Municipality of the County of Cumberland

Proposal for UV Disinfection Equipment

November 2023
Proposal #230808

Municipality of the County of Cumberland

Proposal for UV Disinfection Equipment

0	Request for Proposal	BB	30-Nov-2023	IC
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CBCL Project No. 230808.00

TITLE — SECTION

BIDDING AND CONTRACT REQUIREMENTS

Information to Equipment Suppliers — 00 21 14
Form of Proposal — 00 41 01

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

Ultraviolet Disinfection System — 46 66 00

END

1.0 PROJECT DESCRIPTION

1.1 This project includes the supply and commissioning of UV Disinfection System as specified herein. The equipment will be incorporated into an existing well control building located in Parrsboro, NS. This solicitation is for supply and commissioning of the UV Disinfection System; installation will be by others.

2.0 DEFINITIONS

2.1 **"Owner"** means Municipality of the County of Cumberland and includes the Owner's personal representatives or successors.

2.2 **"Consultant"** means CBCL Limited or its duly appointed representative or such other consultant as the Owner may appoint.

2.3 **"Equipment Supplier"** means a person, firm or corporation who proposes to submit, or who has submitted a proposal for the supply and commissioning of the equipment, or part thereof, referred to herein.

2.4 **"Supplier"** means the Equipment Supplier whose equipment has been selected by the Owner, referred to herein.

2.5 **"Contractor"** means the person or persons, firm or company, whose bid for the installation of the works will be accepted by the Owner pursuant to a General Contract.

2.6 **"General Contract"** means the Advertisement, Information to Bidders, Tender, Agreement, General Provisions, Special Provisions, Technical Specifications, Contract Drawings and all interpretations or addenda issued by the Owner, or Consultant with permission of the Owner, for the UV Disinfection System Installation.

2.7 **"Delivery Period"** means the period commencing on the date of mailing of the Purchaser's official order to the Supplier and ending on the date when delivery to the site designated for delivery, covered by the purchase order, has been complete.

2.8 **"Purchase Order"** means the document prepared by the Owner and submitted to the Supplier for the purchase, delivery and commissioning of the equipment described herein.

2.9 **"Purchaser"** is the party responsible for the payment of the equipment in conformance with the General Conditions of the General Contract and the payment schedule on the Form of Proposal. The Owner will be the Purchaser of the equipment described in this document.

2.10 **"Equipment Manufacturer's Representative"** means a person employed by the Supplier, who is trained and is experienced in the proper installation, start-up, training and maintenance of the equipment or system to be supplied.

3.0 PROPOSAL SUBMISSION

3.1 Submit completed proposal for equipment listed in the Form of Proposal in sealed envelope marked as follows:

Proposal for: Municipality of the County of Cumberland
Proposal for UV Disinfection Equipment
Proposal #230808

and addressed to: CBCL Limited
Consulting Engineers
1505 Barrington Street, Suite 901
Halifax, Nova Scotia, B3J 3K5

Telephone: (902) 492-7979, Ext. 2271
Fax: (902) 423-3938

Attention: Ben Bickerton, M.A.Sc.., P.Eng.

and must be delivered to the Consultant at the above address no later than 3 p.m., local time on Friday, January 5th, 2024. Alternatively, a scan of the complete proposal document may be submitted electronically to bbickerton@cbcl.ca by the date and time listed above. A hard copy of the complete proposal document should be received within 7 days of the date listed above.

3.2 Submit proposals on the Form of Proposal provided. Completely fill out forms in ink. The completed form shall be without interlineation, alterations, or erasures. Signatures must be witnessed.

3.3 No other Form of Proposal will be acceptable. The appending of any qualifying clauses to the Proposal or failure to comply with these instructions in the completing of any proposals renders such proposal liable to disqualification. The proposal as originally submitted shall be essentially complete to permit a full analysis without the need for additional information. The supplementary explanation is assumed or intended.

3.4 Proposal shall be valid for acceptance for a period of sixty (60) days from the date set for its delivery to the Consultant.

3.5 Neither the Owner nor Consultant will defray any expenses whatsoever incurred by Equipment Suppliers in the preparation and submission of their proposals.

4.0 CLARIFICATION AND ADDENDA

4.1 Notify Consultant of omissions, errors or ambiguities found in the Proposal Documents. If Consultant considers that correction, explanation or interpretation is necessary, a written addendum will be issued. All addenda will form part of Proposal Documents.

4.2 No oral explanation in regard to the meaning of the proposal documents will be made and no oral instructions will be given before the selection of equipment.

4.3 Address technical questions to Mr. Ben Bickerton, M.A.Sc., P.Eng., at CBCL Limited, 1505 Barrington Street, Suite 901, Halifax, NS B3J 2R7, telephone: (902) 492-7979, ext. 2271, fax: (902) 423-3938, e-mail: bbickerton@cbcl.ca.

5.0 PURPOSE AND PROCEDURE

5.1 The purpose of receiving Proposals in accordance with these documents is to permit examination and selection of equipment fulfilling the Owner's requirements.

5.2 The Owner is interested to receive proposals for multiple UV disinfection systems. These systems are required for installation at a well control building used by the Owner to supply potable water to the community of Parrsboro.

5.3 The procedure, in general, will be as follows:

.1 Receive and assess proposals for equipment. Request and receive additional information as necessary.

.2 Select equipment.

.3 Notify successful Equipment Supplier and issue Purchase Order.

.4 Successful Equipment Supplier to provide the Consultant with detailed shop drawings.

.5 The Supplier is responsible for the supply, delivery, commissioning, and guarantee of the equipment in accordance with the requirements of this Proposal, and subsequent correspondence.

.6 Equipment will be supplied and delivered to the Municipality of the County of Cumberland and placed in storage at the location of the install (well control building).

.7 Installation will be by others via a general contract.

6.0 INFORMATION WITH PROPOSAL

6.1 Proposals shall include the following information:

.1 Descriptive literature, specifications, engineering and operating requirements, GA drawings and data on every item of equipment proposed.

.2 Description of assembly required at the site including equipment, manpower, and time required.

.3 Performance curves or data on the full range of design conditions.

.4 Complete materials and parts list included with the equipment proposed, with priced recommended spare parts lists. Provide manufacturer’s name and model numbers for equipment components and materials.

.5 Provide price, delivery and site services information as requested in the Form of Proposal.

.6 Provide a detailed and quantitative description of the various items of work required to be performed by the Contractor to install the equipment in the field.

.7 Agree that submission of the foregoing data constitutes a guarantee that the units proposed conform thereto, and are in accordance with, these specifications.

7.0 PRICES

7.1 Proposed prices shall include for delivery to the Municipality of the County of Cumberland installation site. Unloading at the site and equipment storage shall be carried out by the Owner.

7.2 Proposed prices shall exclude Harmonized Sales Tax.

7.3 The fixed proposed prices shall be in Canadian dollars, and shall include and cover all start-up, contingencies, and provisional sums; all patents and licensing fees, duties, and handling charges, transportation and all other charges.

7.4 The Equipment Supplier shall submit the proposal on the Form of Proposal without any connection, comparison of figures with, or knowledge of any other corporation, firm or person making a proposal for similar equipment for this project and the proposal shall be in all respects fair and without collusion or fraud.

8.0 SHOP DRAWINGS AND PRODUCT INFORMATION MATERIAL

8.1 Within two (2) weeks of Owner placing Purchase Order the Supplier shall submit to the Consultant for review, detailed shop drawings and product information for the equipment to be supplied as noted in the technical specifications.

8.2 Six (6) copies of the material shall be submitted in their entirety for all items of equipment being supplied and shall be complete in every detail and show clear compliance with the specifications.

8.3 The Consultant will review and mark comments as required on the material and return them to the Contractor indicating review status and comments. Review of Supplier's shop drawings by the Consultant shall not relieve the Supplier of the responsibility for the correctness thereof nor for the results arising from any error or omission in details of the design. Resubmit all drawings as requested.

8.4 Review of shop drawings and acceptance of the equipment shall in any case be subject to final approval of the equipment and materials after they have been commissioned, all guarantees being fulfilled and the general operation of the equipment and materials having been found satisfactory by the Consultant.

8.5 After the drawings, information and material have been reviewed by the Consultant, no change shall be made in them without the Consultant's written permission. In the event of any alterations or changes being authorized, reprints of each of the final drawings and specifications indicating these changes shall be immediately furnished at the Supplier's expense.

8.6 The Owner will not accept responsibility for cost of changes necessary if any equipment is fabricated without prior review of shop drawings. Review of shop drawings does not relieve the Supplier of responsibility to meet the requirements of the specifications.

8.7 The Supplier shall not ship for delivery any equipment to the municipality storage site until approved shop drawings have been released by the Consultant or until required factory testing is completed.

8.8 The material and drawing information shall include:

1. Dimensional outlines, sections and detail of all equipment, with anchor bolt location plan and required clearances.
2. General assembly drawing with weights, service requirements, points of connection, recommended clearances, and complete parts list.
3. Information concerning any proprietary components outsourced and fitted, such as electric motors and other electrical devices, drive mechanisms, valves, controls and the like.

4. Control panel layout drawing including block wiring diagram and Bill of Materials. Provide complete wiring and field interconnection drawings.
5. Detailed instruction for the erection of equipment.
6. Recommended spare parts.
7. Detailed information on equipment lubricants.

9.0 OPERATIONS AND MAINTENANCE MANUALS

9.1 The Supplier shall furnish operations and maintenance manuals containing information or specifying instructions for the following:
.1 receiving, handling, storage;
.2 installation, alignment checks;
.3 electrical connections;
.4 instrumentation requirements;
.5 operation;
.6 servicing and maintenance procedures;
.7 relevant drawings;
.8 detailed spare parts list complete with current price list valid for one (1) year;
.9 safety instructions; and
.10 tests and Supplier inspection procedures.

9.2 Provide material not later than date when installation of equipment will commence. Include cost of providing this material in proposed price for supply of equipment.

9.3 Provide two (2) sets of operation and maintenance manuals to the Owner, each bound as a complete set in a three ring binder, and one (1) digital copy to the Owner and Consultant.

10.0 DELIVERY, STORAGE AND HANDLING

10.1 All equipment shall be shipped completely assembled where possible. Large, fabricated assemblies shall be shipped in sub-assemblies as large as practical from the point of view of moving them into and about the structures, and piece-marked to facilitate field erection.

10.2 The Supplier shall co-operate with the Owner in the matter of packaging, time of delivery and shipping.

10.3 The Supplier shall propose a guaranteed delivery period from the date of the purchase order for each item of equipment for which a proposal is submitted.

10.4 The proposed delivery period shall allow for:
.1 The time required by the Purchaser's official order to reach the Supplier by mail.
.2 A one (1) week period for the Consultant to review and comment on the Supplier's shop drawings for the equipment to be supplied.
.3 The Supplier will be entitled to an extension of the proposed delivery period on account of the following:
1. The Consultant taking more than one (1) week to review and return to the Supplier the Supplier's shop drawings, provided that the excess time involved was not due to the shop drawings containing errors or omissions or not complying with the requirements of the specifications.

2. Delay attributable to acts of God or other matters which were not the fault of the Supplier and over which the Supplier had no control provided that the Supplier or manufacturer took all possible action to reduce delays and notified the Owner promptly of the occurrence of such delays.

10.5 The equipment and appurtenances shall be delivered to the municipality storage site in a condition satisfactory to the Consultant and the Owner and any omissions, discrepancies, or damage evident on delivery shall be made good by the Supplier.

10.6 The Owner at the storage site shall sign the carrier's pro bill to indicate receipt of the required number of crates, packages, and shall note any apparent shortages of or visible damage to such crates and packages. The Supplier shall furnish to the Owner lists showing the contents of the crates and packages available at the storage site when delivery of the equipment and appurtenances is made. Within seven (7) days after the date of delivery to the storage site, the Owner will notify the Supplier in writing of shortages or damage in the equipment delivered.

11.0 SERVICES REQUIRED AT SITE

11.1 The Supplier shall supply the services of a competent, factory-trained technical representative for the minimum period specified in the technical specification, at no additional cost to the Contract, to commission the equipment. Additional commissioning service shall be at the proposed price per day as outlined in the Form of Proposal.

11.2 The technical representative shall provide the services stated in the relevant technical sections and shall operate and demonstrate the equipment to the Owner's operating staff.

11.3 The Supplier shall provide to the Consultant, a letter or certificate stating that the qualified representative has found the installation to be in accordance with the manufacturer's requirements.

12.0 EVALUATION OF PROPOSALS

12.1 Proposals will be evaluated with consideration of both conformance to technical specifications and cost. Cost comparison will be based on the submitted price as well as other incurred installation and operation and maintenance costs (e.g. cost to reconfigure piping to accommodate new UV equipment).

12.2 Bidders are encouraged to arrange for a non-mandatory site visit to review existing conditions for the intended installation site. Contact the consultant to arrange for a site meeting.

13.0 AMENDMENT OR WITHDRAWAL OF PROPOSAL

13.1 Proposals may be amended or withdrawn by letter, or facsimile.

13.2 Head amendment or withdrawal as follows: "Amendment/Withdrawal for Municipality of the County of Cumberland, Proposal for UV Disinfection Equipment, Proposal #230808". Sign and seal as required for Proposal and submit at address given for receipt of proposals. All submissions must be received prior to time of closing.

14.0 INFORMAL OR UNBALANCED PROPOSAL

14.1 Proposals, which in the opinion of the Owner are considered to be informal or unbalanced, may be rejected.

15.0 RIGHT TO ACCEPT OR REJECT ANY PROPOSAL

15.1 The Owner reserves the right to reject any or all Proposals.

END

1.0 SALUTATION

1.1 To: Municipality of the County of Cumberland
c/o CBCL Limited
Consulting Engineers
1505 Barrington Steet, Suite 901
Halifax, Nova Scotia
Canada B3J 3K5

Attention: Ben Bickerton, M.A.Sc., P.Eng.

1.2 For: Municipality of the County of Cumberland
Water Treatment Upgrades
Proposal for UV Disinfection Equipment
Proposal #230808

1.3 From: _____

_____

_____

2.0 DECLARATION

We, the undersigned Supplier, having carefully examined the Proposal Documents in respect of proposals for the equipment listed in the Form of Proposal, and Specifications herewith submit in accordance with the terms set out in the documents our proposal for the specified equipment.

We agree that, in case of any conflict between the terms and conditions set out in our accompanying proposal and the terms and conditions set out in the proposal documents, the provisions of the proposal documents shall take precedence and shall govern.

We declare that our proposal for the equipment is made without any connection, comparison of figures, or arrangements with or knowledge of any other corporation, firm or person making a proposal for similar equipment for this project and is in all respects fair, without collusion or fraud.

We undertake to keep our proposal valid and open for acceptance for a period of sixty (60) days after the closing date for submission of proposals, and to make the equipment proposed on hereunder, or any item thereof available for sale to the Owner during the said period at the price and delivery stated herein.

3.0 PROPOSAL BREAKDOWN

The prices proposed shall be in Canadian dollars and shall include and cover all provisional sums; all duties, and handling charges, transportation and all other contingencies. Prices exclude Harmonized Sales Tax.

3.1 Name of Firm Proposing: _____

REQUIRED:

Price for supply of two (2) UV Disinfection Systems as described in sections 00 21 14 and 46 66 00 for a design flow of 757 Lpm (200 USgpm) $_____

Add HST (15%) $_____

Total: **$**_____

OPTIONAL:

Additional Price to increase the capacity of the two (2) UV Disinfection Systems to 1514 Lpm (400 USgpm) $_____

Add HST (15%) $_____

Total: **$**_____

Delivery period as defined in Section 00 21 14: _____ weeks

Inspection of installation, field testing, and maintenance instruction, including travelling and other expenses for each 8-hour day in excess of that required in technical specifications: _____ per day

4.0 PAYMENT SCHEDULE

4.1 Payment for equipment will be through the Owner and claimed by way of submission of approved progress claims.

4.2 Equipment payment will be allowed at the following milestones:
.1 50% due upon approval of shop drawings.
.2 50% due upon successful completion of trial testing, commissioning and training.

4.3 Payments will be subject to holdback requirements in accordance with Builders' Lien Act of Nova Scotia.

5.0 SIGNATURE

DATED THIS _____ DAY OF _____, 20____.

_____
Name of Firm Proposing

[Seal]

_____	_____
Address	Telephone
_____	_____
Address	Fax
_____	_____
Signature	Name and Title (Printed)
_____	_____
Signature	Name and Title (Printed)
_____	_____
Witness	Name and Title (Printed)

**NOTE: Proposals submitted by or on behalf of any Corporation must be signed in the name of such corporation by a duly authorized officer or agent, who shall also subscribe own name and office. Affix seal.*

END

PART 1 - GENERAL

1.1 Work Included

.1 Furnish all labour, materials, equipment and appurtenances required to provide a pressurized vessel, amalgam lamp based, ultraviolet (UV) disinfection system for the Municipality of the County of Cumberland. The UV system is to be complete and operational with all control equipment and accessories as specified herein. The work shall include providing all labour, tools, and additional equipment and materials necessary to complete the commissioning of the ultraviolet disinfection equipment following installation by others. The Owner will purchase the ultraviolet system from the Equipment Supplier. The system is to be installed by others and tested and commissioned by Equipment Supplier's Representatives, as specified in this Section.

1.2 Intent

.1 The intent of these specifications is to provide the mechanical and electrical works fully complete in every detail for the purpose designated. Provide any apparatus, appliance, material, or labour not herein specifically mentioned or included but requisite to the operation of the equipment specified without additional expense to the Owner.

1.3 Design Criteria

.1 The design of the UV system shall include two (2) UV reactors, operating in a duty/standby configuration, and may include either a single control panel or two (2) control panels as required by the system design. The UV reactors will contain low-pressure high output (LPHO) lamps and sleeves to achieve a 3rd party validated dose of 40 mJ/cm² at the design flow and UVT provided. The unit shall be equipped with online intensity monitoring, but may not include dose calculation. The unit will serve as the primary disinfection system for three municipal groundwater wells, and will be suited for this application based on previous successful reference applications and based on meeting all requirements of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems (Appendix G.1). The operation of the wells will be continuous at a variable flow rate. The UV unit will receive a start/stop signal from the wellhead PLC, and provide a ‘ready’ signal to the main PLC to enable well pump operation. The UV unit will start and stop in conjunction with the wellhead. Should a lamp warm-up or cool down period be required, the well pump PLC will include a sufficient start/stop delay to allow the UV system to be fully functional before pumping begins. The UV unit will return single, minor, major and critical alarms to the main plant PLC and have detailed local alarm displays.

.2 Provide equipment with the following characteristics:

.1 Reactor options for two design flows:
.1 Design flow 757 Lpm (200 USgpm) (base)
.2 Design flow 1514 Lpm (400 USgpm) (optional)
.2 Equipment Redundancy: The UV design dose will be delivered under design flow conditions, and a minimum UV transmittance of 92% using a single reactor.
.3 Annual process water:
.1 Temperature Range: 5 to 15°C
.4 Disinfection requirements:
.1 The unit must be capable of providing 40 mJ/cm² at a UVT of 92% and maximum for rate as listed above.
.5 Achievement of design dose must be validated by third party testing, conforming to one of the following certification standards acceptable to Nova Scotia Department of Environment and Climate Change:
.1 US EPA UVDGM.
.2 German guideline DVGW W294.
.3 Austrian standard ONORM M 5873
.6 Proof of validation must be provided in English.
.7 Source water: Groundwater with no treatment upstream of reactor. Hardness <40 mg/L as $CaCO_3$, Total Iron (Fe) <150 ug/L, Total Manganese (Mn) <20 ug/L.
.8 System shall be designed to operate in an environment with ambient relative humidity of 5-95% (non-condensing) and ambient air temperature of 0-40°C.

.3 The UV reactors will be configured as follows:
.1 The UV reactors will be supplied pre-assembled and ready for installation, with the exception of the UV lamps, which are to be shipped according to the manufacturer's recommendations.
.2 The UV light source shall be low-pressure high output, with a primary emitted wavelength of 254 nm.
.3 Each UV reactor will include instrumentation for real-time measurement of UV intensity.
.4 Control panels will be provided to operate two UV reactors; however, other options will be considered.
.5 All equipment dimensions, including an estimated allowance for maintenance and lamp removal, are to be provided.
.6 The maximum allowable operating pressure of the UV System shall be a minimum of 150 PSI.
.7 Units shall be equipped with manual UV lamp sleeve cleaning mechanism/wiper which does not require chemical addition or disassembly of the reactor to operate. Unit shall remain in operation during manual wiping.

.4 Performance Requirements:
- .1 UV dose at end of lamp life to be not less than design dosage.
- .2 UV dose at end of lamp life shall be based on a lamp aging factor of 0.98 and a fouling factor of 0.80, respectively.

1.5 Identification of Equipment

.1 Process equipment shall be fitted with the manufacturer's identification nameplates indicating size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power motors, all factory supplied.

1.6 Shop Drawings and Submittals

.1 Shop drawings for all process equipment shall be submitted to the Consultant for review in accordance with Section 00 21 14.

.2 Complete description in sufficient detail to permit comparison with the specifications.

.3 Descriptive information including catalogue cuts and manufacturers' specifications for all major components.

.4 Dimensional drawings.

.5 Electrical drawings.

.6 A written guarantee shall be provided indicating the following:
- .1 3-log inactivation of Giardia cysts at a UVT of 92%.
- .2 40 mJ/cm² 3rd party validated dose at the design flow, UV transmittance, and end of life factors provided.

1.7 Operations and Maintenance Manuals

.1 Provide Maintenance data for inclusion in the Operations and Maintenance manuals, in accordance with Section 00 21 14.

1.8 Extended Warranty

.1 LPHO UV lamps shall be warranted for 12,000 hours of operation, prorated after 9,000 hours, with an assumed daily on/off cycle of 3 cycles per day for the life of the lamps.

1.7 Qualifications of Equipment Suppliers

.1 All items of equipment supplied must be produced by companies regularly engaged in manufacturing this type of equipment and who maintain service and parts departments from which service, repairs and replacements may be obtained quickly at all times.

1.8 Alternates

.1 The Owner is interested in receiving and reviewing proposals for alternative systems. Where named products, trade names, technologies or characteristics particular to a specific manufacturer are mentioned, they are so mentioned to clarify the anticipated quality, operating requirements and general physical arrangements of the system.

.2 The basis of design for the process, equipment, materials and appurtenances have been developed based on industry experience. The purpose of the equipment is to meet the operational and water quality requirements listed in this Section reliably for the life of the equipment, with the lowest level of operational complexity and cost possible. The Owner may be interested in receiving proposals for equipment which does not conform to the specifications herein (i.e. process and materials), but which could achieve the long-term operational and water quality requirements listed. Based on the information included in the submittal, any alternate system may or may not be evaluated on the basis of elevated system complexity, reliability or cost, or the need for additional infrastructure or components to be provided outside the scope of the Treatment System supply contract.

.3 Where the submission does not clearly indicate that the proposed system does not conform to the specifications in any particular aspect, the Supplier is assumed to propose a system which is in conformance with the specifications listed herein. Clarification of non-conformance at the shop drawing stage, where not introduced in the initial proposal, may be considered grounds for immediate termination of the supply agreement at the Owner's sole discretion, without penalty.

1.9 Existing Conditions

.1 The existing well control building where the UV equipment will be installed has limited space. Reconfiguration of the piping and other equipment in this building will be required to incorporate the new UV equipment. The available footprint space is approximately 3m x 1m; it is anticipated that the new UV equipment will be installed in a stacked duplex configuration (with supports designed and installed by others). Systems which cannot conform to this available space, and require additional reconfiguration of existing equipment and piping, may not be acceptable to the Owner.

PART 2 - PRODUCTS

2.1 Design

.1 General:

.1 To be acceptable, the UV system must operate in a closed conduit, be of modular design, use LPHO lamps and have electronic ballasts.

.2 All metal components in continuous contact with process water shall be Type 316 stainless steel.

.3 All material exposed to UV light shall be Type 316 stainless steel, Type 214 quartz or a food-grade and suitably UV resistant material.

.4 The system shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp in the process water. Both lamp electrodes shall operate at the same temperature and be cooled by the process water.

.5 System shall be designed and suitable for use in drinking water applications.

.2 UV Lamp Module:

.1 Each UV lamp module shall consist of UV lamps mounted in a Type 316 stainless steel housing (Type 304 stainless steel for non-wetted parts).

.2 Each lamp shall be enclosed in an individual quartz sleeve and sealed at ends with compressed o-rings.

.3 Electronic ballasts to be housed in close proximity to each UV Lamp Module. Ballasts located in separate enclosures will be permitted.

.4 All wires connecting the lamps to the main power supply shall be enclosed inside the housing of the UV lamp module and not exposed to the process water.

.5 Each quartz sleeve to be independently sealed within the module.

.6 The UV lamp module shall be designed such that operating personnel at the plant can change the lamps and quartz sleeves.

.7 Protection against earth leakage faults to each module shall be provided through a circuit breaker and a ground fault relay.

.8 Each UV reactor shall accept its respective UV lamps and quartz sleeves through only one end (or side) of the vessel. This end (or side) of the UV reactor shall allow for complete reactor entry so internal inspection and/or service can be accomplished.

.9 Lamp position within the reactor will be indicated using a numbering system fixed to the lamp wiring at the service end of the UV reactor.

.3 All components shall be CSA approved.

.4 UV Lamps:
- .1 The UV lamps shall be LPHO.
- .2 The filament shall be significantly rugged to withstand shock and vibration.
- .3 The lamp bases to be resistant to UV.
- .4 The lamps shall be operated by electronic or electromagnetic ballasts.
- .5 LPHO UV lamps will have a monochromatic spectral output with the emissions peaking at 254 nm.
- .6 Minimum conversion efficiency shall be 30% LPHO.

.5 UV Lamp Sleeves:
- .1 Type 214, clear fused quartz tubing.
- .2 Lamp sleeves shall be domed at one end.
- .3 Manufacturer shall submit documentation on the method of sleeve integrity monitoring.
- .4 Manufacturer shall submit data on maximum allowable bending stress on lamp sleeves under maximum flow conditions.

.6 Headloss shall be minimized through the reactor. Efforts shall be made to maintain headloss through the reactor at or less than 1 psi.

.7 The use of cooling water from an external supply is not permissible as a means of controlling reactor temperature.

2.2 Electrical

.1 General:
- .1 The UV system shall be powered, monitored and controlled from a control panel. Service entrance for power feed termination to be provided.
- .2 Maximum total power consumption rating shall be provided in submission.
- .3 Electrical supply to the control panel shall be 120/208 Volt, 60 Hz, 1-phase, 2-wire (plus ground). If another operating voltage is required by the equipment supplier, this information shall be provided in the submission.
- .4 The control panel shall be complete with main disconnecting device, programmable control (PLC) or microprocessor-based controller, and operator interface panel.
- .5 The main disconnect shall be padlockable and shall be operable from either the front or side without opening the enclosure door.
- .6 Provide required wiring for connection between control panel and reactor.
- .7 Control panel shall be complete with all required control transformers and power supplies to provide power to the UV lamps.

.8 Provide DIN rail mounted terminal blocks complete with labels for all terminal blocks. All external wiring shall terminate on terminal strips. Provide separate terminal strips for AC and DC circuits.

.9 All fuses shall be high rupturing capacity type, sized for loads. Use fast acting fuses.

.10 Control devices (pushbutton, selector switches, pilot lights) shall be industrial duty. Pilot lights shall be LED type.

.11 Each module sub-system shall be wired from the main power distribution blocks into a circuit breaker.

.12 All internal components shall be sealed from the environment.

.13 All control panels to be CSA approved with a minimum rating of Type NEMA 4X.

.14 Each control panel shall be factory assembled.

.15 Any required signal wiring interfacing the UV reactor and control panel shall be noted in the submission.

.16 All local fused disconnects or breakers to be supplied by Contractor per local code.

.2 Control and Instrumentation:

.1 Control panel for individual reactors shall communicate with the main plant PLC via hardwired I/O. Control panels for UV equipment shall be provided by the manufacturer.

.2 UV System Control:

.1 The basis for system control shall be a microprocessor or PLC based controller, which continuously monitors and controls the UV system's functions. Custom electronics and pressure switches provide the controller with the necessary indications of system parameters.

.2 Process parameters including:

.1 Reactor status (run and failed).

.2 Minor, major, critical alarms.

.3 UV intensity.

.4 Lamp run-hours or hour-exceedance alarm.

.5 UV reactor temperature or high temperature alarm.

.6 Output parameters shall be 4-20 mA DC signals.

.3 The local operator interface shall be menu driven with multiple screens for monitoring and control. Complete control and monitoring of the UV system is accomplished through this interface.

.4 The interface shall be a graphical capacitive touchscreen, minimum 4” nominal size.

.5 Alarms shall be provided to indicate an extreme alarm condition in which the disinfection

performance may be jeopardized. Alarms will be grouped into three categories (minor, major, critical). Minor alarms will flash on the Operator interface and send a remote alarm signal (digital output). Major alarms will flash on the Operator Interface and send a remote alarm signal (digital output). Upon critical alarm, the reactor will extinguish the lamps and stop the entire treatment process. All alarms shall be time and date stamped when it occurs.

.1 Minor Alarms:
  .1 End of lamp life exceeded
.2 Major Alarms:
  .1 Individual lamp failure - failed lamps will be indicated by specific address (i.e. lamp #).
  .2 Individual ballast failure .
  .3 Low UV intensity - UV intensity to be displayed in mW/cm².
  .4 A low UV alarm will occur if intensity is below the minimum design value.
  .5 Lamp dose alarm will occur if dose drops below 40 mJ/cm², UVT drops below 92%, or measured intensity drops below that required for the corresponding dose.
.3 Critical Alarm:
  .1 UV reactor high temperature alarm
.4 The most recent alarms shall be recorded in an alarm history register and displayed when prompted.
.5 Upon the occurrence of a major or critical alarm, the UV reactor control panel(s) will send a plant shut-down signal to the main PLC. The PLC will receive the alarm and shut down the well pump immediately.

.6 Each UV reactor shall be capable of being placed in either local or remote mode with on/off control in either mode. Local/remote modes shall be selected via a remote mode enable selection in the operator interface. When remote mode is not enabled, the UV system can only be started and stopped by the operator via the local operator interface. When remote mode is enabled, the UV system is started and stopped via a start/stop signal from the main PLC.

.7 Elapsed time of each UV reactor shall be recorded and displayed on the local operator interface screen when prompted.

.8 As a minimum, the following items shall be monitored by the main PLC over the hardwired I/O for each UV reactor:
- .1 Critical alarm.
- .2 Major alarm.
- .3 Minor alarm.
- .4 UV intensity.

.3 Control strategy and monitoring
- .1 A minimum of one (1) UV intensity sensor shall be provided per reactor and for every 10 lamps in LPHO systems. Photocell life shall be greater than 9,000 hours.
- .2 The following parameters shall be monitored and a readout of their values provided on the Operator Interface: UV reactor status, individual lamp status, lamp run times, UV intensity.

.4 Dose-Pacing:
- .1 Dose-pacing is not required for this application.

2.3 Safety Features

.1 Each UV Reactor shall be equipped with a temperature switch, to prevent the reactor from overheating. The temperature switch shall be wired to the control panel, and shall shut the reactor down and initiate a critical alarm condition when activated.

2.4 Cleaning System

.1 Manual cleaning shall be the method of cleaning.

.2 The system shall be provided with the required cleaning reagents and solutions necessary for initial equipment testing and for equipment start-up.

2.5 Spare Parts

.1 The following spare parts and safety equipment are to be supplied:
- .1 One (1) intensity sensor with cable and window.
- .2 Two (2) UV lamps, sleeves, and associated replaceable seals/O-rings.
- .3 One (1) Face Shield, able to block UV light wavelengths between 200 and 400nm.
- .4 Cleaning solution for one (1) year of operation.
- .5 One (1) ballast.

.2 Provide an itemized proposal, valid for one (1) year, with itemized costs for all other spare parts recommended by the system manufacturer.

PART 3 - EXECUTION

3.1 Delivery

.1 Ship equipment to the site pre-assembled where possible.

3.2 Inspection and Start-up

.1 Provide service of competent servicemen, mechanics or other trained personnel of the Suppliers or manufacturers to check the complete installation and be present for start-up of the equipment. A written report signed by the equipment manufacturer's representative shall be submitted to the Consultant stating the following:

- .1 That a satisfactory installation of equipment has been performed and outlining any modifications that have been made as a result of the commissioning or testing of the equipment at no additional cost to the Owner.
- .2 That the equipment is now ready for permanent operation.
- .3 That the operation and maintenance instructions for the equipment have been presented to the Consultant.
- .4 That the equipment has been properly lubricated with the correct lubricants.

.2 The equipment manufacturer's representative shall fully instruct the permanent operator of the equipment in the proper operation and maintenance of all equipment at no additional cost to the Owner.

.3 A minimum period of three (3) days on site for skilled supervision and instruction and a minimum of three (3) trips to the site should be assumed by the equipment supplier. Each unit shall be “dry” commissioned prior to operation to confirm reactor, lamp and sleeve installation, followed by “wet” commissioning to confirm hydraulic operation, I/O and fouling trends. Provide as many trips and days on site as required to complete the installation and put the equipment into satisfactory operation. Within the 3 days/trips, allow for one day on site for troubleshooting and re-training of operations personnel if requested by the Owner within one (1) year of system commissioning at no additional cost to the Owner.

.4 Supplier to provide a per-diem rate for additional site time, as per Form of Proposal.

3.3 Testing

.1 Final acceptance of the equipment requires field testing. Performance requirements include verification of UV dose at design flow and UVT using an installed calibrated intensity meter and a separate temporary reference meter for comparison. Both meters shall show the achieved dose to be equal for testing acceptance.

END