbps EtherNet/IP communications ports. Utilize 10/100 Mbps Ethernet communications for all HMIs and to plant SCADA.
4. Power Supply Module: As required.
5. Digital Input Module: As required with isolated inputs.
6. Digital Output Module: As required with isolated relay outputs.
7. Analog Input Module: As required with isolated 4-20 mA inputs.
8. Analog Output Module: As required with isolated 4-20 mA or 0-10VDC outputs.
9. Design Requirements:
    a. Furnish a removable terminal block (RTB) for each I/O module.
    b. Each chassis shall accommodate a minimum of two future additional I/O modules as shown in the PLC Input and Output List.
    c. Furnish module slot fillers to reserve module slots for future I/O modules.
    d. Each I/O module type used shall accommodate a minimum of 20 percent spare I/O points of the total installed I/O points as shown in the PLC Input and Output List, but no less than two spare I/O of each type of I/O module used.
    e. Furnish one communication module for connection to plant SCADA network.
    f. Furnish one communication module for connection to controller I/O network as required. I/O network traffic shall be separate from plant SCADA network traffic.
10. Manufacturers and Products:
    a. Allen-Bradley; ControlLogix L7 or CompactLogix L45 controllers and associated hardware.
    b. No equal.

D. Human-Machine Interface Unit (HMI):

1. Panel-mounted graphical operator interface capable of bi-directional communication with PLC-based control system.
2. Quantity:
   a. One (1) HMI shall be mounted in each local CPP.
   b. One (1) HMI shall be mounted in each remote control panel.
   c. One (1) HMI shall be mounted in the system supervisory control panel.
3. Include all cables necessary to interface with the PLC control system and to a personal computer.
4. Manufacturers and Products:
   a. Allen-Bradley; PanelView Plus 6 1000 with touch screen only.
   b. No equal.

E. Control System Hierarchy

1. The UV SUPPLIER will apply through hardware, and PLC/HMI software, the following standard control hierarchy/modes to all plant SCADA controlled devices:
   a. LOCAL – When a controlled device's physical. LOCAL/ REMOTE switch is placed in LOCAL, an operator has direct control over each device by means of its physical controls, situated at the device. This mode prevents all SCADA Manual and Automatic control functions. Under all control modes, the SCADA system retains device status monitoring functions. Switching between LOCAL and REMOTE shall be bumpless (retaining the last operational status).
   b. REMOTE MANUAL (MANUAL) – When the device's physical LOCAL/REMOTE switch is placed in REMOTE, device control has been turned over to the SCADA system, disabling all local controls, except emergency stop and safety related control functions such as hardwired interlocks. A device's AUTO/MANUAL control mode state is retained within its controlling PLC, switchable by software means through HMI based controls. MANUAL software controls mimic the device control features available locally at the device, allowing direct remote control over individual devices. Under normal circumstances, switching between MANUAL and AUTO shall be bumpless, unless the current process state satisfies the pre-defined AUTO control conditions, in which a device or set of devices may start or stop immediately.
   c. REMOTE AUTO (AUTO) - With the device's LOCAL/REMOTE physical switch remaining in the REMOTE position and its

SCADA based control placed in AUTO, a device or a set of associated devices in a larger process unit, will be automatically controlled by logic and associated setpoints within the PLC(s), generally without user intervention. MANUAL controls are disabled. Switching between AUTO and MANUAL shall be bumpless.

d. Operator is to have the capability of start/stop equipment set in Manual control mode.
e. Operator is to have the capability adjust control setpoints and parameters of equipment set in AUTO control mode.
f. Operator is to have the capability to open/close valves or adjust the position when applicable.
g. Provide safeguards and warnings to prevent an accidental change of state.

2. Functional Requirements:
   a. The UV System shall calculate the UV reduction equivalent dose based on the flowrate through the reactor, the UV transmittance, and the UV intensity measurements in the reactor. The UV System shall apply the Validation Factor and ASCF (calculated if required) and report the Validated Dose and Log Inactivation of *Giardia* and Log Inactivation of *Cryptosporidium*. The UV reactor flowrate shall be hardwired to the CPP's PLC from the flow meters (by others). The UV transmittance signal shall be hardwired to the UV System Supervisory PLC and distributed to the individual UV reactor PLCs (by UV System Supplier).
   b. The UV System shall maintain the required UV dose and log inactivation and send an alarm to the plant SCADA if it is unable to maintain the dose and log inactivation set points.
   c. The UV System shall monitor for equipment failure or malfunction and shut down the reactor in response to such a failure. The CPP face shall be provided with an emergency STOP pushbutton, which upon activation will shut down the reactor and send the shutdown signal to the plant SCADA.
   d. A permissive to start a UV reactor will be provided by the plant SCADA. If permission is given, the UV reactor shall be allowed to warm-up.

e. Control and monitoring of the UV reactor effluent flow control valves are to be done by the UV System PLC inlet and outlet train. The UV Supplier shall coordinate with the Installing Contractor regarding details of interfacing and communications with this equipment. The valves shall be programmed to prevent flows greater than the maximum allowable or maximum validated flow defined by the UV Supplier.
f. Utilize a non-linear filter to adjust lamp power during rapid changes in flow or UVT to avoid short-periods of off specification water.
g. Send a request to OPEN UV to Waste Valve and CLOSE after lamp break/leak critical alarm.
h. The UV Reactor influent valve shall be opened prior to firing lamps, to allow for cooling water during start-up and is typically only closed for maintenance.
i. The UV reactor effluent flow control valve shall not be opened until warm-up cycle has finished and a SYSTEM READY signal is received from the UV reactor CPP.
j. In order to provide coordination and synchronization between the alarm displays on both the UV System HMIs and the plant SCADA system, both the UV Supplier and the Installing Contractor's System Integrator will provide sufficient synchronization mechanisms and logic within their systems such that all UV System HMI and SCADA alarm display and acknowledgement maintains synchronization.
k. As a minimum, the UV System shall provide the process monitoring and status information to the plant SCADA as listed in the following sections.
l. The UV System Supervisory controller shall have logic to handle the lead/lag and alternation sequencing of UV trains based on selections from the plant SCADA controller. The plant SCADA controller will select between running in a Lead/Lag mode or Automatic Alternation mode. The plant SCADA controller will specify the Lead UV Train, 1st Lag UV Train, 2nd Lag UV Train, and 3rd Lag UV Train.
m. The UV System Supervisory controller shall have logic to handle the sequencing of UV trains in and out of service based on the flow setpoint from the plant SCADA controller.
n. The UV System Supervisory controller shall have logic to select between the two UV Transmittance Transmitters and sending a single value to each of the UV train controllers.
o. The UV System Supervisory controller shall have logic to balance the flow between active UV trains by modulating the position of the UV train effluent flow control valves.

p. The UV System Supervisory controller shall provide trends showing UV Train Flow, UV Transmittance, and UV Dose over time as a minimum for each train.

3. The UV System Supervisory control panel shall communicate all signals with the plant SCADA by way of the following protocol:
   a. UV Supervisory Controller to plant SCADA Controller communications will use the Allen Bradley ODVA Ethernet/IP protocol. Where data from one controller is needed by another controller over a network connection, non-cached message commands (MSG) are used to READ data between controllers. In order to avoid overwriting local control commands in a receiving controller, the use of WRITE messages is not allowed. All data shall mapped as 32-bit data. Analog data is written to a Real data array, and integer and discrete data is written to a Double Integer data array in the remote controller then READ by the receiving controller. The data for each message shall be structured in order: Double integer data, followed by floating point data. Arrays shall not exceed 125 elements, as this corresponds to the 500 byte limit for a single schedule connection between Logix processors.
   b. Produced and consumed tag usage is not allowed.

F. Inputs / Outputs:

1. The following signals will be available from the plant SCADA to the UV Supervisory control panel via the plant network as a minimum:
   a. SCADA Heartbeat (e.g. rolling counter).
   b. SCADA UV to Storage Valve Statuses (Remote, Opened, Closed).
   c. SCADA UV to Waste Valve Statuses (Remote, Opened, Closed).
   d. SCADA Intermediate Pump Statuses (Remote, On/Running).
   e. System Required Flow.
   f. System Required UV Dose.
   g. System Run Request.
   h. System Shutdown Request.
   i. System Sequence Mode Selection, a selection between running in Lead/Lag mode or Automatic Alternation mode.
   j. System UV Train Lead/Lag Selections, a selection for the Lead UV Train, 1st Lag UV Train, 2nd Lag UV Train, and 3rd Lag UV Train.
   k. Enable Permissive for each UV train.
2. The following signals are to be sent from the UV Supervisory control panel to the plant SCADA via the plant network as a minimum:
   a. System Heartbeat (e.g. rolling counter).
   b. System Remote.

c. System Ready.
d. System Common Alarm.
e. System Sequence Mode Status.
f. System Lead/Lag Status.
g. All general alarms for each UV train.
h. All critical alarms for each UV train.
i. Ballast ON/OFF for each UV train.
j. Ballast Power Level for each UV train.
k. Lamp ON/OFF status for each UV train.
l. Remote (e.g., control is from plant SCADA) for each UV train.
m. Running Status (on/running, warming, shutdown, ready, offline) for each UV train.
n. Effluent Valve: Status (Remote, Opened, Closed, Position Feedback) for each UV train.
o. Influent Valve: Status (Remote, Opened, Closed) for each UV train.
p. Flow (MGD) for each UV train.
q. Cumulative Volume (MG) for each UV train.
r. Cumulative Off-Spec Volume (MG) for each UV train.
s. Intensity (per lamp) for each UV train.
t. Reduction Equivalent Dose (MS2 and T1) for each UV train.
u. Validated Dose (mJ/cm2) for each UV train.
v. Validation Factor for each UV train.
w. ASCF for each UV train.
x. Log Inactivation of *Giardia*.
y. Log Inactivation of *Cryptosporidium*.
z. Log Inactivation Virus.
aa. Lamp Run Time (Hours) for each UV train.
bb. UV Dose Operating Safety Factor (1.XX) for each UV train.

3. As a minimum, the UV System Supervisory control panel shall provide the following general alarms to the plant SCADA for each UV train, but will not automatically shut-down the UV reactor:
   a. Lamp run time hours exceeded.
   b. UV intensity sensor calibration check required.
   c. Measured UVT above validated range (Revert to max. validated UVT).
   d. Loss of UVT signal or out of range (Revert to min. design UVT)
   e. Loss of Flow signal or out of range (Revert to max. design flow)
   f. SCADA communication failure (Revert to design UVT and flow).
   g. Measured UVT below validated range (Off-specification event).
   h. Low UV dose (Off-specification event).
   i. UV intensity sensor signal loss (Off-specification event).
   j. Measured flow below validated range (Revert to min. validated flow).

k. Dust Cap Off Alarm.
l. Off-specification Water Produced (other conditions as required).
m. Wiper Fault (any type).

4. As a minimum, the UV System Supervisory control panel shall provide the following critical alarms to the plant SCADA for each UV train and will automatically shut-down the duty UV reactor and activate the standby UV reactor:
   a. GFI Fault.
   b. Lamp failure.
   c. Ballast failure.
   d. Low water level.
   e. Cabinet high temperature.
   f. High reactor/lamp temperature.
   g. Ballast high temperature.
   h. E-Stop Alarm/CPP emergency stop.
   i. Measured flow above validated range (Off-specification event).
5. All alarms generated by the UV Local CPP shall be logged and displayed on the UV Local CPP, UV Remote control panel, and the UV System Supervisory control panel HMIs. Each alarm shall be time and date stamped when it occurs.

G. Field Instruments:

1. Online UVT Analyzer:
   a. Provide two (2) continuous reading, UVA/UVT spectrophotometer analyzers suitable for measurement of UVA/UVT utilizing 180 degree absorption measurement methods for the purposes of calculating UV Dose for UV disinfection reactors. UV light chamber path-length shall be 10 mm or greater. The unit shall include a lamp, sensor, analyzer, transmitter, dehumidification (if applicable), and automated cleaning system.
   b. Performance:
      1) UVA/UVT Range: 0 to 100 percent UVT or 0 – 2 UVA at 254 nm based on nominal 1-cm path length.
      2) UVA/UVT Accuracy: 0.1 Abs/m or +/- 1% UVT, whichever is greater.
      3) Lamp Life: 5,000 hours min.
      4) Measurement Frequency: 1 per 20 seconds min.
   c. Accessories:
      1) Automatic or manual calibration options.
      2) Automatic mechanical cleaning system with manual cleaning option.
      3) Fixed position flow cell (if required) independently mounted to support panel and supply piping, with wiper.

4) 20 feet, IP68 cable with plug to connect analyzer to local monitoring panel/transmitter for signals and power.
5) Wall mounting kit.
6) Interconnecting tubing, isolation valves, pressure regulating/relief valves, rotometers, and strainers as required to connect to process water supply and drain lines to analyzer and monitor/control flow rate through the anlyzer.
7) Analyzer transmitter, as required to deliver UVA/UVT signal to UV master PLC.

d. Local Indication/Transmitter:
1) Source Power: <120 VDC with UPS backup (5 minutes min.).
2) Electrical Enclosure: IP65/NEMA 4, wall mountable enclosure, PP plastic or 316 SST.
3) Push button electronic with LED interface.
4) Signal Outputs to SCADA:
a) 4-20 mA, signals, UV254 as UVA/cm and UVT%.
b) Low lamp 120 V ac dry relay contact output.
c) System fault 120 V ac dry relay contact output.
5) UV Absorption measurement at 254 nm shall be internally converted to provide an absorption measurement which represents the 1-cm standard, regardless of path length of analyzer.

e. Mechanical:
1) Sample Flow Rate: as recommended per manufacturer.
2) Sample Pressure: –up to 50 psig from pump discharge.

f. Environmental:
1) Operating Temperature (Sample): 0.5 degrees C to 35 degrees C.
2) Operating Temperature (Ambient): 0 degrees C to 60 degrees C.
3) Humidity: 0 to 100 percent Condensing.

g. Required Spare Parts/Support:
1) 5-person days installation/start-up support and operator training by UVT analyzer supplier.
2) 3 year manufacturer standard warranty.

h. Manufacturer/Model:
1) I::scan NTU/FTU + UV254 w/S:can con::lyte 2; S::can Inc., Cambridge, MA.
2) Real-Tech, M3000 Series, Whitby, ON, Canada.
3) No “or equal.”

2. Portable UVT Analyzer:
   a. Provide one (1) portable or handheld, NIST traceable UVT analyzing device to verify UVT analyzer performance in field, as recommended by the 2006 UVDGM.
   b. Manufacturer:
      1) RealTech.
      2) No “or equal.”

2.10 SAFETY EQUIPMENT

A. Provide face shield that blocks UV light wavelengths between 200 and 400 nm.

B. Provide acid resistant gloves and face shields for the operators for use with the cleaning equipment.

2.11 ACCESSORIES

A. Equipment Identification Plate: 16 gauge stainless steel with 6 mm die-stamped equipment tag number securely mounted in a readily visible location.

B. Lifting Lugs: Equipment weighing over 100 pounds.

C. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer.

PART 3 EXECUTION

3.01 SHIPPING REQUIREMENTS

A. All packages to be clearly identified as to project destination and contents. Package and/or crate to protect all equipment from damage during shipping.

B. Deliver the equipment and appurtenances to the location designated by the Owner.

C. Polish and protect all surfaces from corrosion and damage during shipment, normal handling and installation.

D. Carefully pack all equipment for shipment and protect all electrical equipment from moisture damage.

E. Each component shall be identified with durable labeling other than paper that is resistant to sunlight exposure and moisture. A UV Supplier representative will be available for assistance as follows:

1. Inspecting the equipment upon arrival at the site to ensure all equipment has been delivered in good order and that no damage has occurred during delivery.
2. Identification of and notification to the Owner and the Engineer of discrepancies between the shipping lists and the equipment received.

3.02 EQUIPMENT DELIVERY AND OFF-LOADING

A. Each component will be identified with durable labeling other than paper that is resistant to sunlight exposure and moisture. A UV Supplier representative will be available for assistance during this time if requested by the Owner. The UV Supplier shall assist the Installing Contractor as follows:

1. Inspecting the equipment upon arrival at the site to ensure all equipment has been delivered in good order and that no damage has occurred during delivery.
2. Identification of and notification to the Installing Contractor and the Engineer of discrepancies between the shipping lists and the equipment received.
3. Identification of all equipment to ensure all equipment is installed in its intended place.

B. The UV Supplier shall complete the Manufacturer’s Certificate of Proper Delivery upon satisfactory installation of the UV System.

3.03 INSTALLATION

A. The UV Supplier shall furnish instructions and supervise the work of the Installing Contractor regarding installation of the UV System. The Installing Contractor shall install the UV System in strict accordance with UV Supplier’s instructions.

B. The UV Supplier shall provide direct supervision of the work of the Installing Contractor of the installation of the UV System if requested by the Owner, including but not limited to:

1. Direct supervision of installation of the UV Reactor, Control Power Panel, and interconnecting control/power wiring.
2. Direct supervision of the work of the Installing Contractor of the installation of UV System HMI computers (Panel-mounted computers are not to be shipped with the panel).

3. Verify all field wiring I/O connections made by the Installing Contractor.
4. Inspect, test and verify all communications links from the respective CPPs to the Plant PLC. Inspect, test and verify all LAN communications connections between the CPP and the communication switches.
5. Installing Contractor shall provide and install anchor bolts, fasteners, washers, and templates needed for installation of UV Equipment. The UV Supplier shall design and locate anchor bolts and submit this information as part of the UV equipment shop drawings, calculations and installation instructions submissions.

C. A 2-inch gap shall be provided between the rear of the control panels and the wall for all new, freestanding and wall mounted enclosures.

D. The UV Supplier shall complete the Manufacturer's Certificate of Proper Installation upon satisfactory installation of the UV System.

E. Refer to General Conditions specifications for additional requirements.

3.04 TESTING - GENERAL

A. The UV Supplier is required to complete the following tests:

1. Factory Acceptance Testing.
2. Functional Testing.
3. Performance Testing.

B. Refer to General Conditions specifications for general requirements regarding these tests. Additional test requirements are defined below.

C. The UV Supplier shall calibrate all instruments, sensors, and meters supplied for testing, including the UVT analyzers, UV intensity sensors, and power consumption meters.

3.05 FACTORY ACCEPTANCE TEST

A. The UV Supplier shall be responsible for the Factory Acceptance Testing (FAT) that shall be conducted by the UV Supplier after the shop drawings are approved and before UV System is shipped to the Site.

B. The UV Supplier shall factory test all major UV System components of the UV System during a single test session for compliance with the construction and functional requirements specified herein.

C. The UV Supplier shall submit a FAT Plan, for approval by Engineer that will demonstrate the full operability of UV Reactors. The test plan shall include, but is not limited to the testing of the delivery of the lamps, the intensity sensors, the cleaning system, CPP for each of the UV reactors, and the instrumentation and controls for each of the reactors, and operator interface units. The test will verify the functions of the UV System via simulation or other methods. The PLC and HMI hardware and software is to be set up to allow thorough testing of controls and communications. The scope of the FAT shall demonstrate that each individual component of the UV System operates as specified.

D. For the FAT, the UV Supplier is to assemble all CPPs to demonstrate the complete UV System. Provide all necessary communications links between the respective panels and computers to simulate the complete UV System. The UV Supplier shall provide 3 weeks' advance notice prior to conducting the FAT. The Owner and/or Engineer may elect to witness the FAT. Costs to witness the FAT shall be the responsibility of the Owner.

E. The UV Supplier shall submit a FAT Report discussing the tests performed, items witnessed, and the results for the approval of the Engineer within 14 days following conclusion of the Factory Test.

F. The UV System components shall not be shipped until the final FAT Report is approved.

3.06 FUNCTIONAL TEST

A. The UV Supplier shall submit a Functional Test Plan, for approval by Engineer that will demonstrate the full operability of UV System. The test plan shall include, but is not limited to the testing the full functionality of the UV System. The test will verify the functions of the UV System as installed. The scope of the Functional Test shall demonstrate that each individual component of the UV System operates as specified and that the UV System operates with the complete treatment plant as specified.

B. The Installing Contractor with assistance from the UV Supplier shall complete all functional testing to the satisfaction of the Engineer and the Owner prior to commencing the Facility Startup. The purpose of the Functional Test shall be to demonstrate the effectiveness of all UV System components and control features in all modes of control. Testing shall include:

1. Automatic "start/stop" of UV reactor by SCADA.
2. Manual "start/stop" of UV reactor by UV System Supervisory Controller.

3. Automatic shutoff and alarms for various failure modes for UV reactor, including but not limited to loss of UVT or flowrate signals, lamp or ballast failure, low water level in reactor, high temperature, cleaning system failure etc., as listed in section 2.07.F.
4. Monitoring and trending of operating data.
5. Monitoring and control from remote workstation.
6. Bumpless switchover from normal power to emergency power, and emergency power to normal power.
7. Operation of UV reactor cleaning systems
8. Operation of all monitoring instruments.
9. All control functions, both at the CPP and remote HMI.
10. Modifying lamp output to verify that UV intensity sensors can detect changes in UV intensity.
11. Modifying flow and UVT to verify UV System can modify and maintain adequate UV dose.
12. All specified communications between the CPP and SCADA.

3.07 PERFORMANCE TEST

A. The UV Supplier shall submit a Performance Test Plan for approval by Engineer that will demonstrate the full operability of UV System. The test plan shall include, but is not limited to demonstrating automatic, manual, and local modes of operation of the UV System and continuous operation without the production of off-specification water due to failure of any UV System component.

B. Performance Test shall not commence until after successful completion of Functional Test, approval by Owner/Engineer of Performance Test Plan, and minimum of 100 hours of operating time of entire UV System (e.g. lamps, ballasts) at 100 percent power level. UV Supplier shall be responsible for replacing failed components of the UV System during this burn-in period at no additional cost to the Owner.

C. Successful completion of the Performance Test shall be defined as 15 calendar days of continuous operation per UV reactor without the production of off-specification water due to failure of any UV System component and demonstration that UV System meets all performance requirements established herein. Downtime resulting from Plant’s operation, including flow or UVT outside of UV reactor’s validated range, will not be counted against the criteria of “continuous days of operation.”

D. The Performance Test shall include normal starts, stops, and changeover to backup UV reactor. Performance Test shall verify normal and emergency (i.e., reactor failure or loss of UVT signal) operation of each installed UV reactor without malfunction.

E. The Performance Test shall include headloss check, power consumption check, UVT and intensity sensor calibration checks, power consumption at guaranteed set points, power factor measurements, harmonics measurements, lamp output verification, sleeve output verification, and UV System dose check (based on UV System CPP readings and calculations). Specifically include:

1. One (1) UVT analyzer calibration and reading stability check weekly for each UVT analyzer provided with the use of the Owner's laboratory spectrophotometer and UV Supplier's portable UVT analyzer, and prepare documentation on its compliance with the 2006 UVDGM requirements.
2. Sensor calibration checks of all supplied/installed duty and reference sensors weekly. Provide uncertainty calculations based on field evaluations. Compare sensor uncertainty based on field evaluations with that provided in the third-party validation. Prepare documentation on the duty UV sensors' compliance with the 2006 UVDGM requirements.
3. Measure 'S/So' at the beginning of the Performance Test after 100-hr minimum burn-in period. Measure 'S/So' for each lamp in each reactor at the end of the Performance Test. Calculate S/So for each lamp/sensor. Identify any results that are outside of manufacturer expectations.

F. The UV Supplier shall be responsible for coordination and inclusion in the report of all data and results required to meet the reporting requirements whether raw data is contained in UV Supplier's PLC or Plant PLCs or SCADA. As a minimum, results shall be provided as follows:

1. Daily tabulated data (provide range and average if applicable) of recorded information.
2. Energy:
    a. Average and range of energy consumption per day (data provided by Owner).
    b. Average energy consumption per volume of net water treated.

c. Harmonic testing results showing UV System performance measured at 50 percent, 75 percent and 100 percent of ballast rated load with harmonics (Voltage and Current) measured to the 35th harmonic. Results shall show that the harmonics are below IEEE 519 standards with a Point of Common Coupling (PCC) at the input terminals of the UV CPP on utility and emergency generator power.
d. Power factor of CPP throughout the full operating range.
e. Power consumption at the guaranteed performance values listed in the Bid Form.

3. Headloss: Headloss across each reactor at minimum, average, and maximum flow (if available).
4. Other:
   a. Quantity of sleeve cleaning cycles and estimated quantity of cleaning materials consumed (if applicable).
   b. Complete list of parts replaced and reasons for replacement.
   c. Complete list and results of calibration or other maintenance activities performed and reasons.
   d. Summary of off-specification occurrences.
   e. Results from off-site lamp output, sleeve transmittance, and UV intensity sensor verifications.

3.08 TRAINING OF OWNER'S PERSONNEL

A. General:

1. Provide for training of designated Owner's personnel in the operation and maintenance of the UV System including all components provided under this Contract.
2. Training shall consist of both classroom and hands-on sessions conducted at time and location acceptable to the Owner.
3. Designate a person responsible for scheduling and coordinating all training.
4. Training sessions may be videotaped if the Owner so chooses. If sessions are to be videotaped, Supplier shall be responsible for providing all necessary videotaping equipment.

B. UV Manufacturer's personnel shall provide detailed system training including, as a minimum, the following:

1. System operations philosophy.
2. System Control:
   a. Loop Functions: The understanding of loop functions including interlocks.

b. Loop Operation: For example, adjusting process variable set points, and control, annunciator acknowledgment and resetting, etc.
c. Interfaces with other loops and subsystems.

3. Operator interface/system set points.
4. Component performance requirements.
5. Component functions.
6. Component maintenance.
7. Component troubleshooting.
8. Instrument operation, maintenance, troubleshooting, replacement, and calibration procedures.

C. Classroom training shall be conducted during regular working hours on weekdays at a location to be designated by the Owner. Hands-on training may be conducted during and as a part of startup. Training shall be repeated in equal morning and afternoon sessions to accommodate Owner's employee's schedules. Provide 10 paper copies of all overheads and slides and one electronic copy used for training.

D. Manufacturer's representative shall be familiar with plant O&M requirements as well as with the specified equipment.

E. Coordinate training periods with Owner's operating personnel and manufacturer's representatives, and with submittal of O&M Manuals.

1. Initial training shall be completed at least 14 days prior to actual startup, but not more than 45 days prior to startup.
2. O&M Manuals shall be reviewed, accepted, and resubmitted in accordance with this section before start of training. Any modifications resulting from startup of the facility shall be incorporated into the final manuals.

3.09 UV SUPPLIERS' SERVICES

A. Provide qualified UV Supplier's Representative at site for installation assistance, inspection and certification of proper installation, functional testing assistance, performance testing assistance, and training of Owner's personnel for specified component, subsystem, equipment, or system.

B. UV Supplier's Representative: Present at project site or classroom designated by the Owner for minimum person-days listed below, travel time excluded:

1. 1-person-day and 1-trip to Milwaukee, WI for mechanical, electrical, and control system support during design phase.
2. 10-person-days in 2 trips for Functional Testing.

3. 10-person-days in 2 trips for Performance Testing.
4. 8-person-days in 4 trips for pre- and post-startup training of UV System for Owner's personnel.
5. Additional support as requested by Owner (part of Allowance).

C. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by the Owner.

3.10 EQUIPMENT GUARANTEE

A. Guarantee each item of mechanical and electrical equipment, instruments and device furnished under this Contract against defects including, but not limited to, the following:

1. Defective material or workmanship of both.
2. Leakage, breakage or other failure which might occur under normal and proper operation of the equipment under the specified conditions.
3. UV Reactor/Component Failure, as defined herein, during the Guaranteed Life.

B. Provide a guarantee for a period of two (2) years from acceptance of the Performance Test based on an approved Test Report and Substantial Completion.

C. Replace each item of equipment or part thereof proving to be defective.

D. Bear the entire expense of replacement including, but not limited to, the cost of all necessary labor, supervision, traveling, replacement parts, transportation and shipping cost. Supplier to coordinate and facilitate all work.

E. The UV Supplier shall provide Guaranteed Lamp Replacement Prices, Guaranteed Quartz Sleeve Replacement Prices, Guaranteed Ballast Replacement Prices, Guaranteed Duty Sensor Calibration Prices, Guaranteed Reference Sensor Calibration Prices, and Guaranteed Duty Sensor Replacement Prices, as a cost per individual item and as a cost for the total system, as supplied in section 00 41 13, Bid Form. The UV Supplier shall guarantee that items may be purchased by the Owner at this price or lower any time up to 20 years following Substantial Completion of the installation contract, with the guaranteed prices being adjusted by the Consumer Price Index (CPI). Freight charges to the Owner's plant for this supply are not to be included.

F. The UV Supplier shall warrant the Lamps, Quartz Sleeves, Ballasts, and Duty and Reference UV Intensity Sensors for the Guaranteed Life, as supplied in section 00 41 13, Bid Form, following final acceptance after Substantial

Completion. If the UV Supplier is not the item's Manufacturer, the Warranty shall be provided, in writing, directly to the Owner by the item's Manufacturer.

G. UV Lamps:

1. MP UV lamps shall be warranted for at least 5,000 hours or the time provided in the Bid Form, whichever is greater; prorated after 1,000 hours. If a lamp fails within the initial prorated period, the UV Supplier shall provide a replacement lamp to the Owner free of charge. If a lamp fails after the initial prorated period (e.g. 1,000 hours) and before the guaranteed life (e.g. 5,000 hours), the following formula will be used to determine the discounted price for replacement lamps:

   Lamp Price = ((Lamp Operating Hours – Initial Proration) / [Guaranteed Life – Initial Proration] x Guaranteed Price)

H. Ballasts:

1. The ballasts shall be warranted for at least 10 years or the time provided in the Bid Form, whichever is greater; prorated after 2 years. If a ballast fails within the initial prorated period, the UV Supplier shall provide a replacement ballast to the owner free of charge. If a ballast fails after the initial prorated period (e.g. 2 year) and before the guaranteed life (e.g., 10 years), the following formula will be used to determine the discounted price for replacement ballast:

   Ballast Price = ((Ballast Age – Initial Proration) / [Guaranteed Life – Initial Proration] x Guaranteed Price)

I. Quartz Sleeves:

1. The quartz sleeves shall be warranted for at least 10 years or the time provided in the Bid Form, whichever is greater; prorated after 1 year. If a quartz sleeve fails within the initial prorated period, the UV Supplier shall provide a replacement quartz sleeve to the owner free of charge. If a quartz sleeve fails after the initial prorated period (e.g. 1 year) and before the guaranteed life (e.g. 10 years), the following formula will be used to determine the discounted price for replacement quartz sleeve:

   Quartz Sleeve Price = ((Quartz Sleeve Age – Initial Proration) / [Guaranteed Life – Initial Proration] x Guaranteed Price)

J. UV Sensors:

1. The duty and reference UV sensors shall be warranted for a minimum of 5 years or the time provided in the Bid Form, whichever is greater; prorated after 1 year. If a sensor fails within the initial proration period, the UV Supplier shall provide a replacement sensor to the owner free of charge. If a sensor fails after the initial proration period (e.g. 1 year) and before the guaranteed life (e.g. 5 years), the following formula will be used to determine the discounted price for replacement quartz sleeve:

   Sensor Price = ((Sensor Age – Initial Proration) / [Guaranteed Life – Initial Proration] x Guaranteed Price)

END OF SECTION

PLC-I
INTERMEDIATE PUMP STATION AND UV FACILITY

ENCLOSURE

REMOTE OPENED CLOSED OPEN CLOSE — TURBIDITY — PARTICLE

I/O MAPPING
SYSTEM
△ REMOTE
△ READY
△ COMMON ALARM
◁ RUN (REQUEST)
◁ SHUTDOWN
◁ SEQUENCE MODE
◁ LEAD/LAG SELECTIONS
▲ UV TRANSMITTANCE
▼ REQUIRED FLOW
▼ REQUIRED UV DOSE

REACTOR
△ GENERAL ALARMS
△ CRITICAL ALARMS
△ READY
△ ON (RUNNING)
△ WARNING
△ SHUTDOWN
△ OFFLINE
△ REMOTE
△ FLOW RATE ▲
△ FLOW TOTAL ▲
△ INFL. OPENED
△ INFL. CLOSED
△ EFF. OPENED
△ EFF. CLOSED
EFF POSITION FEEDBACK ▲
UV DOSE ACTUAL ▲
OFF SPEC VOLUME ▲
UV DOSE SAFETY FACTOR ▲
LAMP RUN HOURS ▲

(1) TYP OF 4

REMOTE OPENED CLOSED OPEN CLOSE — FREE CHLORINE — REMOTE OPENED CLOSED OPEN CLOSE

4(5)

LCP-I5 UV SYSTEM SUPERVISORY CONTROL PANEL *
120V
UV TRANSMITTANCE
RUN (REQUEST)
SHUT DOWN (REQUEST)
3(1)
ODVA ETHERNET / IP, TYP

LCP-I1A UV REACTOR CONTROL POWER PANEL PLC-I1 *
OIU-I1A
480V
UV TRANSMITTANCE
LOW LAMP
SYSTEM FAULT
OPEN CLOSED REMOTE CLOSE OPEN — FLOW TOTAL — FLOW
WIPER STATUS — SENSORS — REACTOR TEMP HIGH — COVER OPEN — LAMP POWER — LOW WATER LEVEL
E-STOP HS 805
POSITION COMMAND POSITION FEEDBACK
OPEN CLOSED REMOTE

TOTALIZER PULSE

LCP-I1B UV REMOTE CONTROL PANEL *
OIU-I1B
E-STOP HS X-X
120V

(2) (X)
1 1/2" V
TSH X-X
LSL X-X
PI X-X
ZIT X-X
FQI X-X
FIT X-X
FE X-X
FV X-X
FCV X-X
S
PDR
DRAIN

UVR- UV REACTOR NO. 1 *
UVR- UV REACTOR NO. 2 *
UVR- UV REACTOR NO. 3 *
UVR- UV REACTOR NO. 4 *
SIMILAR TO ABOVE
SIMILAR TO ABOVE
SIMILAR TO ABOVE (FUTURE)
TYP OF 4
2(1)
2(2)

24" UVI
24" UVE
42" UVI
36" UVI
36" UVE
UVW
SA
HS X-X
OC
OSC
LR
M
480V
ZS X-X
AIT X-X
AE X-X
FI X-X
CL2
DRAIN
TO STORAGE
TO BACKWASH RECOVERY
EXTERIOR

A 08-N-001 FROM PUMPS
B 08-N-001 FROM PUMPS

UVT
PARTICLE
TURBIDITY
120V

SHEET KEYNOTES

1. SEE SPECIFICATIONS FOR COMPLETE LISTING.
2. (X) EQUALS THE NUMBER OF SENSORS OR LIGHTS.

NO.	DATE	REVISION	BY	APVD
DSGN	AG MYERS	DR	MA REICHERT	CHK	APVD

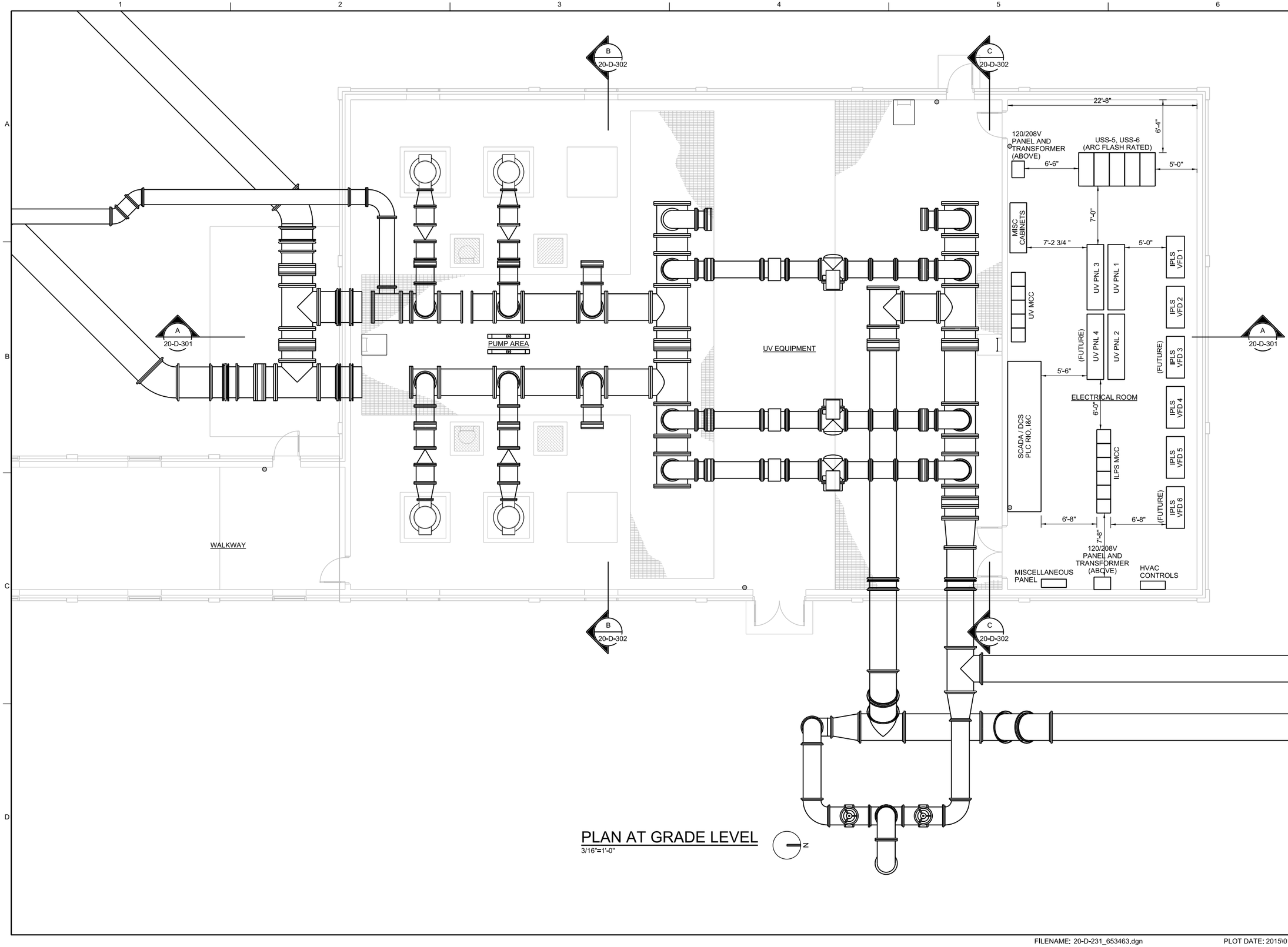
2016 WTP IMPROVEMENTS
OAK CREEK WATER TREATMENT PLANT (WTP)
OAK CREEK WATER AND SEWER UTILITY
CITY OF OAK CREEK, WISCONSIN

CH2MHILL®

INSTRUMENTATION AND CONTROL
UNIT PROCESS
UV DISINFECTION SYSTEM
P&ID

NO SCALE
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JANUARY 2015
PROJ	653463
DWG	08-N-002
SHEET	of



PLAN AT GRADE LEVEL

3/16"=1'-0"

NO.	DATE	REVISION	BY	APVD
DSGN	JR GAGNON	DR	DA KIERZEK	CHK	APVD	CHECKED	APVD

APPROVED

2016 WTP IMPROVEMENTS
OAK CREEK WATER TREATMENT PLANT (WTP)
OAK CREEK WATER AND SEWER UTILITY
CITY OF OAK CREEK, WISCONSIN

CH2MHILL®

PROCESS MECHANICAL

INTERMEDIATE PUMP STATION
AND UV EQUIPMENT FACILITY
PLAN AT GRADE LEVEL

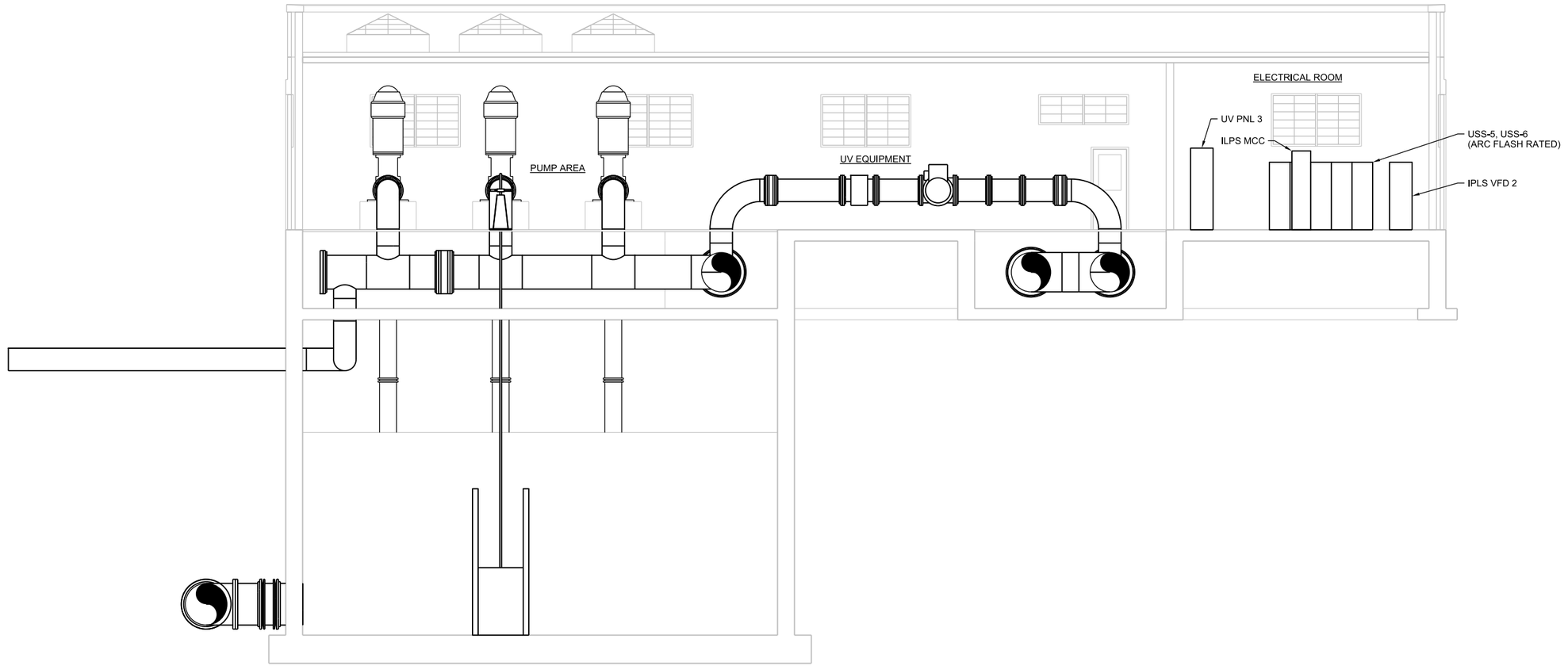
3/16"=1'-0"

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2015
PROJ	653463
DWG	20-D-231
SHEET	of

FILENAME: 20-D-231_653463.dgn PLOT DATE: 2015\01\20 PLOT TIME: 2:00:07 PM



A SECTION
3/16"=1'-0"
20-D-231

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		JR GAGNON	DA KIERZEK	APVD	APVD		

2016 WTP IMPROVEMENTS
OAK CREEK WATER TREATMENT PLANT (WTP)
OAK CREEK WATER AND SEWER UTILITY
CITY OF OAK CREEK, WISCONSIN

CH2MHILL®

PROCESS MECHANICAL

INTERMEDIATE PUMP STATION AND UV EQUIPMENT FACILITY SECTION

3/16"=1'-0"	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	DECEMBER 2014
PROJ	653463
DWG	20-D-301
SHEET	of

FILENAME: 20-D-301_653463.dgn PLOT DATE: 1/6/2015 PLOT TIME: 2:17:56 PM