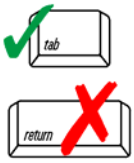
Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

Instructions to Applicant

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



The purpose of this Drinking Water Program (DWP) Facility Checklist is to assist the public water systems to prepare drinking water program permit applications that comply with all MassDEP regulations, policies, and guidelines. Completion of this checklist will ensure that the applicant has considered all minimum permitting aspects identified by the MassDEP Drinking Water Program. MassDEP may require additional information as regulations, standards, or procedures are implemented or revised.

A Massachusetts registered professional engineer must complete the appropriate section(s) of the checklist for the permit requested (including any brief explanations), sign the certification statement, and submit this checklist, brief explanations (where noted), and certification with the permit application (BRP WS 23A, BRP WS 23B, BRP WS 23C, BRP WS 24, BRP WS 25, BRP WS 29, BRP WS 34 or other BRP WS permit application). The DWP staff will use these documents to expedite the review/approval of the permit application.

An onsite three chemical process production of chlorine dioxide may be accomplished by using a pre-engineered commercial generator with a sight tube using a small water dilution line, adding sodium hypochlorite (NaOCl), then adding liquid sodium chlorite (NaClO2), and then the addition of hydrochloric acid (HCl) to act as a catalyst. This is the most common generation method used.

A second method is a two chemical process for onsite production of chlorine dioxide that may be accomplished by using a pre-engineered commercial generator with a sight tube using a small water dilution line, adding chlorine gas (Cl2) and liquid sodium chlorite (NaClO2) together.

A third method is a three chemical process for onsite production of chlorine dioxide that may be accomplished by using a pre-engineered commercial generator with a sight tube, adding sulfuric acid (H2SO4) and liquid Purate® [sodium chlorate (NaClO3) and hydrogen peroxide (H2O2) compound commercially blended together and sold as a single compound], together into a small water dilution line. (Pay attention to any possible violation of perchlorate standards with this method.)

A fourth method is a two chemical process for onsite production of chlorine dioxide that may be accomplished by using a pre-engineered commercial generator which adds chlorine gas and dilution air into dual drums of solid sodium chlorite (NaClO2) located on individual scales, then chlorine dioxide is educted into a small water dilution line. This method was granted MassDEP new technology approval on 7.23.10.

If Cl2 is not added, then answer any Cl2 questions as N/A. If NaOCl is not added, then answer any NaOCl questions as N/A. If no acid is added, then answer any acid questions as N/A. N/A means “not applicable.”
MassDEP Guidelines & Policies for Public Water Systems:
http://www.mass.gov/dep/water/laws/policies.htm#dwguid

MassDEP Drinking Water Regulations 310 CMR 22.00:
http://www.mass.gov/dep/service/regulations/310cmr22.pdf

MassDEP/ORS recommended limits and treatment and monitoring system for the Disinfectant Chlorine Dioxide. http://www.mass.gov/dep/water/laws/clo2.pdf

For this particular checklist it is understood when the following words are used that the words “chemical”, “disinfection”, “chlorine", “feed”, ”pump”, “chlorinator”, and “feeder” shall mean any part of the chlorine dioxide (ClO2) system.

If more than one chemical application, well, or treatment plant will be used, a separate checklist will be required.

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A. Facility Information

PWS Name

City/Town | PWS ID # | Source(s) Code #

Treatment Facility | Permit Application #

Check form submitted: ☐ BRP WS 34 ☐ BRP WS 29 ☐ BRP WS 25

☐ BRP WS 24 ☐ BRP WS 23C ☐ BRP WS 23B ☐ BRP WS 23A

☐ other BRP WS MassDEP Transmittal #

This treatment is considered (check all that apply):

☐ permanent ☐ temporary ☐ optional ☐ Emergency ☐ N.A.

Check type of chlorine addition used:

☐ 100# or ☐ 150 # Cl_2 cylinders ☐ Cl_2 Ton cylinders ☐ NaOCl ☐ No Chlorine

Check type of acid addition used:

☐ HCl ☐ H_2SO_4 ☐ No Acid Used

Check chlorite ion compound used:

☐ Liquid Sodium Chlorite ($NaClO_2$) ☐ Purate® ($NaClO_3$ plus H_2O_2)
☐ Solid Sodium Chlorite ($NaClO_2$)

Fill in exact primary ClO_2 injection point at WTP:

B. Project Checklist

1. **Project description**, including any waiver sought from MassDEP requirements:

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B. Project Checklist (cont'd)

2. Treatment

Answer the following questions regarding treatment. Please note that the questions and sections correspond with the standards contained in the Massachusetts Department of Environmental Protection Drinking Water Program's latest editions of Guidelines and Policies for Public Water Systems.

	Yes	No	N/A
Chapter 1.2.6 Proposed Treatment Processes			
1. Has this chlorine dioxide treatment process been granted new technology approval under (310 CMR 22.04(8) and DWP Policy 89-01)? http://www.mass.gov/dep/water/compliance/newtech.pdf Fill in date approved: _____	☐	☐	☐
Chapter 1.2.12 Simultaneous Compliance			
1. Has a determination been made of any ClO2 simultaneous compliance issues in the finished water, such as changes in pH, sodium increases, formation of any regulated byproducts, bromate formation, chlorite and chlorate formations, etc.?	☐	☐	☐
2. Was above summary of simultaneous compliance issues found discussed in the submitted specifications or other documents?	☐	☐	☐
3. Will all "simultaneous compliance" issues be tracked and reported to MassDEP after installation for at least 12 months using a pre and post 12 month water quality sampling plan?	☐	☐	☐
Chapter 2.15 Operator Certification			
1. With the proposed chlorine dioxide treatment process, indicate the water treatment plant classification for this facility pursuant to 310 CMR 22.11B (4) (a): ☐ VSS ☐ I-T ☐ II-T ☐ III-T ☐ 1V-T ☐ I-D ☐ II-D ☐ III-D ☐ IV-D			☐
2. Does the applicant's proposed staffing plan comply with the Certified Operator provisions of 310 CMR 22.11B? Submittal of plan is required.	☐	☐	☐
Chapter 2.8 Sample Taps			
1. Is a representative labeled raw water sample tap available that is a smooth-nosed type without exterior or interior threads, and without aerators or screens present, and is not of the petcock type?	☐	☐	☐

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B. Project Checklist (cont'd)

		Yes	No	N/A
	Chapter 5.1. Treatment – General Information			
1.	**Pilot facility studies**: Was a pilot study or in-plant demonstration, including the engineer's design recommendations, submitted to and approved by MassDEP prior to preparing plans and specifications?	☐	☐	☐
2.	Will the engineer submit a copy of these proposed chlorine dioxide plans and specifications in one hard copy and one electronic copy on a compact disk or memory stick in PDF format for DEP approval?	☐	☐	☐
3.	Will an operation and maintenance manual be prepared in accordance with DWP Policy 93-02 after construction?	☐	☐	☐
4.	Will calibration curves be provided for all acid (if used) and sodium chlorite or Purate® metering pumps and/or eductors, chlorine compound system, and chlorine dioxide system for the operator (after construction)?	☐	☐	☐
5.	Has a contact time (CT) tracer study been conducted?	☐	☐	☐
6.	Will the chlorine treatment system be overseen by a certified operator who has been properly trained in the operation and maintenance of each piece of equipment, and will records of such training, signed by both the trainer and the operator, be maintained?	☐	☐	☐
	Chapter 5.4. Disinfection			
1.	Will all disinfection byproduct maximum contaminant levels (MCL)s and maximum residual disinfection levels (MRDL)s be less than levels permitted under Drinking Water Regulations 310CMR 22.00 after adding ClO_2?	☐	☐	☐
2.	Will the chlorinator(s) (if chlorine gas is used) be flow paced?	☐	☐	☐
3.	Is automatic changeover equipment (if chlorine gas is used) to switch from one cylinder or bank of cylinders to another cylinder or bank of cylinders provided to ensure that unchlorinated water is not allowed into the distribution system?	☐	☐	☐
4.	Are visual and audio alarms provided for detection of chlorine gas (if chlorine gas is used) leaks and overfeed?	☐	☐	☐
5.	Are gauges (if chlorine gas is used) for measuring water pressure and vacuum at the inlet and outlet of each eductor provided?	☐	☐	☐
6.	Are the pipes carrying elemental liquid or dry gaseous chlorine (if chlorine gas is used) under pressure Schedule 80 seamless steel tubing or other non-PVC materials, as recommended by the Chlorine Institute?	☐	☐	☐
7.	Are pipes and fittings carrying chlorine solution made of rubber, PVC, polyethylene or other materials as recommended by the Chlorine Institute?	☐	☐	☐
8.	Are pipes, products, and fittings carrying chlorine solution made of non-nylon materials?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
9. Does the water supply to each eductor (if chlorine gas is used) have a separate shut-off valve for facilities disinfecting surface water or ground water under the direct influence of surface water?	☐	☐	☐
10. Is there no master water supply shut-off valve to eductors (if chlorine gas is used) for facilities disinfecting surface water or ground water under the direct influence of surface water?	☐	☐	☐
11. Is the chlorine residual test equipment provided recognized in the latest edition of Standards Methods for the Examination of Water and Wastewater, and does equipment either meet:	☐	☐	☐
a. EPA Method 334.0 (The Determination of Residual Chlorine in Drinking Water Using On-Line Chlorine Analyzer), or	☐	☐	☐
b. is equipment capable of measuring residuals to the nearest 0.1 milligrams per liter, and does equipment use an instrument employing the DPD colorimetric method with a digital readout, and does equipment have a self-contained light source, or use the amperometric method?	☐	☐	☐
12. Can chlorine be applied to raw water, settled water, filtered water, and water entering the distribution system for those systems using surface water filters?	☐	☐	☐
13. If only one chemical discharge line is run from chlorinator to point of injection, is an extra (labeled) corporation cock and injection nozzle or diffuser installed for emergency use?	☐	☐	☐
14. For permanent and temporary use, is the chemical equipment designed to ensure that no unchlorinated water is allowed into the distribution system, and there is no bypass(es) around the ClO2 injection point(s)?	☐	☐	☐
15. Is chemical system emergency or standby power available?	☐	☐	☐
Chapter 5.4.5 Chlorine Dioxide			
1. Will notification to the public of a change in disinfection practices and the schedule for the changes, particularly to hospitals, kidney dialysis facilities and fish breeders, as chlorine dioxide and its byproducts be made?	☐	☐	☐
2. Will chlorine dioxide generation equipment be of a type factory assembled, pre-engineered, and have a minimum efficiency of 95%?	☐	☐	☐
3. The following pieces of equipment are required for chlorine dioxide generation. Is each piece of equipment shown in the plans?	☐	☐	☐
(a) Reactor	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
(b) Diaphragm metering pump(s) with back pressure/pressure release valve(s) on discharge line (not needed if using solid sodium chlorite)	☐	☐	☐
(c) Solution tank (not needed if using solid sodium chlorite)	☐	☐	☐
(d) Mixer (static type) (not needed if using solid sodium chlorite)	☐	☐	☐
(e) Chlorine dioxide generating tower	☐	☐	☐
(f) Electrical controls, as needed	☐	☐	☐
(g) PVC/Tygon and/or polyethylene piping (or as recommended by MSDS)	☐	☐	☐
4. If chlorine dioxide is used for disinfection, will complete standby equipment of sufficient capacity be available to replace the largest unit during shutdown?	☐	☐	☐
5. Will the typical dosage of chlorine dioxide planned in drinking water vary from 0.1 mg/L to 0.5 mg/L (depends on injection point) with a maximum of 0.8 mg/L as ClO2?	☐	☐	☐
6. Will chlorine dioxide cellular detectors be installed in the area for continuous monitoring of any chlorine dioxide leaks with the drawtube of the equipment placed close to the floor?	☐	☐	☐
7. Will the chlorine dioxide leak detection equipment be tested periodically for proper functioning, and will the equipment testing procedure be included in the ClO2 Standard Operating Procedure (SOP)?	☐	☐	☐
8. Will audio and visual alarms be provided for detection of chlorine dioxide gas leakage?	☐	☐	☐
9. Are self-contained breathing apparatus available in the event of an emergency?	☐	☐	☐
10. Will the chlorine dioxide mixtures be generated at less than five percent?	☐	☐	☐
11. Will the chlorine dioxide facility (particularly the reactors) be isolated from the rest of the facility?	☐	☐	☐
12. Will the chlorine dioxide storage room be adequately ventilated?	☐	☐	☐
13. Will the exhaust fan be automatically energized upon opening the door of the chlorine dioxide storage room?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
Chapter 6.0.1 Plans & Specifications for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used), and Any Acid (if used)			
1. Are descriptions of all feed equipment, including maximum, average, and non-zero minimum feed ranges (expressed in daily/monthly use and gallons/volume/weight per hour), provided?	☐	☐	☐
2. Are the locations of all feeders, piping layout, and points of application shown?	☐	☐	☐
3. Are descriptions of storage and handling facilities provided?	☐	☐	☐
4. Are specifications provided for the chemicals to be used?	☐	☐	☐
5. Are there operating and control procedures, including proposed application rates for all chemicals?	☐	☐	☐
6. Are descriptions of all testing equipment and procedures provided?	☐	☐	☐
7. Do the plans include a chemical schematic for all chemical equipment and piping including sampling and monitoring equipment used to generate ClO2?	☐	☐	☐
Chapter 6.0.2 Chemical Application for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used), and Any Acid (if used)			
1. Are all chemicals applied at points and by means to assure maximum treatment efficiency?	☐	☐	☐
2. Are all chemicals applied at points and by means to provide maximum safety to consumers?	☐	☐	☐
3. Are all chemicals applied at points and by means to provide maximum safety to operators?	☐	☐	☐
4. Are all chemicals applied at points and by means to assure satisfactory mixing of the chemicals with the water?	☐	☐	☐
5. Are all chemicals applied at points and by means to provide maximum flexibility of operation through various points of application?	☐	☐	☐
6. Are all chemicals applied at points and by means to prevent backflow, prevent back-siphonage, prevent bypassing of treatment units, and eliminate multiple points of feed through common manifolds?	☐	☐	☐
7. Is completed ClO_2 injection point into a pipeline that uses an injection nozzle with corporation stop, ball check (to prevent backflow), and safety chain/cable, or uses a diffuser pipe into a basin?	☐	☐	☐
Chapter 6.0.3 General Equipment Design for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used) and Any Acid (if used)			
1. Will all chemical feeders be able to supply, at all times, the necessary amounts of chemicals at an accurate rate, throughout the range of feed?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
2. Are all chemical contact materials and surfaces resistant to the aggressiveness of the chemical solution?	☐	☐	☐
3. Are all chemicals introduced in such a manner as to minimize potential for corrosion?	☐	☐	☐
4. Are all chemicals that are incompatible not fed, stored or handled together?	☐	☐	☐
5. Are all chemicals conducted from the chlorinator to the point of application in separate conduits?	☐	☐	☐
6. Are all chemical feeders located as near as practical to the feed point?	☐	☐	☐
7. Are all chemical feeders and pumps sized in specifications such that pump will not operate at a point no lower than 10% of feed range dial at any time for greater feeder accuracy?	☐	☐	☐
8. Are all chemical feeders and pumps sized in specifications such that any feeder will not deliver more than 2,000 % of the optimal chemical dosage in mg/l to help prevent potential overfeeds?	☐	☐	☐
Chapter 6.1.1 Feeders and Metering Pumps for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used) and Any Acid (if used)			
1. Do all chemical feed systems include a minimum of two feeders or pumps of which the standby unit or a combination of units is of sufficient capacity to replace the largest unit during shutdown, and standby or reserve unit is mounted and installed?	☐	☐	☐
2. Are spare parts available for all feeders and pumps to replace parts that are subject to wear and damage, such as belts, anti-siphon valves, tubing, gaskets, etc.?	☐	☐	☐
Chapter 6.1.2 Control of Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used), and Any Acid (if used) Feeders and Metering Pumps			
1. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), chlorine gas (if used), and acid (if used) feeders manually or automatically controlled in setting stroke speed, with automatic controls designed so as to allow override by manual controls?	☐	☐	☐
2. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), and acid (if used) chemical feed rates proportioned or automatically flow paced to water flow?	☐	☐	☐
3. Is a means to measure treated water flow (in gpm and total gallons) provided?	☐	☐	☐
4. Are provisions made for measuring the daily net quantities of all sodium chlorite or Purate®, sodium hypochlorite (if used), and acid (if used) chemicals used in milliliters, gallons, or pounds?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
5. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), chlorine gas (if used), and acid (if used) chemical feeders synchronized to start and stop (electrically interlocked with appropriate upstream water pump motor or thermal type flow switch) with the flow of water being treated as the primary electrical interlock?	☐	☐	☐
6. Will the liquid sodium chlorite or Purate®, sodium hypochlorite (if used), and acid (if used) chemical metering pumps interlock system be hard wired or use a twist type plug and receptacle with pilot light "on or energized" indicator to help prevent overfeeds?	☐	☐	☐
7. Will all sodium chlorite or Purate®, sodium hypochlorite (if used), chlorine gas (if used), and acid (if used) controls be configured such that the chemical feeders are restarted only at the water treatment facility following an alarm initiated shutdown?	☐	☐	☐
8. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), chlorine gas (if used), and acid (if used) scales accurate to measure 0.5% of the load in pounds?	☐	☐	☐

Chapter 6.1.3 Chemical Safety Control Strategy for Critical Chemical Control Systems for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used), and Any Acid (if used)

1. Is a continuous chemical monitor with two alarm contacts available to prevent all chemical overfeeds or all chemical underfeed conditions?	☐	☐	☐
2. Is there an emergency under and over-feed alarm system for all chemicals?	☐	☐	☐
3. Is there any emergency automatic phone, radio or cellular dialer alarm to a properly certified operator to report an under or over-feed for all chemicals?	☐	☐	☐
4. Are controls designed so that if any chemical is in the manual mode, the operator is notified locally by a visual and/or audible alarm and/or remotely by an autodialer?	☐	☐	☐
5. Does each chemical feeder have a HOA (hand, off, automatic) switch and a timer on hand mode so feeder will automatically shut down after no more than one hour or a spring loaded switch?	☐	☐	☐
6. Will each HOA switch show proper signage on site explaining usage?	☐	☐	☐
7. If not staffed 24/7/365, will all chemical feeders and water flow automatically shut down and notify the operator if any chemical underfeed or overfeed occurs?	☐	☐	☐
8. Will each chemical feed system be linked to a computer SCADA or alarm system via radio or leased phone lines?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
9. Do the plans and specifications include a description of the "Chemical Safety Control Strategy for Critical Chemical Feed Systems" as described in Chapter 6.1.3?	☐	☐	☐
10. Is a chlorine dioxide chemical analyzer provided to monitor the treated water, or was a chlorine dioxide analyzer waiver granted by MassDEP in writing?	☐	☐	☐
11. Is the chlorine dioxide chemical analyzer interlocked so if chlorine is out of range, then the water flow or water pumps and chlorinator will automatically shut down and an alarm will be sent to the certified operator?	☐	☐	☐
12. Is powering of all chemical feeder(s) configured to prevent overriding of the safety shut down system?	☐	☐	☐
13. Will the SOP include procedures to test all chlorine dioxide chemical alarms and controls (both high and low) quarterly?	☐	☐	☐
14. Are the chlorine dioxide chemical feed system operational parameters (such as pH, % in range, and/or ORP) recorded by a chart recorder, electronic data logger, or SCADA system?	☐	☐	☐
Chapter 6.1.6 Positive Displacement Solution Pumps for Liquid Sodium Chlorite (or Purate® if used), Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Are positive displacement type solution pumps used to feed all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) chemicals?	☐	☐	☐
2. Do all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) feeders have a pressure relief valve (that is safely tubed or piped back into the daytank, solution tank, carboy shipping container, or 1,000 ml calibration chamber used as a suction chamber) on the discharge line for operator safety?	☐	☐	☐
3. Is there a clear calibration chamber (in ml) or mass flow meter mounted near all sodium chlorite, sodium hypochlorite (if used), and acid (if used) feed pumps to aid the operator in setting the pump rate?	☐	☐	☐
Chapter 6.1.7 Siphon Control of Liquid Sodium Chlorite (or Purate® if Used), Sodium Hypochlorite (if used), and Any Acid (if used) Feeders and Metering Pumps			
1. Do all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) liquid chemical feeders provide discharge at a point of positive pressure or provide vacuum relief; and provide an air gap or anti-siphon device?	☐	☐	☐
2. If a sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) peristaltic pump is used, is an anti-siphon or back-pressure valve used on discharge line?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
3. Do all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) chemical feeders provide other suitable means or combinations as necessary to prevent chemical solutions from being siphoned into the water supply, such as a diaphragm type operated backpressure valve or diaphragm type operated anti-siphon valve located where visible and easily accessible to the operator?	☐	☐	☐
4. Wherever a flooded suction pump system is used, such as a sodium hypochlorite system, are two anti-siphon or backpressure valves installed in series as potential for siphoning increases?	☐	☐	☐
Chapter 6.1.8 Cross-Connection Control of Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), and Any Acid (if used) Feeders and Metering Pumps			
1. Is cross connection control in this permit provided in accordance with regulations of the MassDEP Drinking Water Regulations (310 CMR 22.22), and any filtered water feed points and un-filtered water feed points are not cross connected via the chlorinator or any metering pump?	☐	☐	☐
Chapter 6.1.9 Location of Sodium Chlorite or Purate® (if used), Sodium Hypochlorite (if used), and Any Acid (if used) Feeders and Metering Pumps			
1. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) chemical feed equipment located in a separate room to reduce hazards and vapors?	☐	☐	☐
2. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) feed equipment conveniently located near points of application to minimize length of feed lines?	☐	☐	☐
3. Are all sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) chemical feed equipment readily accessible with adequate space provided for servicing, repair, and observation of operation?	☐	☐	☐
4. Are all liquid sodium chlorite or Purate®, sodium hypochlorite (if used), and any acid (if used) chemical feed equipment located either above and inside the containment area, or inside the containment area?	☐	☐	☐
6.1.10 In Plant Service Supply from Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), and Any Acid (if used) Feeders and Metering Pumps			
1. Is the in plant service water supply (if used in this permit) ample in quantity and adequate in pressure to insure ClO2 generator operates properly or is a protected water booster pump needed?	☐	☐	☐
2. Is the ClO2 generator fed from the service water supply (if used in this permit) properly protected against backflow and back-siphonage?	☐	☐	☐
3. Is a rotameter (calibrated in gallons per minute) used to set the in plant dilution carry water supply to or from the chlorine dioxide generator?	☐	☐	☐

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B. Project Checklist (cont'd)

	Yes	No	N/A
4. Are spring loaded check valves properly placed on chlorine dioxide generator feed line to allow injection of each chemical or are eductors used?	☐	☐	☐

Chapter 6.1.11 Chemical Storage and Process Tanks for Liquid Sodium Chlorite or Purate®, NaOCl (if used) and Any Acid (if used)

1. Is space provided for:			
a. at least 30 days of chemical supply to meet average treated demand?	☐	☐	☐
b. convenient and efficient handling of all chemicals?	☐	☐	☐
2. Are all storage tanks and pipelines for liquid chemicals dedicated to the specific chemicals?	☐	☐	☐
3. Will all chemicals be stored in covered or unopened shipping containers, unless the chemical is transferred into an approved covered storage unit?	☐	☐	☐
4. Do ***all*** bulk liquid chemical tanks have:			
a. a means to visually observe liquid level that is calibrated to indicate the liquid volume in the tank?	☐	☐	☐
b. a proper vent that is separate from any other chemical vent?	☐	☐	☐
c. an overflow with minimum size and capacity equal to the fill pipe?	☐	☐	☐
d. a minimum 6-inch high containment curb?	☐	☐	☐
e. a label to designate the chemical name contained?	☐	☐	☐
f. a threaded and capped ball valved drain that discharges to a containment area or holding tank? (Note: Do not trap any NaOCl chemical between the ball valve and threaded cap for operator safety reasons.)	☐	☐	☐
g. a vent(s) sized at 150% of fill pipe diameter to prevent excess pressures or vacuum?	☐	☐	☐
h. a bulk solution tank fill valve station labeled with the chemical name, 4 digit UN number, and formula of the chemical, and provisions for locking when not in use, and provide containment for minor releases during the fill process?	☐	☐	☐
i. a cover?	☐	☐	☐
j. a high level liquid sensor that activates audible and visual alarms mounted at locations that will alert both the treatment system operator and tank truck delivery driver to prevent overfilling of bulk tank(s)?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
k. a ball shut off valve on inside fill pipe to prevent backflow of chemical when hose is disconnected, and to guard against any unauthorized fill ups?	☐	☐	☐
l. a design to minimize accidental splashing, and is overflow brought down to 12-24 inches from floor that discharges over a splash plate, and away from any sensitive equipment?	☐	☐	☐
m. outside vent(s) terminating to prevent contamination, such as, in a down turned position, and covered with a 24-mesh corrosion-resistant screen?	☐	☐	☐
n. if penetrating a roof, does vent terminate at least 24 inches above the roof to prevent snowmelt from entering bulk tank?	☐	☐	☐
o. an inside building location or above ground location?	☐	☐	☐
5. Do all containment areas provide:			
a. a bermed area capable of containing 110% of the volume of the chemicals stored within the area?	☐	☐	☐
b. no floor drains or sump pumps unless the flow is directed to a separate containment area or tank?	☐	☐	☐
c. a sump or sloped to a low area to allow pumpage?	☐	☐	☐
d. an overflow from chemical storage tanks that discharges to the containment area?	☐	☐	☐
e. separate containment for chemicals that are not compatible, such as acids and bases?	☐	☐	☐
f. a leak/spill detection alarm device?	☐	☐	☐
6. If overflow discharges to the outside of the containment area, can all overflows do one of the following?			
a. discharge to a holding tank with a minimum volume equal to 25% of the storage tank, or	☐	☐	☐
b. discharge to a separate covered containment area with a minimum volume equal to 25% of the storage tank, or	☐	☐	☐
c. have an overflow capacity in the storage tank with a minimum volume equal to 25% of the capacity of the tank and a high audio and visual level alarm that will be set at the full level, excluding the overflow volume?	☐	☐	☐
7. Are two solution tanks of adequate volume provided, if necessary, to assure continuity of supply in servicing a solution tank?	☐	☐	☐
8. Are all chemical solutions kept covered and are the openings in bulk tanks with access openings curbed and fitted with tight overhanging covers?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
9. Subsurface locations for all bulk solution tanks:			
a. do they assure freedom from sources of possible contamination?	☐	☐	☐
b. are they located in a double walled containment vault with a spill/leak detection device?	☐	☐	☐
10. Are all overflow pipes:			
a. directed downward into the containment area, with the end screened or otherwise protected?	☐	☐	☐
b. located where noticeable?	☐	☐	☐
11. Is each large tank provided with a valved drain, protected against backflow in accordance with Cross Connection Control Regulations and liquid chemical feeder's guidance, and located so that all chemicals from equipment failure, spillage, or accidental drainage will not enter the water in conduits or treatment or storage basins?	☐	☐	☐
12. If a smaller system, does design show a solid or liquid sodium chlorite or Purate®, any acid (if used), and sodium hypochlorite chemical (if used) fed directly from a scale mounted shipping container no larger than 30 gallons?	☐	☐	☐
13. Is a covered, labeled, and vented daytank provided when bulk storage tank(s) are provided?	☐	☐	☐
14. Are all daytank(s) sized to hold no more than a 30 - 60 hour chemical supply at average treated water demand rate?			
15. Are precise means (scale mounting, ultrasonic level sensing, gauge rods with floats, or visual calibration where ratio of tank height to diameter are meaningful) provided to measure the volume or weight of all chemicals fed daily?	☐	☐	☐
16. Transfer of all chemicals:			
a. Are motor or magnetic-driven transfer pumps to daytank provided?	☐	☐	☐
1. Is a liquid level limit switch on daytank cover provided to automatically shut off transfer pump when daytank is full?	☐	☐	☐
b. Is filling of daytank done manually and not automated, and filled by a safe means?	☐	☐	☐
Chapter 6.1.12 Feed Lines for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Are feed lines as short and straight as possible in length of run and:			
a. of durable, corrosion-resistant material?	☐	☐	☐
b. easily accessible?	☐	☐	☐
c. protected against freezing?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
d. readily cleanable?	☐	☐	☐
e. properly protected and secured?	☐	☐	☐
2. Are the feed lines designed consistent with scale-forming or solids depositing properties of the water, chemical, solution or mixture conveyed?	☐	☐	☐
3. Are the feed lines for chlorine dioxide color-coded **yellow with violet band labels**, labeled with chemical name, and show arrows for direction of flow?	☐	☐	☐
4. Are feed lines for sodium hypochlorite (if used), chlorine gas (if used), sodium chlorite or Purate®, and any acid (if used) labeled with chemical name, properly color coded (see Chapter 2.12 for list of colors), and show arrows for direction of flow?	☐	☐	☐
5. Are any outside underground feed lines in secondary containment for safety?	☐	☐	☐
6. Are any outside underground secondary containment of feed lines sloped to a location where any leaks are visually noticeable?	☐	☐	☐
Chapter 6.1.13 Handling of Sodium Chlorite or Purate®, NaOCl (if used), Chlorine Gas (if used), and Any Acid (if used)			
1. Are hand truck(s) with safety chain for cylinders, or lifting beam(s) with hoist/monorail for containers or other appropriate means provided for chlorine handling by operators?	☐	☐	☐
2. Are carts, elevators, drum skids, drum trucks, and other appropriate means provided for lifting all chemical containers (if used) to minimize excessive lifting by operators?	☐	☐	☐
Chapter 6.1.14 Housing for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Are floor surfaces smooth, impervious, slip-proof and well drained?	☐	☐	☐
2. Do vents from feeders, storage facilities and equipment exhaust discharge to the outside atmosphere above grade and remote from air intakes, doors, windows, and parked vehicles?	☐	☐	☐
Chapter 6.2.1 Shipping Containers for Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Will specifications state that cylinders and/or containers (if chlorine gas is used) and other small chemical shipping containers (if used) shall be fully labeled to include chemical name, purity, concentration, supplier name, and address?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
Chapter 6.2.2 Specifications for Chlorine Gas (if used), Sodium Chlorite and Purate®, Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Do specifications state that above chemicals shall meet (latest issue) ANSI/AWWA Standards and NSF 60 Standards and as referenced in Standard Operating Procedures (SOP)? (http://www.nsf.org/business/newsroom/pdf/drinkwatertreatchem.pdf)	☐	☐	☐
Chapter 6.2.3 Assay for Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Are there provisions for assay of liquid chemicals bulk delivered, such as, a labeled sampling tap on fill line to bulk tank to verify accuracy of chemical specifications?	☐	☐	☐
2. For non-bulk deliveries, will recommendation be included in standard operating procedure (SOP) that visual and chemical sampling of chemical during delivery be conducted to verify the correct chemical is being added, or for bulk deliveries, will the applicant's O & M include delivery and inspection requirements for all bulk chemical deliveries to water treatment facilities, as provided in MassDEP "SOP – Security Guidelines for the Inspection of Bulk Chemical Deliveries"? http://www.mass.gov/dep/water/drinking/bulkchem.doc	☐	☐	☐
Chapter 6.3 Operator Safety for Chlorine Dioxide, Sodium Chlorite or Purate®, Chlorine Gas (if used), Sodium Hypochlorite (if used), and Any Acid (if used)			
1. Are a pair of rubber gloves, an apron or other protective clothing, splash goggles, and facemask provided for each operator per Material Safety Data Sheets (MSDS) and OSHA 29CFR1910?	☐	☐	☐
2. Will a standard operating procedure (SOP) for all chemicals used in this permit be posted in a protective shop envelope on the wall for the operator, and will the chemical MSDS be available on site for all chemicals used in this permit?	☐	☐	☐
3. Does respiratory protection equipment:			
a. meet the requirements of the NIOSH (National Institute for Occupational Safety and Health) available where chlorine gas is handled and stored at a convenient location but not inside any room where chlorine is used or stored?	☐	☐	☐
b. use compressed air?	☐	☐	☐
c. have at least a 30-minute capacity?	☐	☐	☐
d. have compatibility with or is exactly the same as units used by the fire department responsible for the plant?	☐	☐	☐
4. Will a small bottle of ammonium hydroxide, 56 percent ammonia solution, be available outside the chlorine gas (if used) room for chlorine leak detection?	☐	☐	☐
5. If 100-150 pound cylinders are used, is a leak repair kit (type A for 100 and 150 pound cylinders) approved by the Chlorine Institute provided?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
6. If chlorine ton containers are used, is a leak repair kit (type B for one ton cylinders) approved by the Chlorine Institute provided?	☐	☐	☐
7. Will a sufficient amount of chemical spill absorbent (for all chemicals used in this permit) be stored on-site for emergency use and uncontrolled discharges?	☐	☐	☐
8. Is a safety deluge shower and eyewash provided near the chemical storage area(s)?	☐	☐	☐
9. If any bulk chemical feed system over 1,000 gallons is used, is an ANSI Z358.1-2004 (Emergency Eyewash and Shower Equipment) approved safety deluge shower and piped eye-washing device provided?	☐	☐	☐
Chapter 6.4 Chlorine Gas (If Used)			
1. Is the chlorine gas feed and storage enclosed and separated from other operating areas?	☐	☐	☐
2. Is the installation as vandal-proof as possible?	☐	☐	☐
3. Is the chlorine room:			
a. Provided with a shatter-resistant inspection window installed in an interior wall?	☐	☐	☐
b. Constructed in such a manner that all openings between the chlorine room and the remainder of the plant are sealed?	☐	☐	☐
c. Provided with doors with panic-type hardware assuring ready means of exit and opening only to the building exterior?	☐	☐	☐
4. Will full and empty cylinders of chlorine gas be:			
a. Isolated from operating areas?	☐	☐	☐
b. Restrained in position to prevent upset?	☐	☐	☐
c. Stored in locked and secured rooms separate from ammonia and acid storage?	☐	☐	☐
d. Stored in locked and secured areas not in direct sunlight or exposed to excessive heat?	☐	☐	☐
5. Is chlorine room(s) constructed to provide the following:			
a. Does each room have a ventilating fan with a capacity which provides at least 60 complete air changes per hour when the room is occupied?	☐	☐	☐
b. Does the ventilating fan take suction near the floor as far as practical from the door and air inlet, with the point of discharge so located as not to contaminate air inlets to any rooms or structures?	☐	☐	☐
c. Are air inlets through corrosion resistant louvers near the ceiling?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
d. Do louvers for chlorine room intake and exhaust facilitate airtight closure?	☐	☐	☐
e. Floor drains are discouraged. Where provided, are the floor drains not connected to other internal or external drainage systems? See Guidelines Chapter 5.10 titled: Waste Handling and Disposal.	☐	☐	☐
f. Are switches for fans and lights outside of the room, at the entrance, and protected from vandalism and is a signal light indicating fan operation provided at each entrance when the fan can be controlled from more than one point?	☐	☐	☐
g. Do vents from feeders and storage discharge to the outside atmosphere, above grade?	☐	☐	☐
6. Are chlorinator rooms heated to 60 degrees F and protected from excessive heat?	☐	☐	☐
7. Is every non-pressurized chlorine gas line protected from temperatures below 60 degrees F and excessive heat?	☐	☐	☐
8. Will pressurized chlorine feed lines not carry chlorine gas beyond the chlorinator room?	☐	☐	☐
9. Will cylinders or ton containers be located and used out of sunlight and in a cool area (covered in SOP)?	☐	☐	☐
Chapter 6.4.6 Sodium Hypochlorite (if used)			
1. Will sodium hypochlorite be stored in the original shipping container(s) or in sodium hypochlorite compatible bulk liquid storage tank(s) or suction calibration chamber?	☐	☐	☐
2. Will the feed rate be adjusted by operator (covered in SOP) to compensate for progressive loss in chlorine content due to storage age of chemical?	☐	☐	☐
3. When chemical dilution is unavoidable, is dilution water soft, non-acid, and deionized to help avoid contamination?	☐	☐	☐
4. If sodium hypochlorite storage containers are used, will containers be located and used out of sunlight and in a cool area, and will containers be returned for credit and not rinsed out (covered in SOP)?	☐	☐	☐
5. If sodium hypochlorite or liquid Purate® is used, will the SOP include guidance on occurrence of perchlorate, and methods to minimize its occurrence?	☐	☐	☐
Chapter 6.4.7 Sodium Chlorite (or Purate®) for Chlorine Dioxide Generation			
1. Will sodium chlorite or Purate® be stored by itself in a separate room and preferably stored in an outside building detached from the water treatment facility, and away from any organic materials to avoid any possible fires?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
2. Are (spring loaded) check valves properly placed on chlorine dioxide generator make up water line to allow (one way only) injection?	☐	☐	☐
3. If the (outside) storage structure is located in an area where a fire may occur, is water available to keep the sodium chlorite or Purate® area cool enough to prevent heat induced explosive decomposition of the sodium chlorite?	☐	☐	☐
Chapter 7.0 Pumping Facilities for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used), and Any Acid (if used)			
1. Are analyzer discharges in compliance with DEP fact sheet "Registration of Discharges to the Ground From Pump Houses and Other Public Water System Facilities Including Discharges from In-line Analyzers"? http://www.mass.gov/dep/water/drinking/phdisreg.htm	☐	☐	☐
2. Is a representative labeled sample tap located 100 feet downstream available for daily chlorine testing of the treated water?	☐	☐	☐
Chapter 12.1 Minimum Components of Emergency Response Plans			
1. Will the applicant's emergency response plan (ERP) be updated to include the chlorine dioxide chemical addition emergency procedures and notification pursuant to 310 CMR 22.04(13) and MassDEP Guidelines and policies for Public Water Supplies, Chapter 12 – Emergency Response Planning Requirements Guidance, including Appendix O – Handbook for Water Supply Emergencies? http://www.mass.gov/dep/water/laws/policies.htm#dwguid http://www.mass.gov/dep/water/drinking/systems.htm#emerrespgm	☐	☐	☐
3. Monitoring and Reporting for Chlorine Dioxide, Sodium Chlorite or Purate®, Sodium Hypochlorite (if used), Chlorine Gas (if used), and Any Acid (if used)			
1. Will the applicant prepare and submit to MassDEP monthly Chemical Addition Reports for each chemical added pursuant to 310 CMR 22.15(4) requirements?	☐	☐	☐
2. If raw water is currently not sampled for total coliform each monitoring period, will the applicant prepare and submit to MassDEP for approval a revised Total Coliform Sampling Plan that includes sampling of the raw water as required by 310 CMR 22.05(1)(a)?	☐	☐	☐
4. Ground Water Rule(GWR) Disinfection Provisions			
The applicant must demonstrate ability to respond to a Ground Water Rule fecal contamination event in the source water. Two links are: http://www.mass.gov/dep/water/drinking/systems.htm#gwr; http://www.mass.gov/dep/water/drinking/gwr.htm			
1. If used as a primary or secondary disinfectant, is a "Ground Water Rule Log Credit Determination" form (GWR Form A) and associated schematic for each disinfected point of entry included in the application?	☐	☐	☐
2. Has the applicant previously completed the Groundwater Rule Immediate & Long-Term Response to Fecal Contamination Form (GWR Form B – Response form)?	☐	☐	☐

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

B. Project Checklist (cont'd)

	Yes	No	N/A
3. If the source is subject to either GWR compliance monitoring requirements or Surface Water or Ground Water Under the Influence of Surface Water (GWUI) requirements, are applicable monitoring, reporting, and recordkeeping requirements included in the SOP?	☐	☐	☐
4. Is a GWR Form B-Response Form included with the application?	☐	☐	☐
5. Is the treatment system able to provide 4-log disinfection for the inactivation of viruses prior to the first customer?	☐	☐	☐
6. If the treatment system is designed to provide 4-log disinfection, but this level of treatment is not currently required, does the applicant intend to conduct GWR compliance monitoring and reporting to avoid source water GWR triggered monitoring requirements?	☐	☐	☐
7. If 4-log disinfection is required, what is the **minimal dosing level (MDL)** of free chlorine to be maintained at the point of application? (Fill in number:) _____ MDL (mg/L)			☐
8a. Are there satisfactory alarms installed to indicate failures in continuous monitoring?	☐	☐	☐
8b. Fill in the appropriate (anticipated) low and high chlorine alarm set points:			☐

_____ Low alarm set point (mg/L) _____ High alarm set point (mg/L)

5. Detailed Explanation

Please attach a brief explanation for any question answered "No" and "N/A" in the checklist. The brief explanation should explain why the applicant/applicant's engineer does not feel this item is necessary to maintain the integrity of the design and/or operation of the facility.

Detailed explanation of the following question(s) is attached:

Section #	Page #	Question #

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

Water Supply Facility Checklist for Disinfection Using On Site Generated Chlorine Dioxide (ClO_2) for Permit Review/Approval

C. Certification

A. Applicant's Engineer

I hereby certify, as a Professional Engineer registered in Massachusetts, that the Drinking Water Facilities Checklist is a true and accurate representation on the information contained in my plans and specifications submitted with this permit application.

Signature/Stamp of Professional Engineer

Signature/Stamp of Second Professional Engineer (if needed)

Date

Date

Printed Name

Printed Name

Title

Title

Employer

Employer

Phone Number | Email Address

Phone Number | Email Address

B. Applicant

This checklist and attached permit application are submitted on behalf of water representative:

City/Town

Address

PWS Name | PWS ID # | Phone Number

Applicant Name/Title

Email Address

Applicant Signature

Date