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| **Project Name:** |       | **Date:** |       |
| **Engineer Name:** |       | **AK P.E. License No.:** |       |
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| This checklist is applicable to construction or modification of surface water treatment systems intending to install UV disinfection. In order for a UV disinfection system to receive inactivation credits for regulated microbiological contaminants (e.g. Giardia, Cryptosporidium, viruses) it must be validated by an independent third party. Full-scale UV reactor validation testing results must document the operating conditions (e.g. flow, UV intensity, UVT, etc.) under which the reactor can deliver the required dose to achieve the desired inactivation credit. This checklist outlines basic elements of UV validation reports the State will evaluate. Since review of validation reports can take time, design engineers are encouraged to submit UV validation reports for DEC review at least 30 days prior to submittal of design plans. If a UV reactor has been previously approved in the state, it may not be necessary to review its validation report. Also, if a UV reactor is being proposed for 0.5-log inactivation of Giardia or Cryptosporidium, the level of review of the validation report may be less detailed. Contact DEC for more information if these situations apply. Additional information and guidance on UV system validation can be found in the EPA UV Disinfection Guidance Manual (UVDGM), November 2006, (EPA 815‑R-06-007), which is available on the EPA website at <https://www.epa.gov/dwreginfo/long-term-2-enhanced-surface-water-treatment-rule-documents>. Other useful UV system references include: AWWA Standard F110-12 “Ultraviolet Disinfection Systems for Drinking Water,” August 2012; “Ultraviolet Disinfection-Guidelines for Drinking Water and Water Reuse” National Water Research Institute (NWRI), 3rd ed., August 2012. For UV system design review requirements please refer to DEC checklist 6.6b.These questions are geared for UV reactor validations based on biodosimetry (as defined in UVDGM section 5.2). Other validation approaches such as those based on computational fluid dynamics (CFD) or chemical actinometry are not currently accepted in Alaska.Note: When completing this checklist, please answer the question and also include where in the submittal detailed information is found for each submittal requirement. Please be as specific as possible (specify document name, page number, section number, paragraph, etc.). This will accelerate the review process. |

| **Submittal Requirements** | ***Reference*** |
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| 1. **Validation Protocol:** What is the validation protocol used to validate the proposed UV unit identified?
 | *40 CFR 141.720(d)(2) UVDGM 5.2.2*  |
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| 1. **LT2ESWTR Requirements:** How does the validation testing meets the minimum regulatory requirements for UV reactor validation in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)?
 | *40 CFR 141.720(d)(2) UVDGM Table 5.1* |
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| 1. **Testing Organization Qualifications:** What are the qualifications and certifications/accreditations of the independent third-party organization that conducted the validation and the laboratory that performed the microbiological analyses?
 | *UVDGM 5.2.3* |
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| 1. **Validation Report:** Does the submittal include a copy of the full validation report together with an executive summary? If the validation report is in a language other than English, a copy translated into English must be included.
 | *UVDGM 5.11* |
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| 1. **Executive Summary Contents:** Verify the executive summary contains the following minimum elements - validated dose or range of validated doses; inactivation credit achieved for the target pathogens based on the LT2ESWTR UV dose requirements; validated operating conditions (e.g. flow, UVT); and UV intensity set-points (for UV intensity set-point approach) or dose monitoring equation (for calculated dose approach).
 | *UVDGM 5.11.3 40 CFR 141.720(d)(1)* |
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| 1. **Validation Report Contents:** Verify the full validation report contains the following key elements - full scale reactor testing results with data for each test condition evaluated; collimated beam testing results; QA/QC checks (e.g. microbiological work QA/QC, measurement uncertainties of all sensors & meters); calculations of the validated dose including intensity set points and dose equations, as applicable; log‑inactivation calculations and derivation of validation factors; and validated operating conditions.
 | *UVDGM 5.11.3 UVDGM checklist 5.3* |
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| 1. **UV Reactor Description:** Does the validation report have a detailed technical description of the tested UV reactor including specifications of critical components (e.g. lamps, quartz sleeves & sensor ports, UV intensity & UVT sensors) and wetted dimensions? Please review UVDGM Checklist 5.1 for details. Data on the spectral response of the UV intensity sensor should be included.
 | *UVDGM 5.4.8, 5.5.4, 5.11, and D.3**AWWA F110-12 Sec. 4.6.1.2**NWRI Guidelines Chapter 3 Sec. 2* |
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| 1. **Hydraulic Conditions:** Does the validation report have a description of the hydraulic conditions of the validated reactor setup (e.g. inlet and outlet piping configurations)?
 | *UVDGM 3.6 & 5.4.5 AWWA F110-12 Sec. 4.1.6.2(7)* |
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| 1. **Biodosimetry Test Stand:** Does validation report include a diagram of the full-scale biodosimetry test stand showing ports for injection of microorganisms and chemicals, sample locations, means for assuring proper mixing prior to sample taps, online monitoring equipment, and flow meters?
 | *UVDGM 5.4**NWRI Guidelines Chapter 3 Sec. 2* |
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| 1. **Water Quality:** Does the validation report discuss the water quality characteristics used at the test facility including UVT at 254 nm, turbidity, and parameters that could affect fouling of reactor quartz sleeves (e.g. calcium, alkalinity, hardness, iron, manganese, pH, temperature)? If a medium pressure lamp reactor is validated, where in the submittal are UVT scan results covering the germicidal range from 200 nm to 300 nm, with and without a UV absorbing chemical added?
 | *UVDGM 5.4.1**NWRI Guidelines Chapter 3 Sec. 2*  |
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| 1. **Monitoring Equipment:** Does the validation report specify the monitoring equipment used during validation testing, including information on equipment accuracy and latest calibration certificates?
 | *UVDGM 5.5 UVDGM Checklist 5.2* |
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| 1. **Set-Point Dose Monitoring Approach:** For reactors using the UV intensity set‑point dose monitoring approach, does the validation report discuss critical alarm systems (e.g. visual alarm, failsafe shutoff) tested during validation including results of those tests? Results should include UV intensity sensor readings at the triggered alarm condition.
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| 1. **Lamp Fouling and Aging Factor:** What were the lamp fouling and aging factors used during validation such as: how was the value derived/selected; how was it incorporated/ accounted for during validation (e.g. aged lamps, power turndown, or combination); was non-uniform lamp aging potential evaluated and accounted for?
 | *UVDGM 5.4.6 &5.6 NWRI Guidelines Chapter 3 Sec. 4* |
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| 1. **Validation Report QA/QC:** Does the validation report answer the questions in UVDGM Checklist 5.4 (Review of Quality Assurance/Quality Control) and Checklist 5.5 (Review of Key Validation Report Elements)?
 | *UVDGM 5.12 & UVDGM Checklists 5.4 & 5.5* |
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| 1. **Challenge Microorganism:** Does the validation report provide detailed information about the challenge microorganism used in validation, such as: protocols for growth and enumeration; published range for UV dose-response (if other than MS2 bacteriophage or *Bacillus* *subtilis);* and suitability for use as a surrogate for the target pathogens of interest?
 | *UVDGM 5.3* |
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| 1. **Microbial Action Spectra (MP Reactors):** For medium pressure (MP) reactor validation, is there an evaluation of bias issues resulting from differences of action spectra between the challenge and target microorganisms (i.e. ratio of germicidal outputs as determined by UVDGM equation D.3)? If an action spectra correction factor is specified, the evaluation must include a discussion of how it will be incorporated into the validated dose and a peer-reviewed action spectra for the challenge microorganism if it is not MS2. The actual emission spectra of the validated reactor UV lamps should be used in the bias analysis.
 | *UVDGM D.4.1**AWWA F110-12 Sec. 4.6.1.3* |
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| 1. **Water UV Absorbance Spectra (MP Reactors):** For MP reactor validation, is there an evaluation of bias issues resulting from differences in UV absorbance spectra between the validation water and the water treatment facility water, as well as bias due to non-ideal UV intensity sensor location (polychromatic bias)?
 | *UVDGM D.4.2 & D.4.3* |
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