# Rhode Island Pollutant Discharge Elimination System (RIPDES)
# General Permit for Non-Contact Cooling Water Discharges
# Permit Fact Sheet

**Rhode Island Department of Environmental Management**
**Office of Water Resources**
**February 2025**

**Table of Contents**

**FACT SHEET**
**RHODE ISLAND PERMIT DISCHARGE ELIMINATION SYSTEM (RIDPES)**
**2024 NON-CONTACT COOLING WATER GENERAL PERMIT**

## 1. BACKGROUND

The Rhode Island Pollutant Discharge Elimination System (RIPDES) regulations found under the Rhode Island Code of Regulations (See 250-RICR-150-10 §1.11), which were adopted pursuant to Chapters 46-12, 42-17.1 and 42-35 of the General Laws of Rhode Island, specifies that the discharge of pollutants is unlawful except in accordance with a valid RIPDES permit. In order to issue permits to specific categories of discharges, Rhode Island is authorized to issue "general permits" (See 250-RICR-150-10 §1.33).

The RIPDES permit program is authorized to issue a general permit if there are a number of point sources operating in a geographic area that:

1. Involve the same or substantially similar types of operations;
2. Discharge the same types of wastes;
3. Require the same effluent limitations or operating conditions;
4. Require the same or similar monitoring requirements; and
5. are more appropriately controlled under a general permit than under individual permits.

This general permit is for facilities located in Rhode Island that discharge non-contact cooling water to a receiving water located in Rhode Island. Section 4 of the RIPDES Regulations define “Non-contact cooling water” as “water used to reduce temperature for the purpose of cooling. Such waters do not come into direct contact with any raw material, intermediate product (other than heat) or finished product.” Therefore, even though a single industrial category or point source does not generate them, non-contact cooling water discharges involve substantially similar types of process operations, have similar types of waste, and require the same limitations and monitoring requirements.

Due to these similarities, the Rhode Island Department of Environmental Management (DEM) has decided to develop this general permit. This permit will enable facilities to maintain compliance with State and Federal requirements and will extend environmental and regulatory controls to a number of discharges. The issuance of this general permit is warranted by the similarity of (a) environmental conditions, (b) regulatory requirements applicable to the discharges and receiving waters, and (c) pollution control technologies employed.

Attachment A includes a list of facilities that currently discharge non-contact cooling water into Rhode Island waters under the 2013 non-contact cooling water general permit, their current permit number, their addresses, their receiving streams, and the receiving streams corresponding habitat and dilution category.

## 2. SUMMARY OF CHANGES

A summary of changes is provided below at each bullet point, with wording taken from the permit italicized for emphasis:

A. Clarified in Part I.B.(3)b that non-contact cooling water discharges that contain any water treatment chemicals; *other than those in the incoming public water supply* are not authorized under this permit.

B. Addition of Part I.B.(4) Impaired Waters. Discharges to waterbodies that are listed as impaired for one or more designated uses on the applicable state’s most recent EPA approved 303(d) list of waters must demonstrate that the discharge meets applicable water quality standards for listed pollutants causing impairment.

C. Addition of Part I.C.(3) which accounts for the continuation of the permit authorization if this general permit is administratively continued in the case that is not reissued or replaced prior to its

termination date. Facilities would automatically retain authorization to discharge under this permit until the earliest of several conditions occurs.

D. The Monitoring Frequency Requirements in Part II.E of once per week for flow, pH, and temperature applies to all dischargers regardless of their permitted flow. Previously permitted flows of less than or equal to 50,000 gallons per day required once per month monitoring for these parameters. Total Residual Chlorine monitoring requirements remain unchanged at once per quarter for all permittees.

E. Added an effluent limit in Part II.E for facilities that discharge to temperature-impaired waters with dilution limits greater than or equal to fifteen must meet applicable temperature water quality criteria at the point of discharge.

F. Changed the pH effluent limit Table in Part ll. E. for facilities that use a municipal water supply as its source water. Compliance for pH will now be determined by a range of 6.5 s.u.(min) to 9 s.u.(max) for freshwater and 6.5 s.u.(min) to 8.5 s.u.(max) for saltwater. Previously permittees were required to meet a pH limit where the effluent did not change more than 0.5 s.u. from the pH of the influent source water.

G. Clarified in a footnote in Part II.E how to calculate and report average monthly and maximum daily flow.

H. Clarified in a footnote in Part II.E that compliance with limits shall be determined by taking a minimum of four grab samples spaced equally over a normal operating day *that captures a discharge event.*

I. Added a note to III.B that NOI must be submitted in hard copy unless an electronic reporting tool becomes available during the period covered under this permit.

J. Modified General Condition IV.C regarding the Duty to Reapply to be consistent with other DEM general permits.

Explanations for changes to effluent limits and monitoring requirements can be found in the Permit Limit Development section below.

### 3. PERMIT LIMIT DEVELOPMENT

Section 301(a) of the Clean Water Act (CWA), 33 U.S.C. 1311(a), makes it unlawful to discharge pollutants to waters of the United States without a permit. Section 402 of the CWA, 33 U.S.C. 1342, authorizes EPA to issue NPDES permits allowing discharges that will meet certain requirements, including CWA sections 301, 304, and 401 (33 U.S.C. 1331, 1314, and 1341). Those statutory provisions state that NPDES permits must include effluent limitations requiring authorized discharges to: (1) meet standards reflecting specified levels of technology-based treatment requirements; (2) comply with State Water Quality Standards; and (3) comply with other state requirements adopted under authority retained by states under CWA Section 510, 33 U.S.C. 1370. Since Rhode Island has been delegated NPDES permitting authority, the RIPDES permit serves as the NPDES permit and is the mechanism used to implement technology and water quality based effluent limitations and other requirements including monitoring and reporting.

Development of RIPDES permit limitations is a multi-step process consisting of the following steps: determining the applicable technology-based allowable discharge levels; determining necessary best professional judgment (BPJ) allowable discharge levels; calculating the water quality-based allowable discharge levels using in-stream criteria, background data and available dilution; comparing these three allowable discharge levels and taking the most stringent as the final allowable discharge level; conducting an antibacksliding/antidegradation analysis; and assigning final discharge limits.

**Technology-Based Effluent Limitations**

A technology-based limit is a numeric limit, which is determined by examining the capability of a treatment process to reduce or eliminate pollutants. Technology-based limits are identified in Federal Effluent Limitation Guidelines. However, Effluent Limitation Guidelines have not been promulgated for non-contact cooling water discharges. Therefore, technology-based allowable discharge levels were not assigned.

**BPJ-Based Effluent Limitations**

The DEM has limited the maximum Total Residual Chlorine (TRC) concentrations that may be discharged to 1.0 mg/L for discharges with large available dilution based on BPJ. Details regarding the requirement can be found in the Total Residual Chlorine section of this fact sheet.

**Water Quality-Based Effluent Limitations**

Water quality criteria are comprised of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal.

Allowable water quality-based discharge levels are established on the basis of acute and chronic aquatic life criteria and human health criteria using the following: available in-stream dilution; an allocation factor; and background concentrations when available and/or appropriate. The aquatic life and human health criteria are specified in the Rhode Island Water Quality Regulations, as amended. Aquatic life criteria have been established to ensure the protection and propagation of aquatic life. Human health criteria represent the pollutant levels that would not result in a significant risk to public health from the ingestion of aquatic organisms or the direct ingestion of water *(Class AA receiving waters only)*.

When evaluating the need for water quality-based permit limits, the DEM first determines if there is "reasonable potential" for the discharge to cause an exceedance of the water quality criteria. The "reasonable potential" analysis is performed on a pollutant-by-pollutant basis. If it is determined that the pollutant in question has "reasonable potential", a limit is included in the permit.

By definition, non-contact cooling water discharges do not come into contact with raw materials, intermediate products, finished products, or process wastes. Therefore, the DEM has determined that these discharges do not have "reasonable potential" to contain pollutants from raw materials, intermediate products, finished products, or process wastes. However, since non-contact cooling water is used to remove excess heat, the DEM has determined that the discharges do have a "reasonable potential" to exceed the water quality criteria for temperature. Additionally, since the discharges may use well water as its source water, which may have a low pH, the DEM has determined that the discharge of non-contact cooling water has the "reasonable potential" to cause an exceedance of the in-steam water quality criteria for pH. Because some facilities may use municipal drinking water as a source of non-contact cooling water, the DEM has determined that the discharge of non-contact cooling water from such facilities has the "reasonable potential" to cause an exceedance of the in-stream water quality criteria for TRC. Therefore, water quality standards applicable to non-contact cooling water discharges covered by this general permit include temperature, pH, and TRC and are elaborated below.

***Temperature***

When establishing water quality-based limits for temperature, the DEM used a tiered limit structure for discharges to Saltwater and Freshwater (Warmwater Habitats and Coldwater Habitats) receiving waters. Specifically, limits were established for facilities with dilutions less than 15 and for facilities with dilutions of 15 or greater. To determine its dilution, each facility must complete and submit a dilution calculation with its Notice of Intent (NOI). DEM recommends facilities use the USGS application StreamStats to calculate the 7Q10 flow for dilution calculations.

Temperature impacts in freshwater, caused by heated discharges, are limited in the Rhode Island Water Quality Regulations such that the receiving water will not exceed 83 degrees Fahrenheit (°F) for warm water habitats and such that "Heated discharges into designated Cold-Water habitats (See § 1.25 of this Part for cold-water designated waters) shall not raise the temperature above 68 degrees F outside an established thermal mixing zone. In no case shall the temperature of the receiving water be raised more than 4 degrees F" (250-RICR-150-05 §1.10(D)). Based on this criteria, the maximum temperature limits for discharges with a dilution less than 15 was set equal to the water quality criteria (68° F into cold-water habitats and 83° F into warm-water habitats). This will ensure that the instream temperature will not exceed the water quality criteria because of the discharge. In this permit, discharges into a temperature-impaired freshwater from dischargers with a dilution equal to or greater than 15 were assigned a permit limit equal to the applicable warm-water or cold-water water quality criteria. This will ensure that these discharges do not impair the waters. Dischargers into freshwaters with no temperature impairment and a dilution equal to or greater than 15, were assigned a temperature limit of 92° F. The resultant change in temperature is calculated by the equations listed below:

**Summer Conditions**
Summer Temp = 70°F  Wastewater Temp = 92°F  Dilution = 15

$$\frac{\text{Wastewater Temp} + (\text{Dilution} - 1) * \text{Summer Temp}}{\text{Dilution}} - \text{Summer Temp} = \text{Temp Change} = 1.5°F$$

**Winter Conditions**  River Winter Temp = 32°F

$$\frac{\text{Wastewater Temp} + (\text{Dilution} - 1) * \text{Winter Temp}}{\text{Dilution}} - \text{Winter Temp} = \text{Temp Change} = 4.0°F$$

Since the in-stream temperature changes are less than or equal to those allowed by the Rhode Island Water Quality Regulations (4.0°F), it has been determined that a temperature limit of 92°F would be protective of the water quality criteria. Therefore, this limit has been applied. The summer and winter conditions were selected based on available data from USGS stream gages with water temperature data, to determine a winter water condition of 32°F.

Temperature increases in saltwater, caused by heated discharges, is limited in the Rhode Island Water Quality Regulations as "none except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83 degrees F nor raise the normal temperature more than 1.6 degrees F, 16 June through September and not more than 4 degrees F from October through 16 June". Based on this criteria, the maximum temperature limits for discharges to saltwater was set equal to the water quality criteria (83°F) with a maximum in-stream temperature change of 1.6°F (June 16 – September 30) and 4.0°F (October 1 - June 16). This will ensure that the in-stream temperature will not exceed the water quality criteria as a result of the discharge.

***pH***

The Rhode Island Water Quality Regulations establishes water quality criteria for both freshwater and saltwater discharges (See 250-RICR-150-05 §1.10(D) and §1.10(E)). The pH criteria for freshwater discharges is "6.5 [standard units] – 9.0 [standard units] or as naturally occurs". The pH criteria for saltwater discharges is "6.5 [standard units] – 8.5 [standard units] but not more than 0.2 units outside of the normally occurring range". In the previous permit, pH permit limits for discharges of non-contact cooling water were determined based on whether the non-contact cooling water source water source was private well water or municipal drinking water supply.

This permit requires that all facilities meet the applicable pH water quality criteria for the receiving water in their effluent. The DEM has assigned a pH limit that is equivalent to the water quality criteria for the receiving water (e.g., either 6.5 S.U. – 9.0 S.U. for freshwater or 6.5 S.U. – 8.5 S.U.

for saltwater). By placing pH limitations on the discharge, which are equivalent to the water quality criteria, the DEM is ensured that the discharge will not cause the receiving waters to violate the applicable water quality criteria.

Previously, the DEM assigned permit limits for facilities that used a municipal water supply as the source water for non-contact cooling based on the change in pH from the influent to effluent. The DEM limited the pH change (effluent – influent) of the non-contact cooling water to 0.5 S.U. The DEM has qualitatively reviewed the data collected over the last five years and discussed with the permitees a change to require that the permittees meet the water quality criteria. The data and the permittees both indicate that the facilities can meet the water quality criteria in their effluent.

***Total Residual Chlorine***

The Non-Contact Cooling Water General Permit will establish TRC monitoring requirements for permittees and will limit the allowable discharge TRC concentration. This will ensure that discharges comply with water quality standards for chlorine. Potable water sources typically are chlorinated to minimize or eliminate pathogens. Regulations at 40 CFR § 141.72 require that a public water system's residual disinfection concentration cannot be less than 0.2 mg/l for more than 4 hours. Therefore, the discharge of chlorinated drinking water has the potential to exceed water quality standards for chlorine. Since the permit does not cover discharges that add chemicals, discharges from facilities using other water sources are not likely to contain chlorine in concentrations sufficient to exceed water quality standards.

The TRC limits and associated monitoring requirements only apply to facilities that use municipal drinking water as a source of non-contact cooling water. The permittee may not add chlorine or any other biocide to non-contact cooling water used at the facility (See Part I.B.(3).)

The Rhode Island Water Quality Regulations at 250-RICR-150-05 §1.20, states that in all surface waters, existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected, and is applicable to any new, reissued, or modified RIPDES permits. Establishing TRC monitoring requirements for permittees and limiting the allowable discharge TRC concentration is consistent with EPA Region 1 NCCW permitting practices; wherein the maximum effluent concentration of chlorine shall not exceed 1.0 mg/l TRC. In Rhode Island the TRC limits established for discharges with high dilution factors will be capped at 1.0 mg/l based on this policy. This upper TRC effluent limit will adequately protect aquatic organisms from toxic amounts of chlorine.

The dilution factor and applicable chlorine limits will be approved by DEM during review of the facilities' NOI. The permittee will be provided with these limits when notified of permit coverage.

***Limits***

Rhode Island has narrative criteria in the Rhode Island Water Quality Regulations that prohibit toxic discharges in toxic amounts (See 250-RICR-150-05 §1.26). The listed limits on chlorine will ensure that chlorine is not discharged in toxic amounts. The State of Rhode Island also has numeric water quality criteria for chlorine (See 250-RICR-150-05 §1.26(J)), which are the same as the recommended federal water quality criteria. DEM will base chlorine effluent limits on these water quality criteria for discharges to flowing freshwater bodies, which are listed below.

- Freshwater acute – 19 µg/l (0.019 mg/l); use for daily maximum
- Freshwater chronic – 11 µg/l (0.011 mg/l); use for average monthly

TRC effluent limits will be based on the following equation:

Effluent Limit = (Dilution Factor) x (Water-Quality Criterion)

The dilution factor will be based on the same 7Q10 flow the permit applicant determines for effluent temperature limits, as written in the NOI. The accompanying dilution factor worksheet details the use of StreamStats, a USGS application for determining values such as 7Q10 for where the permit applicant discharges into the receiving stream.

For any facility using municipal water as their source of non-contact cooling water and discharging to a saltwater habitat, or to non-flowing freshwater bodies such as lakes or ponds, the maximum daily and average monthly concentration of TRC allowed in the effluent is 0.02 mg/L. This limit is based upon the quantitation limits of available methods approved by EPA as detailed in 40 CFR 136. Because lakes and ponds do not flow, DEM has assigned these freshwater bodies a dilution factor of 1 (one). Therefore, these non-flowing freshwater bodies will have the same effluent limits as saltwater bodies, also given a dilution factor of 1 (one). By limiting the TRC concentration such that the discharge will be below the quantitation limit the DEM will be assured that chlorine criteria will not be exceeded.

TRC concentrations are required to be measured (analyzed) within 15 minutes of collection of the sample per 40 CFR 136. The following methods may be used to analyze the grab samples: (1) Low Level Amperometric Titration, Standard Methods (18th Edition) No. 4500-Cl E; (2) DPD Spectrophotometric, EPA No. 330.5 or Standard Methods (18th Edition) No. 4500-Cl G.), all data below the detection level of 0.02 mg/L shall be reported as non-detect.

***Dilution Factors for discharges to Freshwater***

The available dilution shall be reviewed by DEM using the equations that can be found in the 2024 Final Dilution Worksheet and described in Section VII of the 2024 NOI Instructions. Both the dilution factor and applicable chlorine limits will be reviewed by DEM during review of the facility's NOI. The permittee will be provided with these limits when notified of permit coverage.

***Exemptions***

The following dischargers are exempt from the TRC testing requirements of this rule unless DEM determines that there is a need for testing based on the nature, location, or circumstances of an individual discharge.

a. When discharging to a freshwater body the point of discharge from the facility is at least 2100 feet from the receiving water body (i.e. the discharge is to a stormwater system that conveys the NCCW discharge to the receiving water), or;
b. When discharging to a saltwater body the point of discharge from the facility is at least 2400 feet from the receiving water body, or;
c. If the facility has four consecutive quarters of non-detection for TRC the facility may request a waiver from DEM to be exempt from TRC requirements for the remainder of the permit period or until DEM determines there is a reason to resume sampling.

If the facility meets the requirements for at least one of these exemptions, the facility may be exempt from TRC monitoring for the effective period of the permit, unless DEM determines there is a reason to resume testing.

The distance-based exemptions are based on calculations for chlorine dissipation from non-contact cooling water while traveling through storm-sewer systems (See Attachment B of this fact sheet) adapted from "Chlorine Dissipation from NCCW in Storm Drains" (Knutson, 2015) by Jason Knutson, P.E. at the Wisconsin Department of Natural Resources.

***Flow***

A flow limit will be established for each facility based on the information contained in the NOI. The flow limit will ensure that the dilution does not fall below that which was listed in the NOI. This will guard against a facility increasing its flow to a point where adverse temperature impacts will be seen in the receiving waters. Additionally, to prevent any water quality impacts from large non-

contact cooling water flows, facilities with flows greater than 1.0 Million Gallons per Day (MGD) are not eligible to obtain coverage under this general permit. These facilities must apply for an individual permit.

**Antibacksliding and Antidegradation**

The Antibacksliding Provision of the Clean Water Act (found in section 402(o) and repeated in 40 CFR 122.44(l)) prohibits issuing a permit containing less stringent effluent limits than the comparable limits from the previous permit. In terms of a RIPDES permit, an increased discharge is defined as an increase in any limitation, which would result in an increased mass loading to a receiving water. The baseline for this comparison would be the monthly average mass loading established by the previous permit. It would be inappropriate to use the daily maximum mass loading since the Policy is not applicable to short-term changes in water quality. Since none of the limits in the existing non-contact cooling water general permit are more stringent than the limits in this non-contact cooling water general permit, antibacksliding regulations are being met.

Antidegradation is intended to protect current water quality by preventing increases in the discharge of pollutants to surface waters. This general permit will not apply to any new or increased discharge unless it can be determined that such discharges will not result in significant effects to the receiving waters. This determination shall be made in accordance with the Rhode Island Antidegradation Policy prior to issuing a general permit.

**Geothermal Systems at Three-Family or Smaller Residential Buildings**

This permit establishes a separate category for groundwater discharges from geothermal systems at three-family and smaller residential buildings. These buildings typically use “Open loop” geothermal systems that use well water pumped into the heat pump unit where the heat is extracted and the water is then discharged into a surface water. Typical water requirements are approximately three gallons per minute of well water per ton of cooling capacity. As a result, a 3,000-square-foot, well-insulated home would typically require 10 to 15 gallons per minute.

A. Discharges from residential geothermal heat exchangers at three-family or smaller residential buildings are not required to submit monitoring results to the DEM, however, they are required to comply with appropriate water quality-based limits. The temperature limits chosen for this category are equivalent to the maximum temperature changes from the Rhode Island Water Quality Regulations for either freshwater discharges (receiving water’s temperature not to be raised more than 4.0°F) or for saltwater discharges (the receiving water’s temperature not to be raised more than 4.0°F from October 1 through June 15 or more than 1.6°F from June 16 through September 30). Since this category only authorizes discharges from geothermal systems at three-family or smaller homes that use private well water, the DEM’s concern is that the pH of the well water may be changed as a result of a leak in the system. Therefore, the permit also includes pH limits for this category based on the pH limits from the Rhode Island Water Quality Criteria. Discharges from these facilities into saltwater receiving waters shall not cause the pH of the receiving water to be more than 0.2 s.u. outside of the normally occurring range and discharges from these facilities into freshwater receiving waters shall not cause the receiving water’s pH to be outside of the range of 6.5 – 9.0 s.u. DEM may require sampling to confirm that the above limits are being met on a case-by-case basis.

Discharges of non-contact cooling water from geothermal systems at three-family and smaller residential buildings shall be automatically granted authorization to discharge on the effective date of this permit. Any discharges from geothermal systems that are not associated with a three-family or smaller residential buildings cannot get coverage under this section. However, these discharges are eligible for coverage under the other sections of the general permit.

## 4. FINAL PERMIT LIMITATIONS

It is only necessary to establish permit limits for those pollutants in the discharge which have the reasonable potential to cause or contribute to the exceedance of in-stream criteria. Based on the analysis presented above, permit limits are required for Temperature, pH, TRC, and Flow.

## 5. LIMITATIONS ON COVERAGE

As previously indicated, to prevent any water quality impacts from large non-contact cooling water flows, facilities with flows greater than 1.0 Million Gallons per Day (MGD) are not eligible to obtain coverage under this general permit.

Also, to prevent water quality impacts from treatment chemicals, facilities that add water treatment chemicals to their non-contact cooling water are not eligible to obtain coverage.

Facilities that have been determined to be a potential cause of a water quality violation or have been determined that they may adversely impact a listed, endangered, or threatened species cannot obtain coverage under this general permit.

In accordance with 250-RICR-150-05 §1.25 of the Rhode Island Water Quality Regulations, discharges into the terminal reservoir of a public water supply cannot obtain coverage under this general permit.

Facilities that have non-contact cooling water, which uses ground water that is impacted by a release of a toxic or hazardous material, and/or non-contact cooling water that is contaminated from failing or leaking heat exchangers or process equipment cannot obtain coverage under this general permit. All permittees are required to perform annual testing of its cooling water system to verify that it is not leaking and maintain such records on site for a minimum period of five (5) years to be made available upon request.

Any owner or operator authorized by a general permit may request to be excluded from coverage of a general permit by applying for an individual permit. This request may be made by submitting a NPDES permit application together with reasons supporting the request. The Director may also require any person authorized by a general permit to apply for and obtain an individual permit. Any interested person may petition the Director to take this action. However, individual permits will not be issued for sources discharging non-contact cooling water covered by this general permit unless it can be clearly demonstrated that inclusion under the general permit is inappropriate. The Director may consider the issuance of individual permits when:

A. The discharger is not in compliance with the terms and conditions of the general permit;
B. A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source;
C. Effluent limitations guidelines are subsequently promulgated for the point sources covered by the general NPDES permit;
D. A Water Quality Management plan or Total Maximum Daily Load (TMDL) containing requirements applicable to such point sources is approved;
E. Circumstances have changed since the time of the request to be covered so that the discharger is no longer appropriately controlled under the general permit, or either a temporary or permanent reduction or elimination of the authorized discharge is necessary; or
F. The discharge(s) is a significant contributor of pollution.

In accordance with 40 CFR 122.28(b)(3)(iv), the applicability of the general permit is automatically terminated on the effective date of the individual permit.

## 6. PERMIT LIMIT SUMMARY

Each outfall authorized to discharge non-contact cooling water shall be limited and monitored by the permittee as specified below, in accordance with the receiving water classification, when indicated.

| | | Discharge Limitations | Monitoring Requirements |
|---|---|---|---|

| Effluent Characteristic | Dilution Factor[1] | Average Monthly | Maximum Daily | Monitoring Frequency | Sample Type |
|---|---|---|---|---|---|
| **Flow** | | | | | |
| All Discharges | NA | ----- | [2] | 1/Week | Calculated[3] |
| **Temperature** | | | | | |
| Discharge to Freshwater Warm Water Habitat | <15 (Fifteen)[1] or Temperature Impaired | ----- | 83°F[4] | 1/Week | Grab or Continuous[5] |
| | ≥15 (Fifteen)[1] | ----- | 92°F[4] | 1/Week | Grab or Continuous[5] |
| Discharge to Freshwater Cold-Water Habitat | <15 (Fifteen)[1] or Temperature Impaired | ----- | 68°F[4] | 1/Week | Grab or Continuous[5] |
| | ≥15 (Fifteen)[1] | ----- | 92°F[4] | 1/Week | Grab or Continuous[5] |
| Discharge to Saltwater Habitat | NA | ----- | 83°F[6] | 1/Week | Grab or Continuous[5] |
| **pH** | | | | | |
| Discharge to Freshwater Habitat | NA | 6.5 s.u. (min) | 9.0 s.u. (max) | 1/Week | Grab or Continuous[5] |
| Discharge to a Saltwater Habitat | NA | 6.5 s.u.[7] (min) | 8.5 s.u.[7] (max) | 1/Week | Grab or Continuous[5] |
| **Total Residual Chlorine** | | | | | |
| Municipal Water Supply and Discharge to Freshwater Habitats (except Lakes or Ponds) | See Part II.F. | See Part II.F. | See Part II.F. | 1/Quarter | Grab[5] |
| Municipal Water Supply and Discharge to Lakes or Ponds or Saltwater Habitats | NA | 0.02 mg/L[8] | 0.02 mg/L[8] | 1/Quarter | Grab[5] |

Sampling shall be performed on a typical operating day.

----- Signifies a parameter which must be monitored, and data must be reported; no limit has been established at this time.

[1] See NCCW NOI Instructions for dilution factor calculations.

[2] Limit based upon the maximum non-contact cooling water design flow in the applicant's NOI.

[3] Flow shall be either calculated using a flow totalizer or estimated using the cooling water pumping rate. Reported flow is the flow which occurs over the course of a normal operating day when discharge is occurring. Monthly average flow is to be calculated by dividing the total flow discharged for a given month by the number of days in which there was a discharge during the month (i.e., if a given month had 30 days, but the facility only discharged on 25 days, the monthly average flow would be determined by dividing the total volume discharged during the month by 25 days). Since the reporting period consists of more than one month (i.e., quarterly reporting), the monthly average flow to be reported on the DMR is the highest monthly average flow for all the months in the reporting period. The daily maximum flow is the highest daily flow observed during the reporting period.

[4] In no case shall the discharge cause the temperature of the receiving water to be raised more than 4.0°F.

[5] Compliance with these limitations shall be determined by taking a minimum of four (4) grab samples equally spaced over the course of a normal operating day that captures a discharge event. The maximum value to be reported is the highest individual measurement obtained during the monitoring

period. The minimum value to be reported is the lowest individual measurement obtained during the monitoring period. Continuous monitoring devices may be used to measure effluent water body temperature and pH. When required, the maximum temperature and monthly average temperature shall be reported based on the continuous dataset.

[6] In no case shall the discharge cause the temperature of the receiving water to be raised more than 4.0 °F (from October 1 through June 15) or more than 1.6 °F (from June 16 through September 30).

[7] In no case shall the discharge cause the pH of the receiving water to be more than 0.2 s.u. outside the normally occurring range.

[8] The limit at which compliance/noncompliance determinations will be based is the Quantitation Limit which is defined as 0.02 mg/L for TRC. These values may be reduced by permit modification as more sensitive methods are approved by EPA and the State. The following methods may be used to analyze the grab samples: (1) Low Level Amperometric Titration, Standard Methods (18th Edition) No. 4500-Cl E; (2) DPD Spectrophotometric, EPA No. 330.5 or Standard Methods (18th Edition) No. 4500-Cl G.

## 7. COMMENT PERIOD, HEARING REQUESTS, AND PROCEDURES FOR FINAL DECISIONS

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the Rhode Island Department of Environmental Management, Office of Water Resources, 235 Promenade Street, Providence, Rhode Island, 02908-5767. Any person, prior to such date, may submit a request in writing for a public hearing to consider the draft permit to the Rhode Island Department of Environmental Management. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public hearing may be held after at least thirty days public notice whenever the Director finds that response to this notice indicates significant public interest. In reaching a final decision on the draft permit the Director will respond to all significant comments and make these responses available to the public at DEM's Providence Office.

Following the close of the comment period, and after a public hearing, if such hearing is held, the Director will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days following the notice of the final permit decision any interested person may submit a request for a formal hearing to reconsider or contest the final decision. Requests for formal hearings must satisfy the requirements of 250-RICR-150-10 §1.50 of the Regulations for the Rhode Island Pollutant Discharge Elimination System.

## 8. DEM CONTACT

Additional information concerning the permit may be obtained between the hours of 8:30 a.m. and 4:00 p.m., Monday through Friday, excluding holidays from:

Madison Heller
Rhode Island Department of Environmental Management
RIPDES Program
235 Promenade Street
Providence, Rhode Island, 02908
Telephone: (401) 537-4197
E-mail: madison.heller@dem.ri.gov

Date

Heidi Travers, P.E.
Environmental Engineer IV
Office of Water Resources
Department of Environmental Management

## ATTACHMENT A EXISTING NON-CONTACT COOLING WATER PERMITTEES

| Permit Number | Facility | Facility Location | Mailing Address | Receiving Water | Habitat | Dilution | Source Water |
|---|---|---|---|---|---|---|---|
| RIG250004 | The Original Bradford Soap Works, Inc. | 200 Providence St West Warwick, RI | 200 Providence St West Warwick, RI 02893 | South Branch Pawtuxet River | Warm | >15 | Private Well |
| RIG250019 | Leonard Valve Company | 1360 Elmwood Ave. Cranston, RI | 1360 Elmwood Ave. Cranston, RI 02910 | Fenner Pond | Warm | <15 | Municipal |
| RIG250026 | New England Union Company | 107 Hay Street, West Warwick, RI | 107 Hay Street West Warwick, RI 02893 | South Branch Pawtuxet River | Warm | <15 | Municipal |

## ATTACHMENT B CHLORINE DISSIPATION FROM NCCW IN STORM DRAINS

**Chlorine Dissipation from Non-Contact Cooling Water (NCCW) in Storm Drains**
Adapted from "Chlorine Dissipation from NCCW in Storm Drains" (Knutson, 2015) by Jason Knutson, P.E. at Wisconsin Department of Natural Resources

**Purpose:**
The purpose of this calculation is to calculate the travel distance within storm drains required for chlorine to dissipate from concentrations typically found in drinking water (0.2 mg/L – see 40 CFR § 141.72) to Rhode Island's Water Quality Standards listed below.

- Freshwater acute – 19 µg/l (0.019 mg/l); use for daily maximum
- Freshwater chronic – 11 µg/l (0.011 mg/l); use for average monthly
- Saltwater acute – 13 µg/l (0.013 mg/l); use for daily maximum
- Saltwater chronic – 7.5 µg/l (0.0075 mg/l); use for average monthly

The nature of this calculation is intentionally conservative in that it neglects two significant sinks of chlorine during transport: (1) dissipation during the wastewater's drop into the storm drain and (2) degradation of chlorine due to contact with organic material within the storm drain. It only considers dissipation of chlorine during laminar flow through the storm drain.

**Summary:**
Chlorine levels in non-contact cooling water (NCCW) will be reduced to Rhode Island's Water Quality standards for acute toxicity by the time the NCCW travels 1950 feet within storm sewers for discharges to saltwater bodies and 1700 feet for discharges to freshwater bodies. Dischargers covered under Rhode Island's NCCW General Permit who are situated greater than the above listed distances from the receiving body they discharge to may be exempted from compliance requirements for chlorine, so long as chlorine concentrations within their discharge are not above the typical concentration in potable water (0.2 mg/L).

**Inputs and Justifications:**
- **Flow rate (Q) = 1.0 MGD (1.547 fps)**. This effluent flow rate is the maximum allowable effluent flow rate for NCCW General Permit holders in the state. It was selected as the Q for conservative purposes.
- **Manning Coefficient (n) = 0.013.** Concrete pipes typically have Manning coefficients between 0.012 and 0.014 (Munson et al 569). The 0.013 value was confirmed by the DEM's stormwater engineers as the typical for storm drain calculations.
- **Slope of storm drains (S) = 1%**. DEM's stormwater engineers concurred that a typical slope for storm drains is around 1%, and cited the Rhode Island Stormwater Design Manual minimum slope criteria.
- **Storm drain pipe diameter (D) = 1.5 feet**. The typical minimum size for storm drains is 12" diameter. However, size increases with proximity to the receiving water, so storm drain outfalls less than 18" in diameter are uncommon. Because the calculations in this model are focused on the final few thousand feet before the outfall, a size of 18" was used as an input.
- **Concentration of chlorine ($C_o$) = 0.2 mg/L**. The concentration of chlorine within typical potable water, at the point of use, is 0.2 mg/L.
- **Rhode Island's Water Quality Standard for Chlorine (C) = 0.019 mg/L for freshwater acute and 0.013 mg/L for saltwater acute.**
- **Molecular Weight of $O_2$ = 32.0 g/mol**

- **Molecular Weight of $Cl_2$ = 70.9 g/mol**
- **K = 1.49.** This is the correction factor for use of British Units in the Manning equation.

**Equations used:**

Manning equation $V = \frac{K}{n} R_h^{\frac{2}{3}} S^{\frac{1}{2}}$ (1) (V [ft/s], K [ ], n [ ], $R_h$ [ft], S[])

or $Q = \frac{K}{n} A R_h^{2/3} S^{1/2}$ (2) (Q [$ft^3/s$], K [ ], n [ ], A [$ft^2$], $R_h$ [ft], S [ ])

Area under a chord $A = \frac{D^2 (\theta - \sin\theta)}{8}$ (3)

Wetted Perimeter $P = \frac{D\theta}{2}$ (4)

Hydraulic Radius $R_h = \frac{A}{P} = \frac{D (\theta - \sin\theta)}{4\theta}$ (5)

Depth of Flow $d = \frac{D}{2}(1 - \cos(\frac{\theta}{2}))$ (6)

from Thin Film Theory: $\frac{k_{Cl_2}}{k_{O_2}} = \frac{\sqrt{MW_{Cl_2}}}{\sqrt{MW_{O_2}}}$ (7)

Reaeration Equation (Owens et al) $k_{O_2} = \frac{23.2\, V^{0.73}}{d^{1.75}}$ (8) ($k_{O2}$ [$d^{-1}$], V [ft/s], d [ft])

First Order Decay $C = C_0\, e^{-k_{Cl2}\, t}$ (9)

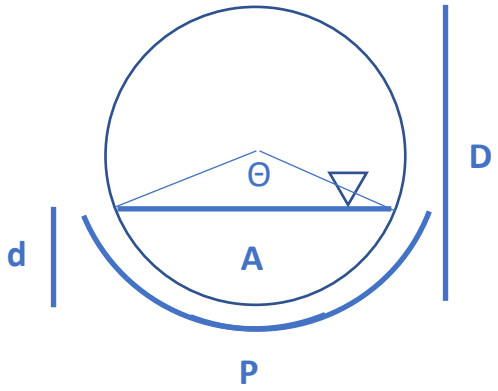


Figure 1: Cross-section of a pipe, for use with equations (3) – (5).

A = Cross-sectional area of flow
D = Diameter
$R_h$ = Hydraulic Radius
V = Average velocity of NCCW in storm drain
d = depth
P = Wetted Perimeter
t = time
Θ = Angle from pipe center to NCCW surface

**Calculation:**

**Step 1: Calculate depth of flow in storm drain**

Substitute the Area Under Chord equation (3) and the Hydraulic Radius equation (5) into the Manning equation (2) for *A* and $R_h$:

$$Q = \frac{K}{n} (A) (R_h)^{2/3} S^{1/2}$$

$$Q = \frac{K}{n} (\frac{D^2 (\theta - \sin\theta)}{8}) (\frac{D (\theta - \sin\theta)}{4\theta})^{2/3} S^{1/2}$$

$$Q = \frac{K}{n}\frac{D^{8/3}}{2^{13/3}}\frac{(\theta - sin\theta)^{5/3}}{\theta^{2/3}}S^{1/2}$$

Solving this equation for θ, using the inputs stated above, gives:

$$\theta = 2.1357\ radians$$

Plug this into the Depth of Flow equation:

$$d = \frac{D}{2}(1 - \cos\left(\frac{(2.1357)}{2}\right))$$

$$\boldsymbol{d = 0.38849\ feet}$$

**Step 2: Calculate the average velocity of NCCW in the storm drain**

Find the submerged cross-sectional area using θ and the Area Under Chord equation (3):

$$A = \frac{D^2\ ((2.1357) - sin(2.1357))}{8}$$

$$A = 0.36310$$

Divide the Flow Rate by the cross-sectional Area to find the average flow velocity:

$$V = \frac{Q}{A} = \frac{2.47557\ ft^3/s}{.50841\ ft^2}$$

$$\boldsymbol{V = 4.2612\ feet/second}$$

**Step 3: Calculate the distance required for sufficient dissipation of chlorine**
The Owens, et al. reaeration equation is an empirical equation used to model the rate at which oxygen is exchanged between air and water (the reaeration rate or gas exchange rate for $O_2$):

$$k_{O_2} = \frac{23.2\ V^{0.73}}{d^{1.75}}$$

According to the Thin Film Theory, the ratio of the square roots of molecular weights of two gases is equal to the ratio of their gas exchange coefficients. Solve for the gas exchange rate for $Cl_2$ by substituting in the Owens, et al. equation:

$$\frac{k_{Cl_2}}{k_{O_2}} = \frac{\sqrt{MW_{Cl_2}}}{\sqrt{MW_{O_2}}}$$

$$k_{Cl_2} = k_{O_2} * \frac{\sqrt{MW_{Cl_2}}}{\sqrt{MW_{O_2}}}$$

$$k_{Cl_2} = \frac{23.2\ V^{0.73}}{d^{1.75}} * \frac{\sqrt{MW_{Cl_2}}}{\sqrt{MW_{O_2}}}$$

Assuming that the concentration of Chlorine in the air is negligible, the following first-order decay equation represents the dissipation of chlorine from water:

$$C = C_0\, e^{-k_{Cl2}\, t}$$

Solve it for time:

$$t = \frac{\ln\,(C/C_0)}{-k_{Cl2}}$$

Multiply by velocity to solve for distance the water must travel for chlorine to dissipate:

$$distance = \frac{\ln\,(C/C_0)}{-k_{Cl2}} * V$$

Factor in a correction of units:

$$distance = \frac{\ln\left(\frac{C}{C_0}\right)[\,]}{-k_{Cl2}\,[d^{-1}]} * V\,[ft/s] * \frac{60*60*24\ s}{1\ day}$$

Substitute the derived equation for $k_{Cl2}$ into this equation, and solve for distance:

$$distance = -\frac{\ln\left(\frac{C}{C_0}\right) * d^{1.75}\sqrt{MW_{O_2}}}{23.2\ *\sqrt{MW_{Cl_2}}} * V^{0.27} * \frac{86{,}400\ s}{1\ day}$$

Substitute either a) 0.019 mg/L for concentration (C) to get the distance for dischargers to freshwater bodies or b) 0.013 mg/L for concentration (C) for dischargers to saltwater.

a) $$distance = -\frac{\ln\left(\frac{0.019}{0.2}\right)*(0.38849\ ft)^{1.75}\sqrt{32.0\frac{g}{mol}}}{23.2\ *\sqrt{70.9\frac{g}{mol}}} * \left(4.2612\,\frac{ft}{s}\right)^{0.27} * \frac{86{,}400s}{1\ day}$$

b) $$distance = -\frac{\ln\left(\frac{0.013}{0.2}\right)*(0.38849\ ft)^{1.75}\sqrt{32.0\frac{g}{mol}}}{23.2\ *\sqrt{70.9\frac{g}{mol}}} * \left(4.2612\,\frac{ft}{s}\right)^{0.27} * \frac{86{,}400s}{1\ day}$$

**a)** $\boldsymbol{distance = 1700\ feet}$
$\boldsymbol{required\ for\ dissipation\ of\ chlorine\ to\ freshwater\ acute\ WQS}$

**b)** $\boldsymbol{distance = 1950\ feet}$
$\boldsymbol{required\ for\ dissipation\ of\ chlorine\ to\ saltwater\ acute\ WQS}$