The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Robert R. Scott, Commissioner

April 18, 2025

Mark Sanborn, Regional Administrator
EPA New England, Region 1
5 Post Office Square - Suite 100
Boston, MA 02109-3912

Re: Request for approval of amendments to New Hampshire Surface Water Quality Standards

Dear Mr. Mark Sanborn:

In accordance with New Hampshire law, the New Hampshire Department of Environmental Services (NHDES) adopted amendments to the New Hampshire Surface Water Quality Standards (Env-Wq 1700) on February 25, 2025. The purpose of this letter is to request EPA approval of the adopted amendments. To assist your review and to satisfy the submittal requirements of 40 CFR §131.6 and §131.20(c), the following documents are attached:

- **Exhibit 1**. Certification by the State Attorney General that the surface water quality regulations were duly adopted pursuant to state law;
- Exhibit 2. Copy of the public notice for the public hearing related to the revisions;
  - **Exhibit 2a**. New Hampshire Rulemaking Register (dated October 24, 2024);
  - **Exhibit 2b**. New Hampshire Rulemaking Notice (number 2024-219) and announcement of public hearing on November 15, 2024 (see page 5);
- **Exhibit 3a** - Marked-up version of the Env-Wq1700 initial proposal showing new and deleted language;
- **Exhibit 3b** – Table of changes and public outreach leading to the Env-Wq1700 initial proposal;
- **Exhibit 4**. Clean copy of the final revised regulations;
- **Exhibit 5.** Public comments from;
  - OspreyOwl Environmental, L.L.C., (pg 1-6);
  - Conservation Law Foundation (CLF) (co-signed by Connecticut River Conservancy, Manchester NAACP, Merrimack Citizens for Clean Water, Merrimack River Watershed Council, New Hampshire Healthy Climate, New Hampshire Rivers Council, New Hampshire Safe Water Alliance, Society for the Protection of New Hampshire Forests and Testing for Pease), (pg 7-16);
    - plus substantially identical form letter comments from 49-members of CLF. (pg 17-67);
  - NH LAKES, (pg 68);
  - the City of Rochester, (pg 69-71);
  - the EPA, (pg 72-77);
  - New Hampshire Office of Legislative Services (OLS) (pg 78-135);
- **Exhibit 6**. State's responses to public comments.

Technical/scientific basis for revisions to the surface water quality criteria;

- The following adopted amendments to the surface water quality criteria in the regulations followed guidance from the U.S. Environmental Protection Agency (EPA).

- Human health criteria (HHC) were updated to reflect the 2015 EPA 304(a) HHC for the remainder of the 94 chemicals[1] that were not adopted in the last triennial review.
- Freshwater aquatic life use criteria for Selenium[2].
- Freshwater aquatic life use criteria for Aluminum, including the multiple linear regression calculators[3]. While not a surface water quality standard, in close consultation with EPA R1 staff, NHDES developed a document explaining the process for the implementation of the revised aluminum criteria NPDES permitting (**Exhibit 7**).
- Cyanobacteria criteria for microcystin and cylindrospermopsin were added at Env-Wq 1703.17 to align with the 2019 304(a)[4] to protect swimming and other recreational uses.

- The following adopted amendments to the surface water quality criteria in the regulations were prompted by actions at the state level.
  - Revised the bacteria requirements in Env-Wq 1703.06 and Env-Wq 1706 (b) for tidal waters to align with revision to RSA 485-A:2, V pursuant to Chapter 208 (SB 146-FN), Part IV of the Laws of 2021, effective October 9, 2021. The RSA changes were previously approved by EPA R1 in a February 2, 2022, action letter.
  - Revised the dissolved oxygen statements in Env-Wq 1703.07(b)(1) by striking ", as specified in RSA 485-A:8, II," to align with revisions to RSA 485-A:8, II pursuant to Chapter 211 (SB 127), of the Laws of 2017, effective September 8, 2017.
  - Revisions to the radionuclide requirements to directly reference the drinking water maximum contaminant levels (MCLs) and application of those MCLs solely to the 20-miles upstream of PWS surface waters as described in Env-Wq 1703.22(l). Radionuclide criteria in the previous rules were from the radionuclide section of the "Public Health Service - Drinking Water Standards of 1962 (US Dept of Health, Education and Welfare)"[5], the predecessor to the Safe Drinking Water Act.
  - The arsenic criteria for both "fish consumption only" and "water and fish consumption only" have been updated and differentiated between fresh and marine waters. This update changed the stated target risk factor from 10^{-6} to 10^{-5}. Additionally, the update increases to body weight (70 to 80 kg), drinking water intake (2.0 to 2.7 L/d) and fish consumption rate (6.5 to 95 g/d), and decreases in cancer potency factor (1.75 to 1.5 per mg/kg-d), bioconcentration factor (44 in all waters to 14 in freshwater and 26 in marine water) and inorganic fraction (100 to 10%). (**Exhibit 8**) The level of review and computation need to update any criteria is extensive. As such, this effort was applied to just one parameter which is fairly common in New Hampshire waters. Failure to revise the criteria would constrain the benefits of consuming fish while and placing addition pressures on wastewater treatment facilities.
  - All drinking water MCLs were added to Table 1703-01 and Tables 1703-2A where the state adopted MCL is lower than the water and fish consumption only human health criteria, even where there was no preexisting water and fish consumption only human

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[1] Human Health Ambient Water Quality Criteria: 2015 Update. Environemntal Protection Agency, Office of Water.
[2] 2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium - Freshwater 2016. Environemntal Protection Agency, Office of Water.
[3] 2018 Final Aquatic Life Criteria for Aluminum in Freshwater. Environemntal Protection Agency, Office of Water.
[4] Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin
[5] Public Health Service Drinking Water Standards, 1962

health criteria. Many of the state adopted MCLs can be found in the National Primary Drinking Water Regulations[6], however there are several parameters not in the national list.

- The Methyl tertiary-butyl ether (MtBE) MCL was developed by the New Hampshire Department of Health & Human Services, Office of Community and Public Health in February 2000 (**Exhibit 9**) and adopted by NHDES into the drinking water standards.
- The MCLs for 4-PFAS; Perfluoro sulfonic acid (PFNA), Perfluorononanoic acid (PFNA), Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) were developed by NHDES in June 2019 (**Exhibit 10**). The 4-PFAS MCLs became state law in July 2020 when New Hampshire House Bill 1264 was signed.
- Three aldicarb compounds; aldicarb (temik), aldicarb sulfoxide and aldicarb sulfone (aldoxycarb) were federally promulgated 56 FR 30266 (July 1, 1991) and adopted into New Hampshire's drink water standards. While the 3-aldicarbs are no longer on the National Primary Drinking Water Regulations list[6] as they were "stayed" in 1992 for federal use, the 3-aldicarbs are part of New Hampshire's drink water standards.

- Permitting on nutrient discharges was revised in two sections.
  - Procedures for the development of site-specific nutrient criteria were added at Env-Wq 1704.03. Any such developed site-specific criteria would be adopted in future rule-making efforts.
  - The permitting related standards section was renamed and revised (Env-Wq 1705). Changes were initially to align with revisions to RSA 485-A:8, II pursuant to Chapter 211 (SB 127), of the Laws of 2017, effective September 8, 2017. The 2017 RSA change stated that nutrient permitting cannot be based on 7Q10 flows (7-day average that occurs once in a 10-year period). Use of any higher flows would require a lower target instream concentration than the 100 ug/L used by EPA. Although Chapter 239 (SB 60), of the Laws of 2023 struck the prohibition of use of the 7Q10 for nutrient permitting, interested parties and the department were still committed in revamping the nutrient discharge permitting procedures. In Env-Wq 1705.02(d) the revised rules set up the processes by which permits shall be written based upon a default target instream concentration, a model, or any of the other acceptable methods described in the section or site-specific criteria adopted pursuant to Env-Wq 1704.03. In terms of target flow conditions, Env-Wq 1705.02(d)(2) aligns the flow with the nutrient target. The ultimate approval of those permits lies in the EPA approval of a particular permit.

The remainder of the changes to the regulations are primarily administrative and do not require technical/scientific justification.

[6] National Primary Drinking Water Regulations | US EPA

NHDES respectfully requests EPA approval of these amendments to the New Hampshire Surface Water Quality Standards per 40 CFR §131.5 and §131.21.

Should you have any questions, please do not hesitate to contact me at (603) 271-0677 or Rene.J.Pelletier@des.nh.gov, or Ken Edwardson at (603) 271-8864 or Kenneth.J.Edwardson@des.nh.gov.

Sincerely,

Rene J. Pelletier, P.G.

Director, Water Division

Enclosure(s) (#)

cc: Thane Joyal, NHDES

Ted Diers, NHDES

Dave Neils, NHDES

Ken Edwardson, NHDES

Ken Moraff, EPA

Katie Lamoureux, EPA

Nathan Chien, EPA

Dan Arsenault, EPA

Allen Brooks, NHDOJ

Exhibit 1

CERTIFICATE OF LEGAL AUTHORITY

TO WHOM IT MAY CONCERN:

This is to certify that the New Hampshire Surface Water Quality regulations, NH Code Admin. Rule Env-Wq 1700, were legally adopted by the New Hampshire Department of Environmental Services pursuant to the New Hampshire Administrative Procedure Act, RSA Chapter 541-A, on February 25, 2025.

JOHN M. FORMELLA
ATTORNEY GENERAL

Date: April 10, 2025

By: ______________________

Joshua C. Harrison
Assistant Attorney General
Environmental Protection Bureau
Office of the Attorney General
1 Granite Place South
Concord, New Hampshire 03301
(603) 271-3679

Exhibit 2a

NEW HAMPSHIRE

RULEMAKING REGISTER

OFFICE OF LEGISLATIVE SERVICES

ROOM 234, STATE HOUSE ANNEX
25 CAPITOL STREET
CONCORD, NEW HAMPSHIRE 03301-6312
Tel. (603) 271-3680
Website: www.gencourt.state.nh.us/rules/index.html

TDD Access:
Relay NH 1-800-735-2964

Published every Thursday pursuant to RSA 541-A:9

Number 43, October 24, 2024

Proposed Rules			
Notice Form	**Rule Number**	**Agency**	**Proposed Rule**
2024-219	Env-Wq 1700	Department of Environmental Services Water Quality and Quantity Programs	Surface Water Quality Regulations
2024-220	He-W 899.02	Department of Health and Human Services Former Division of Human Services	Post Office Boxes and General Delivery Mailing Addresses
2024-221	He-W 804.04 and He-W 804.05	Department of Health and Human Services Former Division of Human Services	Electronic Account Notification and Electronic Account Access
2024-222	He-W 606.37	Department of Health and Human Services Former Division of Human Services	Pursuit of Social Security Benefits
Postponement Notice 2024-178	Gen 200	Governing Board of Genetic Counselors	Procedural Rules
Postponement Notice 2024-179	Gen 300	Governing Board of Genetic Counselors	Initial Licensure for Genetic Counselors
Postponement Notice 2024-180	Gen 400 various	Governing Board of Genetic Counselors	License Renewal, Reinstatement, Voluntary Surrender, and Continuing Education Requirements for Genetic Counselors
Extension of Public Comment 2024-111	Puc 100	Public Utilities Commission	Organizational Rules
Extension of Public Comment 2024-110	Puc 200	Public Utilities Commission	Procedural Rules

* Denotes that the rule implements new legislation.

JLCAR

2024 SCHEDULED MEETING DATES AND FILING DEADLINES

The JLCAR has voted to hold its regularly scheduled meetings for January through June on the **third Friday** of the month and for July through December on the **third Thursday** of the month as listed below. The minimum 21-day "deadline" prior to the regular JLCAR meeting is listed for agencies to file final proposals or proposed interim rules* for placement on the JLCAR agenda pursuant to RSA 541-A:12, I and RSA 541-A:19, V. The JLCAR has also scheduled continued meetings as listed below on select Thursdays and Fridays to address items postponed from the prior regular meetings.

Regular Meeting Filing Deadline	Regular Meeting Date	Continued Meeting Date
December 29*	**January 19**	February 2
January 26	**February 16**	March 1
February 23	**March 15**	April 5
March 29	**April 19**	May 3
April 26	**May 17**	May 31
May 31	**June 21**	June 28
June 27	**July 18**	August 1
July 25	**August 15**	August 29
August 29	**September 19**	October 3
September 26	**October 17**	October 31
October 31	**November 21**	December 5
December 2**	**December 19**	None

***NOTE**:

The filing deadlines relate to JLCAR meetings pursuant to RSA 541-A. However, from January through June, if a proposed interim rule is filed with a rulemaking notice for publication in the *Rulemaking Register*, be aware that Thursdays—not Fridays—remain the filing deadline under the *Drafting and Procedure Manual for Administrative Rules* to have the rulemaking notice published the following week. Pursuant to RSA 541-A:19, V, the notice must be published at least 14 days before the regularly scheduled meeting for which the proposed interim rule has been placed on the agenda. Therefore, filing the notice together with the proposed interim rule no later than the Thursday **before** the 21-day statutory deadline would assure that both the 21-day deadline for filing the rule and the 14-day deadline for publication in the *Rulemaking Register* would be met.

****NOTE**:

The 21-day deadline to file for the December 19 meeting falls on Thanksgiving, November 28. Pursuant to RSA 541-A:16, IV, it is automatically extended to Monday, December 2.

However, if a proposed interim rule is filed with a rulemaking notice for publication in the *Rulemaking Register*, be aware that Wednesday, November 27 remains the filing deadline under *the Drafting and Procedure Manual for Administrative Rules* to have the rulemaking notice published the following week. Pursuant to RSA 541-A:19, V, the notice must be published at least 14 days before the regularly scheduled meeting for which the proposed interim rule has been placed on the agenda. Therefore, filing the interim rulemaking notice together with the proposed interim rule no later than Wednesday, November 27 would assure that both the 21-day deadline for filing the rule for the December 19 JLCAR meeting and the 14-day period for notice publication in the *Rulemaking Register* would be met.

NEXT REGULAR MEETING: November 21, 2024
Live Stream Link*: https://youtube.com/live/Dlh54lltP6g?feature=share*
The meetings will be held in-person in rooms 306/308 of the Legislative Office Building.

Exhibit 2b

Notice Number	**2024-219**	Rule Number	**Env-Wq 1700**

1. Agency Name & Address: **Department of Environmental Services** **29 Hazen Drive** **P.O. Box 95** **Concord, NH 03302-0095**	2. RSA Authority: **RSA 485-A:6, I, & XI-c, XIV & XV and RSA 485-A:8, VI** 3. Federal Authority: **33 U.S.C. 1251 *et seq*.; 40 CFR Part 131** 4. Type of Action: Adoption ____ Repeal ____ Readoption ____ Readoption w/amendment **X**

5. Short Title: **Surface Water Quality Regulations**

6. (a) Summary of what the rule says and of any proposed amendments including whether the rule implements a state statute for the first time:

The Department of Environmental Services (Department) is proposing to readopt with amendment Env-Wq 1700, which specifies narrative and numeric water quality standards for the state's surface waters, specifically for the designated uses identified in RSA 485-A:8. The rules in Env-Wq 1700 were readopted and effective on December 1, 2016, and are scheduled to expire on December 1, 2026. The Clean Water Act (CWA) requires states to review and update their water quality standards every three years, which is the reason for initiating this rulemaking.

The proposed rulemaking clarifies existing requirements. The Department also is proposing to update the numeric water quality standards to better align the rules with more recent Environmental Protection Agency (EPA) National Recommended Water Quality Criteria (NRWQC) as follows:

- **Env-Wq 1701.02(a) – Clarifies the applicability of surface water quality standards, or lack thereof, to particular "artificial waters".**

- **Env-Wq 1701.04 – "Water Quality Standards Variances" – Variance section added for transparency. Variances are already allowed under the CWA and are explicitly adopted into the water quality standards under the standard state rule adoption and EPA approval processes. Since there was no mention of variances in the existing rules, some sources were likely unaware that variances are a legal option.**

- **Env-Wq 1702 – "Definitions" – Removed 3 unused definitions, added 1 definition, and clarified 6 definitions. Changes result in renumbering.**
  - **Clarifications:**
    - **Env-Wq 1702.03 – "Assimilative Capacity" definition was inconsistent with the provisions in 1708.09 (see the "Assimilative Capacity and Antidegradation" discussion below).**
    - **Env-Wq 1702.25 - Struck "wastewater" from the mixing zone requirements. Inclusion of the term "wastewater" in the existing mixing zone definition could be misinterpreted to mean that mixing zones only apply to wastewater treatment facility discharges and not to other discharges such as those from construction projects or stormwater activities.**

- **Env-Wq 1708 - Assimilative Capacity and Antidegradation – Env-Wq 1708 describes the antidegradation provisions of the water quality standards. The existing rules already provided that both quality and quantity are protected as a general matter in the water quality standards and in the calculations of assimilative capacity. Changes appear in two places: in the "Assimilative Capacity" definition (Env-Wq 1702.03) and in the antidegradation analysis in Env-Wq 1708.**

- **Env-Wq 1703.01(d) – "Water use Classifications; Designated Uses" now includes volume, area, or depth as other potentially suitable measures for quantity.**

- **Env-Wq 1703.03(c) and Env-Wq 1703.04(a) General Water Quality and Class-Specific Criteria– The CWA has specific limitations on how water quality standards may be modified (variances, use attainability analysis, compliance schedules). Struck "…~~unless otherwise specifically allowed by a statute, rule, order, or permit~~." as EPA did not approve that modification.**

- **Env-Wq 1703.06 Bacteria – Revise the bacteria requirements for tidal waters to align with revision to RSA 485-A:2, V pursuant to Chapter 208 (SB 146-FN), Part IV of the Laws of 2021, effective October 9, 2021.**

- **Env-Wq 1703.07(b)(1) – Regarding dissolved oxygen, struck "~~, as specified in RSA 485-A:8, II,~~" to align with revisions to RSA 485-A:8, II pursuant to Chapter 211 (SB 127), of the Laws of 2017, effective September 8, 2017.**

- **Env-Wq 1703.15, Env-Wq 1703.16, and Env-Wq 1703.17 – Revisions to the radionuclide requirements to directly reference the existing drinking water maximum contaminant levels (MCLs) and apply just to the 20 miles upstream of public water system (PWS) surface waters as Env-Wq 1703.22(*l*). Revised criteria fit into Env-Wq 1703.15, and Env-Wq 1703.16. Criteria in the existing rules were from the radionuclide section of the "Public Health Service - Drinking Water Standards of 1962 (US Dept of Health, Education and Welfare)", the predecessor to the Safe Drinking Water Act.**

- **Env-Wq 1703.17 – Reused subsection Env-Wq 1703.17 for the addition of "cyanotoxins" limits to align with the NRWQC to protect swimming and other recreational uses of New Hampshire's surface waters.**

- **Env-Wq 1703.20 – Revised phrasing to align with current toxicological practices.**

- **Table 1703-01 contains numeric criteria for toxic substances. The changes are categorized as follows:**
  - **Aquatic life use criteria changes.**
    - **4 changes relate to the superscript notes and are discussed below with reference to the affected criteria.**
    - **8 changes are due to chemical name corrections.**
    - **2 changes relate to criteria updates. See Env-Wq 1703.22(o) and (s) below for selenium and aluminum.**
    - **Restructuring of Endosulfan and its isomers, alpha-Endosulfan and beta-Endosulfan, as the criteria apply to the sum of the isomers, not the components individually.**
  - **Human health criteria changes.**
    - **30 chemicals added to the table to show "Note *l*" due to MCLs that have no NRWQC counterpart. The additional MCLs include the 4-per- and polyfluoroalkyl substances (PFAS).**

- **7 chemicals have either spelling updates or the addition of "Note *l*", and one removal of "Note (*l*)", a compound that was already in the table.**
- **1 chemical removed which is an older synonym to Dinitro-o-cresol (4,6) (CASNO 534-52-1) and appears to have been mistakenly left here between 2002 and 2015 using the old criteria.**
- **66 chemicals have one or more lowered human health criteria. The 2016 rules update incorporated the instances where the NRWQC increased in 2015, and the Department delayed implementation of the stricter limits.**
- **3 chemicals have one or more criteria which have increased:**
  - **While the 2016 rule amendments intended to incorporate all of the instances where the NRWQC increased in 2015, the "fish consumption only" criteria for Chloromethyl ether (Bis) and cyanide were missed.**
  - **Arsenic – The arsenic criteria for both "fish consumption only" and "water and fish consumption only" have been updated and differentiated between fresh and marine waters. Surface water quality standards are required to be based solely on data, independent of other considerations, except that for human health criteria EPA allows states to make risk-based decisions for human health criteria. This update changes the stated risk factor. Additionally, the update increases to body weight (70 to 80 kg), drinking water intake (2.0 to 2.7 L/d) and fish consumption rate (6.5 to 95 g/d), and decreases in cancer potency factor (1.75 to 1.5 per mg/kg-d), bioconcentration factor (44 in all waters to 14 in Fresh Waters and 26 in Marine Waters), and inorganic fraction (100 to 10%).**

- **Env-Wq 1703.22(*l*) – Updated to explicitly state the duration of the MCL based human health criteria be in alignment with Env-Dw 700.**

- **Env-Wq 1703.22(l), Table 1703-2A contains MCL numeric criteria from Env-Dw 702-706 for toxic substances to protect human health within 20 miles upstream of public water supply surface water intakes. Of the criteria that would change, 32 MCLs are additions as they were missing from the table, and the 2 for which the NRWQC is now below the MCL would be removed.**

- **PFAS – The 4-PFAS that have New Hampshire MCLs will be added to Table 1703-1 and 1703-2A, applicable to locations within 20 miles upstream of public water supply surface water intakes.**

- **Env-Wq 1703.22(o) and Env-Wq 1703.34 – Selenium – The NRWQC was updated in 2016 from a single fixed water concentration to a hierarchal criterion where the preferred sampling is of fish eggs/ovaries, then fish whole body or muscles tissues, then water column samples. The exception to the hierarchy is when a waterbody is fishless or if a new discharge were to come online such that fish have not equilibrated to the instream condition. Selenium is not common in New England, and we see that in the historical water quality sampling. No National Pollutant Discharge Elimination System (NPDES) individual permits have selenium limits and the past NPDES remediation general permit effluent samples were all far below the new NRWQC water limit.**

- **Env-Wq 1703.22(s) – Aluminum – The existing aluminum criteria in Env-Wq 1700 is from the older NRWQC developed in 1988 as acid soluble aluminum. In 2018, EPA updated the aluminum NRWQC to a multiple linear regression (MLR) model based on sample level pH, hardness and dissolved organic carbon (DOC) giving a criteria output in total aluminum. The revisions to Env-Wq 1703.22(s) state that where there is pH,**

hardness and DOC data, the new MLR model will be used, and absent the MLR input data the 1988 acid soluble criteria will be used. In 2020, the Department began a 12-month study of the 40 river trend monitoring stations in hopes of developing regional default criteria based on the MLR model. In evaluating that data, it became clear that the variability in space and time was too great to create meaningful regional or state-wide defaults at this time. Broadly speaking, the lowest criteria occur in the most pristine waters or under the highest flows and the highest criteria in the most polluted areas and the lowest flows. There are several wastewater treatment facilities (WWTF) that currently have 3-year compliance schedules for meeting the existing aluminum criteria and are awaiting the adoption of the MLR, which may result in a less stringent effluent limit. There is also at least one WWTF that discharges to an otherwise pristine waterbody, and using the MLR may lead to more stringent effluent limits depending upon how the revised criteria are implemented in NPDES permits.

- **Env-Wq 1704 and Env-Wq 1705 –**
  - **Addition of Env-Wq 1704.03 to specify the procedures for the development of site-specific nutrient criteria.**
  - **Renamed and revised the permitting related standards section (Env-Wq 1705) to revamp the nutrient discharge permitting procedures. In Env-Wq 1705.02(d) the revised rules set up the processes by which permits shall be written based upon acceptable methods described in the section or site-specific criteria adopted pursuant to Env-Wq 1704.03. In terms of target flow conditions, Env-Wq 1705.02(d)(2) aligns the flow with the nutrient target. The ultimate approval of those permits lies in the EPA approval of a particular permit.**
  - **Env-Wq 1705.03 – This is a new section which will allow for restoration activities to occur on a temporary basis and to use all of the remaining assimilative capacity of a waterbody during that temporary period.**

- **Env-Wq 1706 – Revised the bacteria sampling procedures for discharge permits to align with revision to RSA 485-A:2, V pursuant to Chapter 208, Part IV of the Laws of 2021, effective October 9, 2021.**

- **Env-Wq 1708.12 – Clarified that water transfers may be conducted for reasons other than subsequent withdrawal. Absence of this clarification may limit the Department's ability to approve water transfers for ecological improvement.**

6. (b) Brief description of the groups affected:

Any person or entity responsible for activities that cause discharges to surface waters of the state may be affected by the proposed rules.

6. (c) Specific section or sections of state statute or federal statute or regulation which the rule is intended to implement:

Rule Section(s)	**State Statute or Federal Statute or Regulation Implemented**
Env-Wq 1701 (also see specific section listed below)	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq.*
Env-Wq 1701.03	RSA 485-A:13, I(a); 33 U.S.C. 1251 *et seq.*; 40 CFR § 122.47
Env-Wq 1701.04	RSA 485-A:13, I(a); 40 CFR § 131.14
Env-Wq 1702	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq.*
Env-Wq 1703	RSA 485-A:4, V; RSA 485-A:8, I, II, & III; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1704	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*

Rule Section(s)	State Statute or Federal Statute or Regulation Implemented
Env-Wq 1705	RSA 485-A:4, V; RSA 485-A:6, VII; RSA 485-A:8, VI; RSA 485-A:13, I(a); 33 U.S.C. 1251 et seq
Env-Wq 1706	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1707	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1708	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1709	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*

7. Contact person for copies and questions including requests to accommodate persons with disabilities:

Name: **Ken Edwardson**

Title: **Senior Scientist**

Mailing Address: **Department of Environmental Services**
29 Hazen Drive
P.O. Box 95
Concord, NH 03302-0095

Phone #: **(603) 271-8864**
Fax#: **N/A**
E-mail: **Kenneth.j.edwardson@des.nh.gov**

TTY/TDD Access: Relay NH 1-800-735-2964 or dial 711 (in NH)

8. Deadline for submission of materials in writing or, if practicable for the agency, in the electronic format specified: **Friday, November 22, 2024, at 4 PM**

☐ Fax ☒ E-mail ☐ Other format (specify):

9. Public hearing scheduled for:

Date and Time: **Friday, November 15, 2024, at 1 PM**

Physical Location: **Department of Environmental Services**
29 Hazen Drive, Room 208C
Concord, NH 03301

Electronic Access (if applicable):
Microsoft Teams
Click here to join meeting
Meeting ID: 244 503 744 531
Passcode: SURqDF

Dial in by phone
+1 603-931-4944,455095511# United States, Concord
Find a local number
Phone conference ID: 455 095 511#

If you have any questions or technical issues connecting to the hearing, contact Nisa Marks at nisa.m.marks@des.nh.gov or (603) 271-8811

10. Fiscal Impact Statement (Prepared by Legislative Budget Assistant):

FIS # **24:206** , dated **09/27/2024**

1. Comparison of the costs of the proposed rule(s) to the existing rule(s):
There is no difference in cost when comparing the proposed rules to the existing rules.

2. **Cite the Federal mandate. Identify the impact on state funds:**
The Clean Water Act, 33 U.S.C. 1251 et seq., and 40 CFR Part 131 require states to adopt water quality standards that meet the requirements of the Act. If the Department does not adopt surface water quality standards, the State risks losing approximately $3.2 million annually in federal funds.

3. **Cost and benefits of the proposed rule(s):**

   A. **To State general or State special funds:**
   None.

   B. **To State citizens and political subdivisions:**
   None.

   C. **To independently owned businesses:**
   None.

11. Statement Relative to Part I, Article 28-a of the N.H. Constitution:

Any costs associated with the proposed rules are primarily attributable to the statute(s). The proposed rules do not mandate or assign to any political subdivision a program or responsibility that is new, expanded, or modified from what existed before state action which would necessitate additional expenditures by a local subdivision, and so do not violate Part I, Article 28-a of the New Hampshire Constitution.

Exhibit 3a

Readopt with amendment Env-Wq 1700, eff. 12-1-16 (Document #12042), to read as follows:

CHAPTER Env-Wq 1700 SURFACE WATER QUALITY REGULATIONS

Statutory Authority: RSA 485-A:6, I, ~~&~~ XI-c***, XIV & XV*** and RSA 485-A:8, VI

PART Env-Wq 1701 PURPOSE; APPLICABILITY; COMPLIANCE SCHEDULES***; VARIANCES***

Env-Wq 1701.01 Purpose. The purpose of these rules is to establish water quality standards for the state's surface water uses as set forth in RSA 485-A:8, I, ***II-a***, II, III and V. These standards are intended to protect public health and welfare, enhance the quality of water and serve the purposes of the federal Clean Water Act, 33 U.S.C. 1251 et seq., and RSA 485-A. These standards provide for the protection and propagation of fish, shellfish, and wildlife, and provide for such uses as recreational activities in and on the surface waters, public water supplies, agricultural and industrial uses, and navigation in accord with RSA 485-A:8, I and II.

Env-Wq 1701.02 Applicability. These rules shall apply to:

(a) All surface waters ***except:*** ~~; and~~

(1) Artificial bodies of water for management of stormwater provided they are legally designed and constructed in accordance with all applicable permits and other legal requirements;

(2) Bodies of water that are exempt from permitting pursuant to RSA 482-A:3, IV(b); and

(3) Wastewater facilities designed and constructed to convey or treat sewage or waste, as defined in RSA 485-A:2, X and RSA 485-A:2, XVI respectively, and permitted in accordance with RSA 485-A:13.

(b) Any person who:

(1) Causes any point or nonpoint source discharge ~~of any pollutant~~ to surface waters;

(2) Undertakes hydrologic modifications, such as dam construction or water withdrawals; or

(3) Undertakes any other activity that affects the beneficial uses or the water quality of surface waters.

Env-Wq 1701.03 Compliance Schedules in NPDES Permits.

(a) A National Pollutant Discharge Elimination System (NPDES) permit issued or renewed for a discharge to New Hampshire surface waters, as defined herein, shall not specify a schedule leading to compliance with New Hampshire or federal surface water quality standards, or both, unless:

(1) The permittee cannot comply with the permit limits or other requirements immediately upon issuance of the permit; and

(2) The compliance schedule is provided to afford the permittee adequate time to comply with one or more permit requirements or limitations that are***:*** ~~based on~~

a. new~~,~~***;***

b. newly interpreted~~,~~***;*** or

c. revised water quality standards that became effective after issuance of the original discharge permit and after July 1, 1977.

(b) A compliance schedule established to meet any surface water quality standard that applies to the New Hampshire waters receiving the discharge shall:

(1) Include dates for specified tasks or activities leading to compliance;

(2) Include interim effluent limits; and

(3) Require compliance at the earliest practicable time.

Env-Wq 1701.04 Water Quality Standards Variances. Water quality standards variances as defined in 40 CFR 131.3(o) shall be issued in accordance with 40 CFR § 131.14 and RSA 541-A:3.

PART Env-Wq 1702 DEFINITIONS

Env-Wq 1702.01 "7Q10" means the lowest average flow that occurs for 7 consecutive days on an annual basis with a recurrence interval of once in 10 years on average, expressed in terms of volume per time period.

~~Env-Wq 1702.02 "Acute toxicity" means an adverse effect such as mortality or debilitation caused by an exposure of 96 hours or less to a toxic substance.~~

Env-Wq 1702.~~03~~***02*** "Antidegradation" means a provision of the water quality standards that maintains and protects existing water quality and uses.

Env-Wq 1702.~~04~~***03*** "Assimilative capacity" means the ***chemical, physical, biological, and radiological alterations that can occur*** ~~amount of a pollutant or combination of pollutants that can safely be released to a waterbody~~ without causing violations of applicable water quality criteria or ~~negatively impacting~~ ***impairing any existing or designated*** uses.

Env-Wq 1702.~~05~~***04*** "Benthic community" mean the community of plants and animals that live on, over, or in the substrate of the surface water.

Env-Wq 1702.~~06~~***05*** "Benthic deposit" means any sludge, sediment, or other organic or inorganic accumulations on the bottom of the surface water.

Env-Wq 1702.~~07~~***06*** "Best management practices" means those practices that are determined, after problem assessment and examination of all alternative practices and technological, economic, and institutional considerations, to be the most effective practicable means of preventing or reducing the amount of pollution***, including hydrologic modification,*** generated by point or nonpoint sources to a level compatible with water quality goals.

Env-Wq 1702.~~08~~***07*** "Biological integrity" means the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

Env-Wq 1702.~~09~~***08*** "Biota" means species of plants or animals occurring in surface waters.

Env-Wq 1702.~~10~~***09*** "Chronic toxicity" means an adverse effect, such as reduced reproductive success or growth or poor survival of sensitive life stages, that occurs as a result of prolonged exposure to a toxic substance.

Env-Wq 1702.~~11~~***10*** "Class A and B waters" means those surface waters that are legislatively classified as Class A or B waters pursuant to RSA 485-A:8, I, II and III.

Env-Wq 1702.~~12~~***11*** "Clean Water Act (CWA)" means the federal Clean Water Act, Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117, Pub. L. 100-4, 33 U.S.C. 1251 et seq.

Env-Wq 1702.~~13~~***12*** "Community" means one or more populations co-occurring in surface waters.

Env-Wq 1702.~~14~~***13*** "Criterion" means:

(a) A designated concentration of a pollutant;

(b) A narrative statement concerning that pollutant that when not exceeded, will protect an organism, a population, a community, or a prescribed water use; or

(c) A numeric value or narrative statement related to other characteristics of the surface waters, such as flow and biological community integrity.

Env-Wq 1702.~~15~~***14*** "Cultural eutrophication" means the human-induced addition of wastes that contain nutrients to surface waters, resulting in excessive plant growth or a decrease in dissolved oxygen, or both.

Env-Wq 1702.~~16~~***15*** "Department" means the department of environmental services.

Env-Wq 1702.~~17~~***16*** "Designated uses" means those uses specified in water quality standards for each waterbody or segment whether or not such uses are presently occurring. The term includes the following:

(a) Swimming and other recreation in and on the water, meaning the surface water is suitable for swimming, wading, boating of all types, fishing, surfing, and similar activities;

(b) Fish consumption, meaning the surface water can support a population of fish free from toxicants and pathogens that could pose a human health risk to consumers;

(c) Shellfish consumption, meaning the tidal surface water can support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers;

(d) Aquatic life integrity, meaning the surface water can support aquatic life, including a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region;

(e) Wildlife, meaning the surface water can provide habitat capable of supporting any life stage or activity of undomesticated fauna on a regular or periodic basis; and

(f) Potential drinking water supply, meaning the surface water could be suitable for human intake and meet state and federal drinking water requirements after adequate treatment.

Env-Wq 1702.~~18~~***17*** "Discharge" means:

(a) ***Additions, introductions, leakage, spillage, emissions, or flow*** ~~The addition, introduction, leaking, spilling, or emitting of a pollutant~~ to surface waters, either directly**,** or indirectly through the groundwater, whether done intentionally, unintentionally, negligently or otherwise; or

(b) The placing of a pollutant in a location where the pollutant is likely to enter surface waters.

Env-Wq 1702.~~19~~***18*** "Dissolved oxygen" means the oxygen dissolved as a gas in sewage, water or other liquid expressed in milligrams per liter (mg/~~l~~***L***), parts per million (ppm), or percent saturation.

Env-Wq 1702.~~20~~***19*** "Effluent limitation(s)" means any restriction(s) imposed by the department pursuant to RSA 485-A on quantities, discharge rates, characteristics, or concentrations of pollutants, or any combination thereof, that are allowed to be discharged to surface waters.

Env-Wq 1702.~~21~~***20*** "Epilimnion" means the upper, well-circulated warm layer of a thermally stratified lake, pond, impoundment or reservoir.

Env-Wq 1702.~~22~~***21*** "Existing uses" means those uses, other than assimilation or waste transport, that actually occurred in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards.

Env-Wq 1702.~~23~~***22*** "High quality waters" means any surface water whose water quality is better than required by any aquatic life and/or human health water quality criteria contained in these rules or other criteria assigned to the surface water, or whose qualities and characteristics make the surface water critical to the propagation or survival of important living natural resources.

Env-Wq 1702.~~24~~***23*** "Industrial waste" means "industrial waste" as defined in RSA 485-A:2, VI, as reprinted in Appendix C.

Env-Wq 1702.~~25~~***24*** "Maintain and protect" means to preserve the existing and designated uses of surface waters.

Env-Wq 1702.~~26~~***25*** "Mixing zone" means a defined area or volume of the surface water surrounding or adjacent to a ~~wastewater~~ discharge where the surface water, as a result of the discharge, might not meet all applicable water quality standards.

Env-Wq 1702.~~27~~***26*** "Most sensitive use" means the use that is most susceptible to degradation by a specific pollutant, combination of pollutants, or activity, such as drinking, swimming, boating, fish and aquatic life propagation, fish consumption by higher level consumers including man, or irrigation.

Env-Wq 1702.~~28~~***27*** "Naturally-occurring conditions" means conditions that exist in the absence of human influences.

Env-Wq 1702.~~29~~***28*** "Nephelometric turbidity unit (NTU)" means a standard used to measure the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through water, as measured by a nephelometer.

Env-Wq 1702.~~30~~***29*** "Noncontact cooling water" means water used for cooling that does not come into direct contact with any raw material, intermediate product, waste product or finished product and to which no pollutants, other than heat, have been added.

Env-Wq 1702.~~31~~***30*** "Nonpoint source" means any source other than a point source.

Env-Wq 1702.~~32~~***31*** "No observed effect concentration (NOEC)" means the highest measured continuous concentration, in percent, of an effluent at which no adverse effects are observed on the aquatic test organisms.

Env-Wq 1702.~~33~~***32*** "Nuisance species" means any species of flora or fauna living in or near the water whose noxious characteristics or presence in sufficient number or mass prevent or interfere with a designated use of those surface waters.

Env-Wq 1702.~~34~~***33*** "Other wastes" means "other wastes" as defined in RSA 485-A:2, VIII, as reprinted in Appendix C.

Env-Wq 1702.~~35~~***34*** "Outstanding resource water (ORW)" means surface waters of exceptional recreational or ecological significance.

Env-Wq 1702.~~36~~***35*** "pH" means a measure of the hydrogen ion concentration in a solution, expressed as the logarithm to the base 10, of the reciprocal of the hydrogen ion concentration in gram moles per liter.

Env-Wq 1702.~~37~~***36*** "Point source" means a discernible, confined, and discrete conveyance from which pollutants are or might be discharged, excluding return flows from irrigated agriculture or agricultural stormwater runoff. The term includes, but is not limited to, a pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft.

Env-Wq 1702.~~38~~***37*** "Pollutant" means "pollutant" as defined in 40 CFR 122.2, as reprinted in Appendix D.

Env-Wq 1702.~~39~~***38*** "Pollution" means the man-made or man-induced alteration of the chemical, physical, biological, or radiological integrity of water.

Env-Wq 1702.~~40~~***39*** "Population" means a group of individuals of one biological species co-occurring in time and space.

~~Env-Wq 1702.41 "Publicly owned treatment works (POTW)" means any device or system used in the treatment of municipal sewage and/or industrial wastewater that is owned by the state or a political subdivision of the state.~~

Env-Wq 1702.~~42~~***40*** "Radionuclide" means a radioactive atomic nucleus specified by its atomic number, atomic mass and energy state.

Env-Wq 1702.~~43~~***41*** "Sewage" means "sewage" as defined in RSA 485-A:2, X, as reprinted in Appendix C.

Env-Wq 1702.~~44~~***42*** "Surface waters" means "surface waters of the state" as defined in RSA 485-A:2, XIV, as reprinted in Appendix C, and waters of the United States as defined in 40 CFR 122.2.

Env-Wq 1702.~~45~~***43*** "Tainting substance" means any material that can impart objectionable taste, odor, or color to the flesh of fish or other edible aquatic organisms.

Env-Wq 1702.~~46~~***44*** "Tidal waters" means those portions of the Atlantic Ocean within the jurisdiction of the state, and all other surface waters subject to the rise and fall of the tide.

~~Env-Wq 1702.47 "Toxicity test" means a test to determine the toxicity of a chemical or an effluent that involves exposing test organisms in a laboratory setting to one or more concentrations of the chemical or dilutions of the effluent in accordance with standard laboratory procedures.~~

Env-Wq 1702.~~48~~***45*** "Toxic unit chronic (TU_c)" means the reciprocal of the effluent dilution that causes no unacceptable effect to the test organisms by the end of the chronic exposure period, which can be calculated by dividing 100 by the chronic NOEC value.

Env-Wq 1702.~~49~~***46*** "Waste" means "waste" as defined in RSA 485-A:2, XVI, as reprinted in Appendix C.

Env-Wq 1702.47 "Wastewater facilities" means "wastewater facilities" as defined in RSA 485-A:2, XIX, as reprinted in Appendix C, namely the structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes, and dispose of the effluent and sludge.

Env-Wq 1702.~~50~~***48*** "Water quality standards" means the combination of designated uses of surface waters, and the water quality criteria for such surface waters based upon such uses ***and antidegradation requirements***.

Env-Wq 1702.~~51~~***49*** "Wetland***s***" means "wetland***s***" as defined in RSA 482-A:2, X, as reprinted in Appendix C. Wetlands include, but are not limited to, swamps, marshes, bogs and similar areas as delineated in accordance with Env-Wt 100 et seq.

Env-Wq 1702.~~52~~***50*** "Zone of passage" means an area bordering a mixing zone that is free from pollutants and allows for unobstructed movement of aquatic organisms.

PART Env-Wq 1703 WATER QUALITY STANDARDS

Env-Wq 1703.01 Water Use Classifications; Designated Uses.

(a) All surface waters shall be classified as provided in RSA 485-A:8, based on the standards established therein for class A and class B waters. Each classification shall identify the most sensitive use it is intended to protect.

(b) All surface waters shall be restored to meet the water quality criteria for their designated classification including existing and designated uses, and to maintain the chemical, physical, and biological integrity of surface waters.

(c) All surface waters shall provide, wherever attainable, for the protection and propagation of fish, shellfish and wildlife, and for recreation in and on the surface waters.

(d) Unless ***alterations in water quantity, including but not limited to flow rate, volume, area or depth*** ~~high or low flows~~ are caused by naturally-occurring conditions, surface water quantity shall be maintained at levels that protect existing uses and designated uses.

Env-Wq 1703.02 Wetlands Criteria.

(a) Subject to (b), below, wetlands shall be subject to the criteria listed in this part.

(b) Wherever the naturally-occurring conditions of the wetlands are different from the criteria listed in these rules, the naturally-occurring conditions shall be the applicable water quality criteria.

Env-Wq 1703.03 General Water Quality Criteria.

(a) The presence of pollutants in the surface waters shall not justify further introduction of pollutants from point or nonpoint sources, alone or in any combination.

(b) Once classified, state surface waters shall retain their legislated classification until such time as they are reclassified in accordance with RSA 485-A:10, even if they fail to meet any or all of the general, class-specific, or toxic criteria contained in this part.

(c) ~~Unless otherwise specifically allowed by a statute, rule, order, or permit, t~~***T***he following physical, chemical, and biological criteria shall apply to all surface waters:

(1) All surface waters shall be free from substances in kind or quantity that:

a. Settle to form harmful benthic deposits;

b. Float as foam, debris, scum or other visible substances;

c. Produce odor, color, taste or turbidity that is not naturally occurring and would render the surface water unsuitable for its designated uses;

d. Result in the dominance of nuisance species; or

e. Interfere with recreational activities;

(2) The level of radioactive materials in all surface waters shall not be in concentrations or combinations that would:

a. Be harmful to human, animal or aquatic life or the most sensitive designated use;

b. Result in radionuclides in aquatic life exceeding the recommended limits for consumption by humans; or

c. Exceed limits specified in EPA's national drinking water regulations or subtitle Env-Dw, whichever are more stringent; and

(3) Tainting substances shall not be present in concentrations that individually or in combination are detectable by taste and odor tests performed on the edible portions of aquatic organisms.

Env-Wq 1703.04 Class-Specific Criteria.

(a) In addition to the general water quality criteria specified in Env-Wq 1703.03, the class-specific criteria specified in Env-Wq 1703.05 through Env-Wq 1703.33 shall apply to all surface waters ~~unless otherwise specifically allowed by a statute, rule, order, or permit~~.

(b) The surface waters in each classification shall satisfy all criteria applicable to the lower classification(s).
Env-Wq 1703.05 Combined Sewer Overflows.

(a) An applicant for a surface water discharge permit under RSA 485-A:13 who asserts that class B criteria cannot reasonably be met at all times in the receiving water due to combined sewer overflows shall conduct a use attainability analysis (UAA) in accordance with 40 CFR §131.10 and submit the UAA to the department.

(b) If, after public notice and comment, the department determines, based on the UAA and any public comments received, that the UAA supports the establishment of less stringent criteria, the department shall recommend a change in the classification of the waterbody to the legislature.

(c) Exceedances of class B criteria and uses due to combined sewer overflows shall be limited to those identified in the long-term combined sewer overflow plan developed in accordance with “EPA Combined Sewer Overflow (CSO) Control Policy”, EPA 830-B-94-001, dated April, 1994, available as noted in Appendix B, after full implementation of the control measures.

Env-Wq 1703.06 Bacteria.

(a) Uses and criteria associated with bacteria shall be as set forth in RSA 485-A:8, I, II, and V, as summarized in Appendix E.

(b) Subject to (~~c~~***d***), below, the bacteria criteria shall be applied at the end of a wastewater ~~treatment~~ facility’s discharge pipe.

(c) Tidal waters must meet the national shellfish sanitation program, guide for the control of molluscan shellfish within the shellfish beds as specified in RSA 485-A:8, V.

(~~c~~***d***) For any combined sewer overflow that discharges into non-tidal surface waters, a bacteria criteria of 1,000 Escherichia coli per 100 milliliters shall apply at the end of the combined sewer overflow’s discharge pipe.

Env-Wq 1703.07 Dissolved Oxygen.

(a) Class A waters shall have a dissolved oxygen content of at least 75% saturation, based on a daily average, and an instantaneous minimum of at least 6 mg/~~l~~***L*** at any place or time except as naturally occurs.

(b) Except as naturally occurs and subject to (c) ~~and~~ ***through*** (e), below, class B waters shall have a dissolved oxygen content of:

(1) At least 75% of saturation~~, as specified in RSA 485-A:8, II~~, based on a daily average; and

(2) An instantaneous minimum dissolved oxygen concentration of at least 5 mg/~~l~~***L***.

(c) In areas identified by the New Hampshire fish and game department (NHF&G) as cold water fish spawning areas of species whose early life stages are buried in the gravel on the bed of the surface water, the 7 day mean dissolved oxygen concentration shall be at least 9.5 mg/~~l~~***L*** and the instantaneous minimum dissolved oxygen concentration shall be at least 8 mg/~~l~~***L*** for the period from October 1 of one year to May 14 of the next year, provided that the time period shall be extended to June 30 for a specific discharge to a specific waterbody if modeling done in consultation with the NHF&G determines the extended period is necessary to protect spring spawners or late hatches of fall spawners, or both.

(d) Unless naturally occurring or subject to (a), above, surface waters within the top 25 percent of depth of thermally unstratified lakes, ponds, impoundments, and reservoirs or within the epilimnion shall contain a dissolved oxygen content of at least 75 percent saturation, based on a daily average and an instantaneous minimum dissolved oxygen content of at least 5 mg/~~l~~***L***. Unless naturally occurring, the dissolved oxygen content below those depths shall be consistent with that necessary to maintain and protect existing and designated uses.

(e) As specified in RSA 485-A:8, III, waters in a temporary partial use area established under RSA 485-A:8, II as a surface water that is receiving a combined sewer overflow discharge shall contain not less than 5 parts per million of dissolved oxygen for the duration of the discharge and up to 3 days following cessation of the discharge.

Env-Wq 1703.08 Benthic Deposits.

(a) Class A waters shall contain no benthic deposits, unless naturally occurring.

(a) Class B waters shall contain no benthic deposits that have a detrimental impact on the benthic community, unless naturally occurring.

Env-Wq 1703.09 Oil and Grease.

(a) Class A waters shall contain no oil or grease, unless naturally occurring.

(b) Class B waters shall contain no oil or grease in such concentrations that would impair any existing or designated uses.

Env-Wq 1703.10 Color.

(a) Class A waters shall contain no color, unless naturally occurring.

(b) Class B waters shall contain no color in such concentrations that would impair any existing or designated uses, unless naturally occurring.

Env-Wq 1703.11 Turbidity.

(a) Class A waters shall contain no turbidity, unless naturally occurring.

(b) Class B waters shall not exceed naturally occurring conditions by more than 10 NTUs.

(c) Turbidity in waters identified in RSA 485-A:8, III shall comply with the applicable long-term combined sewer overflow plan prepared in accordance with Env-Wq 1703.05(c).

(d) For purposes of state enforcement actions, if a discharge causes or contributes to an increase in turbidity of 10 NTUs or more above the turbidity of the receiving water upstream of the discharge or otherwise outside of the visible discharge, a violation of the turbidity standard shall be deemed to have occurred.

Env-Wq 1703.12 Slicks, Odors, and Surface Floating Solids.

(a) Class A waters shall contain no slicks, odors, or surface floating solids unless naturally occurring.

(b) Class B waters shall contain no slicks, odors, or surface floating solids that would impair any existing or designated use, unless naturally occurring.

(c) Slicks, odors, and surface floating solids in waters in temporary partial use areas shall comply with the applicable long-term combined sewer overflow plan prepared in accordance with Env-Wq 1703.05(c).

Env-Wq 1703.13 Temperature.

(a) There shall be no change in temperature in class A waters, unless naturally occurring.

(b) Temperature in class B waters shall be as specified in RSA 485-A:8, II and VIII.

Env-Wq 1703.14 Nutrients.

(a) Class A waters shall contain no phosphorus or nitrogen unless naturally occurring.

(b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.

(c) Existing discharges containing phosphorus or nitrogen, or both, which encourage cultural eutrophication shall be treated to remove the nutrient(s) to ensure attainment and maintenance of water quality standards.

(d) There shall be no new or increased discharge of phosphorus into lakes or ponds.

(e) There shall be no new or increased discharge containing phosphorus or nitrogen to tributaries of lakes or ponds that would contribute to cultural eutrophication or growth of weeds or algae in such lakes and ponds.

Env-Wq 1703.15 ~~Gross Beta Radioactivity~~***Radionuclide Contaminants***. ~~Class A and B waters shall not contain gross beta radioactivity in excess of 1,000 picocuries per liter.~~***Waters within 20 miles upstream of any active surface water intake for a public water system as defined in RSA 485:1-a, XV shall not exceed the drinking water maximum contaminant level (MCL) for radionuclides contaminants, as specified in Env-Dw 703.01.***

Env-Wq 1703.16 ~~Strontium-90~~ ***Beta Particle and Photon Radioactivity from Man-Made Sources***. ~~Class A and B waters shall not contain strontium-90 in excess of 10 picocuries per liter.~~ ***Waters within 20 miles upstream of any active surface water intake for a public water system as defined in RSA 485:1-a, XV shall not exceed the annual dose equivalent for beta particle and photon radioactivity, as specified in Env-Dw 703.03.***

Env-Wq 1703.17 ~~Radium-226~~ ***Cyanotoxins***. ~~Class A and B waters shall contain no radium-226 in excess of 3 picocuries per liter.~~

(a) The recreational human health criteria to protect swimming and other recreation in and on the water from excessive microcystin and cylindrospermopsin toxins shall be as follows:

(1) Microcystin shall not exceed 8 ug/L in three or more 10-day periods during a 12-month rolling period; or

(2) Cylindrospermopsin shall not exceed 15 ug/L in three or more 10-day periods during a 12-month rolling period.

(b) The values in (a)(1) and (2) are chronic concentrations not to be exceeded more than once in five years.

(c) Other cyanotoxins will be evaluated based on known health risks and potential for cyanotoxin production and accumulation.

Env-Wq 1703.18 pH.

(a) The pH of class A waters shall be as naturally occurs.

(b) As specified in RSA 485-A:8, II, the pH of class B waters shall be 6.5 to 8.0 unless due to natural causes.

(c) As specified in RSA 485-A:8, III, the pH of waters in temporary partial use areas shall be 6.0 to 9.0 unless due to natural causes.

Env-Wq 1703.19 Biological and Aquatic Community Integrity.

(a) All surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

(b) Differences from naturally-occurring conditions shall be limited to non-detrimental differences in community structure and function.

Env-Wq 1703.20 ***Target*** Risk ~~Factors~~ for Human Health Criteria.

(a) ***Except as provided in (d) below***, t~~T~~he department shall use a target risk ~~factor~~ of one in 1,000,000 when determining human health criteria for all new discharges.

(b) ***Except as provided in (d) below, t***~~T~~he department shall use a one in 1,000,000 ***target*** risk ~~factor~~ when determining human health criteria for any modification to a permit for an existing discharge unless the applicant for a water discharge permit can demonstrate that the criteria obtained using the one in 1,000,000 ***target*** risk ~~factor~~ cannot be achieved because it is either technologically impossible or economically unfeasible.

(c) When establishing an alternative ***target*** risk ~~factor~~ under (b), above, the department shall not allow ~~a~~***more*** risk ***than allowed by*** ~~factor~~ ~~greater than~~ one in 100,000.

(d) The department shall use a target risk of one in 100,000 when determining human health criteria for all existing and new discharges that contain arsenic.

Env-Wq 1703.21 Water Quality Criteria for Toxic Substances.

(a) Unless naturally occurring or allowed under Env-Wq 1707, all surface waters shall be free from toxic substances or chemical constituents in concentrations or combinations that:

(1) Injure or are inimical to plants, animals, humans or aquatic life; or

(2) Persist in the environment or accumulate in aquatic organisms to levels that result in harmful concentrations in:

a. Edible portions of fish, shellfish, other aquatic life, or

b. Wildlife that might consume aquatic life.

(b) Unless allowed under Env-Wq 1707 or naturally occurring, concentrations of toxic substances in all surface waters shall not exceed the recommended safe exposure levels of the most sensitive surface water use shown in Table 1703-1, subject to the notes in Env-Wq 1703.22, as follows:

Table 1703-01: Water Quality Criteria for Toxic Substances

CAS Number	**Chemical Name**	**Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~*L*)**[v]				**Protection of Human Health Units per Liter**	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
83-32-9	Acenaphthene	1,700	520	970	710	20 µg [j]	20 µg [j]
107-02-8	Acrolein	3	3	55	--	~~6~~ ***3*** µg	400 µg

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
107-13-1	Acrylonitrile	7,550	2,600	--	--	0.061 µg [c]	7 µg [c]
15972-60-8	***Alachlor (Lasso)***	--	--	--	--	***Note l***	--
116-06-3	***Aldicarb (Temik)***	--	--	--	--	***Note l***	--
1646-87-3	***Aldicarb sulfoxide***	--	--	--	--	***Note l***	--
1646-88-4	***Aldicarb sulfone(aldoxycarb)***	--	--	--	--	***Note l***	--
309-00-2	Aldrin	3.0 [k]	--	1.3 [k]	--	~~0.049~~ ***0.0007*** ng [c]	~~0.05~~ ***0.0007*** ng [c]
N/A	Alkalinity	--	20,000 [u]	--	--	--	--
7429-90-5	Aluminum	750 [s]	87 [s]	--	--	--	--
7664-41-7	Ammonia [a]	Note a	Note a	Note a	Note a	--	--
62-53-3	Aniline	28	14	77	37	--	--
120-12-7	Anthracene	(see Polynuclear Aromatic Hydrocarbons)				~~8,300~~ ***300*** µg	~~40,000~~ ***400*** µg
7440-36-0	Antimony	9,000	1,600	--	--	5.6 µg	640 µg
7440-38-2	Arsenic	340 [d, i]	150 [d, i]	69 [d, i]	36 [d, i]	~~18 ng~~ ***0.19/0.18 ug*** [b, c, w]	~~140 ng~~ ***4.1/2.2 ug*** [b, c, w]
1332-21-4	Asbestos	--	--	--	--	7,000,000 fibres [c]	--
1912-24-9	***Atrazine (Atranex, Crisazine)***	--	--	--	--	***Note l***	--
7440-39-3	Barium	--	--	--	--	1.0 mg	--
71-43-2	Benzene	5,300	--	5,100	700	~~2.2~~ ***2.1*** µg [c]	58 µg [c]
92-87-5	Benzidine	2,500	--	--	--	0.14 ng [c]	11 ng [c]
56-55-3	Benzo(a) Anthracene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.0012*** µg [c]	~~0.018~~ ***0.0013*** µg [c]

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50-32-8	Benzo(a) Pyrene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.00012*** µg [c]	~~0.018~~ ***0.00013*** µg [c]
205-99-2	Benzo(b) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.0012*** µg [c]	~~0.018~~ ***0.0013*** µg [c]
192-97-2	Benzo(e) Pyrene	(see Polynuclear Aromatic Hydrocarbons)				--	--
191-24-2	Benzo(g,h,i) Perylene	(see Polynuclear Aromatic Hydrocarbons)				--	--
205-82-3	Benzo(j) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				--	--
207-08-9	Benzo(k) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				0.012 µg [c]	~~0.018~~ ***0.013*** µg [c]
7440-41-7	Beryllium	130	5.3	--	--	Note ***l***	--
~~N/A~~ ***608-73-1***	BHC (Hexachloro-cyclohexane)	100 [e***k***]	--	0.34 [e***k***]	--	(see individual compounds)	
319-84-6	alpha-BHC	(see BHC ***(Hexachloro-cyclohexane)***)				~~2.6~~ ***0.36*** ng [c]	~~4.9~~ ***0.39*** ng [c]
319-85-7	beta-BHC	(see BHC ***(Hexachloro-cyclohexane)***)				~~9.1~~ ***8*** ng [c]	~~17~~ ***14*** ng [c]
319-86-8	delta-BHC	(see BHC ***(Hexachloro-cyclohexane)***)				0.0123 µg	0.0414 µg
58-89-9	gamma-BHC (Lindane)	0.95	0.08 [***k***]	0.16 [k]	--	4.2 µg [*l*]	4.4 µg
608-73-1	technical-BHC	(see Hexachlorocyclo-hexane-(Technical))				(see Hexachlorocyclo-hexane-(Technical))	
111-91-1	Bis (2-Chloroethoxy) methane	(see Chloroalkyl ethers)				--	--
111-44-4	Bis (2-Chloroethyl) Ether	(see Chloroalkyl ethers)				0.03 µg [c]	2.2 µg [c]
108-60-1	Bis (2-Chloroiso-propyl) ether	(see Chloroalkyl ethers)				~~1,400~~ ***200*** µg	~~65,000~~ ***4,000*** µg
117-81-7	Bis (2-Ethylhexy***l***)Phthalate	(see Phthalate esters)				~~1.2~~ ***0.32*** µg [c]	~~2.2~~ ***0.37*** µg [c]
75-25-2	Bromoform	(see Halomethanes)				7 µg [c]	~~140~~ ***120*** µg [c]
101-55-3	4-Bromophenyl phenyl ether	(see Haloethers)				--	--
85-68-7	Butyl benzyl phthalate	(see Phthalate esters)				~~1,500~~ ***0.1*** µg[***c***]	~~1,900~~ ***0.1*** µg[***c***]

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7440-43-9	Cadmium [i]	0.39 [f, d]	0.21 [f, d]	33 [d]	7.9 [d]	Note *1*	--
63-25-2	Carbaryl	2.1	2.1	1.6	--	--	--
1563-66-2	***Carbofuran (Furadon, 4F)***	--	--	--	--	***Note l***	--
56-23-5	Carbon Tetrachloride	35,200	--	50,000	--	0.4 µg [c]	5 µg [c]
57-74-9	Chlordane	2.4 [k]	0.0043 [k]	0.09 [k]	0.004 [k]	~~0.8~~ ***0.31*** ng [c]	~~0.81~~ ***0.32*** ng [c]
N/A	Chlorinated benzenes	250 [e]	50 [e]	160 [e]	129 [e]	(see individual compounds)	
108-90-7	Chlorobenzene	(See Chlorinated benzenes)				20 µg [j]	20 µg [j]
16887-00-6	Chlorides	860,000	230,000	--	--	--	--
70776-03-3	Chlorinated nap***h***thalenes	1,600[e]	--	7.5[e]	--	(see individual compounds)	
7782-50-5	Chlorine	19	11	13	7.5	Note *1*	--
10049-04-4	***Chlorine Dioxide, as ClO$_2$***	--	--	--	--	***Note l***	--
N/A	Chloroalkyl ethers	238,000[e]	--	--	--	(see individual compounds)	
10599-90-3	***Chloramines, as Cl$_2$***	--	--	--	--	***Note l***	--
111-44-4	Chloroethyl ether (Bis-2)	***(***see Bis (2-Chloroethyl) Ether***)***				***(***see Bis (2-Chloroethyl) Ether***)***	
110-75-8	Chloroethyl vinyl ether-2	(see Chloroalkyl ethers)				--	--
124-48-1	Chlorodibromomethane	(see Halomethanes)				0.8 µg [c]	21 µg [c]
111-91-1	Chloroethoxy methane (Bis-2)	(see Bis (2-Chloroethoxy) methane)				(see Bis (2-Chloroethoxy) methane)	
67-66-3	Chloroform	28,900	1,240	(see Halomethanes)		60 µg [c]	2,000 µg [c]
108-60-1	Chloroisopropyl ether (Bis-2)	(see Bis (2-Chloroisopropyl) ether)				(see Bis (2-Chloroisopropyl) ether)	
59-50-7	p-Chloro-m-cresol	(see 3-Methyl-4-chlorophenol)				(see 3-Methyl-4-chlorophenol)	
542-88-1	Chloromethyl ether (Bis)	(see Chloroalkyl ethers)				0.15 ng [c]	~~0.17~~ ***17*** ng [c]

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91-58-7	Chloronaphthalene 2	(see Chlorinated naphthalenes)				~~1,000~~ ***800*** µg	~~1,600~~ ***1,000*** µg
95-57-8	Chlorophenol 2	4,380	2,000	--	--	0.1 µg [j]	0.1 µg [j]
108-43-0	Chlorophenol 3	--	--	--	--	0.1 µg [j]	0.1 µg [j]
106-48-9	Chlorophenol 4	--	--	29,700	--	0.1 µg [j]	0.1 µg [j]
93-72-1	Chlorophenoxy herbicides (2,4,5-TP)	--	--	--	--	100 µg [l]	--***400 ug***
94-75-7	Chlorophenoxy herbicides (2,4-D)	--	--	--	--	1,300 µg [l]	-- ***12,000 ug***
7005-72-3	Chlorophenyl phenyl ether 4	(see Haloethers)				--	--
2921-88-2	Chlorpyrifos	0.083	0.041	0.011	0.0056	--	--
59-50-7	Chloro-4 Methyl-3 Phenol	(see 3-Methyl-4-chlorophenol)				(see 3-Methyl-4-chlorophenol)	
18540-29-9	Chromium+6	16 [d, i]	11 [d, i]	1,100 [d, i]	50 [d, i]	~~note l~~ **Note *l***	--
16065-83-1	Chromium+3	152 [f, d, i]	19.8 [f, d ,i]	10300	--	~~note l~~ **Note *l***	--
218-01-9	Chrysene	(see Polynuclear Aromatic Hydrocarbons)				0.12 µg [c]	0.13 µg [c]
7440-50-8	Copper [i]	2.9 [f, d]	2.3 [f, d]	4.8 [d]	3.1 [d]	1,000 µg [j]	1,000 µg [j]
57-12-5	Cyanide	22[m]	5.2[m]	1.0[m]	1.0[m]	~~140~~ ***4*** µg [q]	~~140~~ ***400*** µg [q]
72-55-9	DDE(4,4')	1050	--	14	--	~~0.22~~ ***0.018*** ng [c]	~~0.22~~ ***0.018*** ng [c]
72-54-8	DDD(4,4')	0.6	--	3.6	--	~~0.31~~ ***0.12*** ng [c]	~~0.31~~ ***0.12*** ng [c]
50-29-3	DDT(4,4')	1.1[k, t]	0.001[k, t]	0.13[k, t]	0.001[k, t]	~~0.22~~ ***0.03*** ng [c]	~~0.22~~ ***0.03*** ng [c]
75-99-0	***Dalapon***	--	--	--	--	***Note l***	--
8065-48-3	Demeton	--	0.1	--	0.1	--	--
333-41-5	Diazinon	0.17	0.17	0.82	0.82	--	--
53-70-3	Dibenzo(a,h)Anthracene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038 µg~~ ***0.12 ng*** [c]	~~0.018 µg~~ ***0.13 ng***[c]

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96-12-8	***Dibromochloropropane (DBCP)***	--	--	--	--	***Note l***	--
84-74-2	Dibutyl Phthalate	(see Di-n-butyl Phthalate)				(see Di-n-butyl Phthalate)	
N/A	Dichlorobenzenes	1,120[e]	763[e]	1,970[e]	--	(see individual compounds)	
95-50-1	Dichlorobenzene(1,2)	(see Dichlorobenzenes)				1,000 µg [l]	3,000 µg
541-73-1	Dichlorobenzene(1,3)	(see Dichlorobenzenes)				~~320~~ ***7*** µg	~~960~~ ***10*** µg
106-46-7	Dichlorobenzene(1,4)	(see Dichlorobenzenes)				300 µg [l]	900 µg
91-94-1	Dichlorobenzidine(3,3')	--	--	--	--	0.049 µg [c]	0.15 µg [c]
75-27-4	Dichlorobromomethane	(see Halomethanes)				0.95 µg [c]	27 µg [c]
75-71-8	Dichlorodifluoromethane	(see Halomethanes)				6.9 mg [c]	570 mg [c]
107-06-2	Dichloroethane(1,2)	118,000	20,000	113,000	--	9.9 µg [c, ***l***]	650 µg [c]
25323-30-2	Dichloroethylenes	11,600 [e]	--	224,000 [e]	--	(see individual compounds)	
75-35-4	Dichloroethylene(1,1)	(see Dichloroethylenes)				~~330~~ ***300*** µg [l]	20,000 µg
156-59-2	***Dichloroethylene (1,2-cis)***	-- -- -- --***(see Dichloroethylenes)***				***Note l***	--
156-60-5	Dichloroethylene (1,2-Trans)	(see Dichloroethylenes)				~~140~~ ***100*** µg [l]	~~10,000~~ ***4,000*** µg
576-24-9	Dichlorophenol(2,3)	--	--	--	--	0.04 µg [j]	0.04 µg [j]
120-83-2	Dichlorophenol(2,4)	2020	365	--	--	0.3 µg [j]	0.3 µg [j]
583-78-8	Dichlorophenol(2,5)	--	--	--	--	0.5 µg [j]	0.5 µg [j]
87-65-0	Dichlorophenol(2,6)	--	--	--	--	0.2 µg [j]	0.2 µg [j]
95-77-2	Dichlorophenol(3,4)	--	--	--	--	0.3 µg [j]	0.3 µg [j]
26638-19-7	Dichloropropanes	23,000 [e]	5,700 [e]	10,300 [e]	3,040 [e]	(see individual compounds)	
78-87-5	Dichloropropane(1,2)	(see Dichloropropanes)				0.9 µg [c]	31 µg [c]

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26952-23-8	Dichloropropenes	6,060 [e]	244 [e]	790 [e]	--	(see individual compounds)	
542-75-6	Dichloropropene(1,3)	(see Dichloropropenes)				~~0.34~~ ***0.27*** µg [c]	~~21~~ ***12*** µg [c]
60-57-1	Dieldrin	0.24	0.056 ***[k]***	0.71 [k]	0.0019 [k]	~~0.052~~ ***0.0012*** ng [c]	~~0.054~~ ***0.0012*** ng [c]
84-66-2	Diethyl Phthalate	--	--	--	--	~~17 mg~~ ***600 ug***	~~44 mg~~ ***600 ug***
105-67-9	Dimethyl Phenol(2,4)	1,300	530	270	110	~~380~~ ***100*** µg	400 µg [j]
131-11-3	Dimethyl Phthalate	(see Phthalate esters)				~~270 mg~~ ***2,000 ug***	~~1.1 g~~ ***2,000 ug***
84-74-2	Di-n-butyl Phthalate	(see Phthalate esters)				~~2 mg~~ ***20 ug***	~~4.5 mg~~ ***30 ug***
N/A	Dinitrotoluenes	330 [e]	230 [e]	590 [e]	370 [e]	(see individual compounds)	
121-14-2	Dinitrotoluene(2,4)	(see Dinitrotoluenes)				~~0.11~~ ***0.049*** µg [c]	~~3.4~~ ***1.7*** µg [c]
606-20-2	Dinitrotoluene(2,6)	(see Dinitrotoluenes)				--	--
~~N/A~~	~~Dinitro-o-cresol (2,4)~~	~~(see Nitrophenols)~~				~~13.4 µg~~	~~765 µg~~
534-52-1	Dinitro-o-cresol (4,6)	(see 2 Methyl-4,6-Dinitrophenol)				(see 2 Methyl-4,6-Dinitrophenol)	
25550-58-7	Dinitrophenols	(see Nitrophenols)				~~69~~ ***10*** µg	~~5,300~~ ***1,000*** µg
51-28-5	Dinitrophenol(2,4)	(see Nitrophenols)				~~69~~ ***10*** µg	~~5,300~~ ***300*** µg
117-84-0	Di-n-octyl phthalate	(see Phthalate esters)				--	--
88-85-7	***Dinoseb***	--	--	--	--	***Note l***	--
85-00-7	***Diquat***	--	--	--	--	***Note l***	--
1746-01-6	2,3,7,8-TCDD (Dioxin)	--	--	--	--	0.000005 ng [c]	0.0000051 ng [c]
122-66-7	Diphenylhydrazine(1,2)	270	--	--	--	~~0.036~~ ***0.03*** µg [c]	0.2 µg [c]
103-23-1	***Di(2-ethylhexyl)adipate***	--	--	--	--	***Note l***	--
117-81-7	Di-2-ethylhexyl phthalate	(see Bis (2-Ethylhexy)Phthalate***)***				(see Bis (2-Ethylhexy)Phthalate***)***	

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115-29-7	***Endosulfan***	***0.22*** [k, r]	***0.056*** [k, r]	***0.034*** [k, r]	***0.0087*** [k, r]	***(see individual compounds)***	
~~959-98-8~~	~~alpha-Endosulfan~~	~~0.22 [k, r]~~	~~0.056 [k, r]~~	~~0.034 [k, r]~~	~~0.0087 [k, r]~~	~~62 µg~~	~~89 µg~~
959-98-8	***alpha-Endosulfan***	***(see Endosulfan)***				***20 ug***	***30 ug***
~~33213-65-9~~	~~beta-Endosulfan~~	~~0.22 [k, r]~~	~~0.056 [k, r]~~	~~0.034 [k, r]~~	~~0.0087 [k, r]~~	~~62 µg~~	~~89 µg~~
33213-65-9	***beta-Endosulfan***	***(see Endosulfan)***				***20 ug***	***40 ug***
1031-07-8	Endosulfan Sulfate	--	--	--	--	~~62~~ ***20*** µg	~~89~~ ***40*** µg
145-73-3	***Endothall***	--	--	--	--	***Note l***	--
72-20-8	Endrin	0.086	0.036	0.037 [k]	0.0023 [k]	~~0.059~~ ***0.03*** µg	~~0.06~~ ***0.03*** µg
7421-93-4	Endrin Aldehyde	--	--	--	--	1 µg	1 µg
100-41-4	Ethylbenzene	32000	--	430	--	~~530~~ ***68*** µg	~~2,100~~ ***130*** µg
106-93-4	***Ethylene Dibromide (EDB)***	--	--	--	--	***Note l***	--
206-44-0	Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				~~130~~ ***20*** µg	~~140~~ ***20*** µg
86-73-7	Fluorene	(see Polynuclear Aromatic Hydrocarbons)				~~1,100~~ ***50*** µg	~~5,300~~ ***70*** µg
16984-48-8	***Flouride***	--	--	--	--	***Note l***	--
1071-83-6	***Glyphosate***	--	--	--	--	***Note l***	--
86-50-0	Guthion	--	0.01	--	0.01	--	--
N/A	Haloethers	360 [e]	122 [e]	--	--	(see individual compounds)	
N/A	Halomethanes	11,000 [e]	--	12,000 [e]	6,400 [e]	(see individual compounds)	
76-44-8	Heptachlor	0.52 [k]	0.0038 [k]	0.053 [k]	0.0036 [k]	~~0.079~~ ***0.0059*** ng [c]	~~0.079~~ ***0.0059*** ng [c]
1024-57-3	Heptachlor Epoxide	0.52 [k]	0.0038 [k]	0.053 [k]	0.0036 [k]	~~0.039~~ ***0.032*** ng [c]	~~0.039~~ ***0.032*** ng [c]

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67-72-1	Hexachloroethane	980	540	940	--	~~1.4~~ ***0.1*** µg [c]	~~3.3~~ ***0.1*** µg [c]
118-74-1	Hexachlorobenzene	(see Chlorinated benzenes)				~~0.28~~ ***0.079*** ng [c]	~~0.29~~ ***0.079*** ng [c]
87-68-3	Hexachlorobutadiene	90	9.3	32	--	~~0.44~~ ***0.01*** µg [c]	~~18~~ ***0.01*** µg [c]
608-73-1	Hexachlorocyclo-hexane-(Technical)	(see BHC ***(Hexachloro-cyclohexane)***)				~~0.0123~~ ***0.0066*** µg	~~0.0414~~ ***0.01*** µg
77-47-4	Hexachlorocyclopentadiene	7	5.2	7	--	1.0 [j]	1.0 [j]
193-39-5	I***n***deno(1,2,3-cd)Pyrene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.0012*** µg [c]	~~0.018~~ ***0.0013*** µg [c]
7439-89-6	Iron	--	1000	--	--	0.3 mg [j]	--
78-59-1	Isophorone	117,000	--	12,900	--	~~35~~ ***34*** µg [c]	1,800 µg [c]
7439-92-1	Lead [i]	10.5 [f, d]	0.41 [f, d]	210 [d]	8.1 [d]	--	--
121-75-5	Malathion	--	0.1	--	0.1	--	--
7439-96-5	Manganese	--	--	--	--	50 µg [j]	100 µg
7439-97-6	Mercury	1.4 [d, i]	0.77 [d, i]	1.8 [d, i]	0.94 [d, i]	0.05 µg	0.051 µg
72-43-5	Methoxychlor	--	0.03	--	0.03	~~100~~ ***0.02*** µg	-- ***0.02 µg***
74-83-9	Methyl Bromide	(see Halomethanes)				100 µg	10,000 µg
74-87-3	Methyl Chloride	(see Halomethanes)				--	--
1634-04-4	***Methyl tertiary-butyl ether (MtBE)***	--	--	--	--	***Note l***	--
75-09-2	Methylene Chloride	(see Halomethanes)				20 µg [c]	1,000 µg [c]
22967-92-6	Methylmercury	(see Mercury ***)***				--	0.3 mg/kg [g]
534-52-1	2 Methyl-4,6-Dinitrophenol	(see Nitrophenols)				~~13~~ ***2*** µg	~~280~~ ***30*** µg
1570-64-5	2-Methyl-4-chlorophenol	--	--	--	--	1,800 µg [j]	1,800 µg [j]

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59-50-7	3-Methyl-4-chlorophenol	30	--	--	--	~~3,000~~ ***500*** µg [j]	~~3,000~~ ***2,000*** µg [j]
615-74-7	3-Methyl-6-chlorophenol	--	--	--	--	20 µg [j]	20 µg [j]
2385-85-5	Mirex	--	0.001	--	0.001	--	--
91-20-3	Naphthalene	2,300	620	2,350	--	--	--
7440-02-0	Nickel [i]	120.0 [f, d]	13.3 [f, d]	74 [d]	8.2 [d]	610 µg	4,600 µg
14797-65-0	***Nitrite-N***	--	--	--	--	***Note l***	--
14797-55-8	Nitrate~~s~~***-N***	--	--	--	--	10 mg[l]	--
14797-55-8 + 14797-65-0	***Nitrate-N + Nitrite-N***	--	--	--	--	***Note l***	--
98-95-3	Nitrobenzene	27000	--	6680	--	~~17~~ ***10*** µg	30 µg[j]
25154-55-6	Nitrophenols	230 [e]	150 [e]	4,850 [e]	--	(see individual compounds)	
88-75-5	Nitrophenol 2	(see Nitrophenols)				--	--
100-02-7	Nitrophenol 4	(see Nitrophenols)				--	--
N/A	Nitrosamines	5,850 [e]	--	3,300,000 [e]	--	0.8 ng	1.24 µg
924-16-3	Nitrosodibutylamine N	(see Nitrosamines)				6.3 ng [c]	220 ng [c]
55-18-5	Nitrosodiethylamine N	(see Nitrosamines)				0.8 ng [c]	1,240 ng [c]
62-75-9	Nitrosodimethylamine N	(see Nitrosamines)				0.69 ng [c]	3 µg [c]
621-64-7	Nitrosodi-n-propylamine N	(see Nitrosamines)				0.005 µg [c]	0.51 µg [c]
86-30-6	Nitrosodiphenylamine N	(see Nitrosamines)				3.3 µg [c]	6 µg [c]
930-55-2	Nitrosopyrrolidine N	(see Nitrosamines)				16 ng [c]	34,000 ng [c]
84852-15-3	Nonylphenol	28	6.6	7	1.7	--	--
56-38-2	Parathion	0.065	0.013	--	--	--	--
1336-36-3	PCB	2.0 [e, n]	0.014 [e, n]	10.0 [e, n]	0.03 [e, n]	0.064 ng [c, n]	0.064 ng [c, n]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
N/A	PCB-1242	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1254	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1221	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1248	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1260	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1016	(see PCB)				(see PCB)	(see PCB)
76-01-7	Pentachloroethane	7240	1100	390	281	--	--
608-93-5	Pentachlorobenzene	(see Chlorinated benzenes)				~~1.4~~ ***0.1*** µg	~~1.5~~ ***0.1*** µg
87-86-5	Pentachlorophenol	5.28 [h]	4.05 [h]	13	7.9	~~0.27~~ ***0.03*** µg [c]	~~3~~ ***0.04*** µg [c]
85-01-8	Phenanthrene	(see Polynuclear Aromatic Hydrocarbons)				--	--
108-95-2	Phenol	10,200	2,560	5,800	--	300 µg [j]	300 µg [j]
N/A	Phthalate Esters	940 [e]	3 [e]	2,944 [e]	3.4 [e]	--	--
1336-36-3	Polychlorinated Biphenyls	(see PCBs)				(see PCB)	(see PCB)
N/A	Polynuclear Aromatic Hydrocarbons	--	--	300 [e]	--	(see individual compounds)	
23135-22-0	***Oxamyl (Vydate)***	--	--	--	--	***Note l***	--
355-46-4	***Perfluorohexane sulfonic acid (PFHxS)***	--	--	--	--	***Note l***	--
375-95-1	***Perfluorononanoic acid (PFNA)***	--	--	--	--	***Note l***	--
1763-23-1	***Perfluorooctane sulfonic acid (PFOS)***	--	--	--	--	***Note l***	--
335-67-1	***Perfluorooctanoic Acid (PFOA)***	--	--	--	--	***Note l***	--
1918-02-1	***Picloram***	--	--	--	--	***Note l***	--
129-00-0	Pyrene	(see Polynuclear Aromatic Hydrocarbons)				~~830~~ ***20*** µg	~~4,000~~ ***30*** µg
7782-49-2	Selenium	-- ***Note o***	~~5~~ ***Note o***	290[d,i]	71[d,i]	170 µg [l]	4,200 µg

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
7440-22-4	Silver	0.20[d,f, i, ***k***]	--	1.9[d,i,k]	--	105 µg [p]	65 mg [p]
122-34-9	***Simazine***	--	--	--	--	***Note l***	--
100-42-5	***Styrene***	--	--	--	--	***Note l***	--
7783-06-4	Sulfide-Hydrogen Sulfide	--	2	--	2	--	--
95-94-3	Tetrachlorobenzene 1,2,4,5	(see Chlorinated benzenes)				~~0.97~~ ***0.03*** µg	~~1.1~~ ***0.03*** µg
79-34-5	Tetrachloroethane 1,1,2,2	(see Tetrachlor-oethanes)	2400	9020	--	0.2 µg [c]	~~4~~ ***3*** µg [c]
25322-20-7	Tetrachloroethanes	9,320 [e]	--	--	--	(see individual compounds)	
127-18-4	Tetrachloroethylene	5,280	840	10,200	450	10 µg [c]	29 µg [c]
935-95-5	Tetrachlorophenol 2,3,5,6	--	--	440	--	--	--
58-90-2	Tetrachlorophenol 2,3,4,6	--	--	--	--	1.0 µg [j]	1.0 µg [j]
7440-28-0	Thallium	1,400	40	2,130	--	0.24 µg	0.47 µg
108-88-3	Toluene	17,500	--	6,300	5,000	~~1.3 mg~~ ~~[l]~~ ***57 ug***	~~15 mg~~ ***520 ug***
8001-35-2	Toxaphene	0.73	0.0002	0.21	0.0002	0.70 ng [c]	0.71 ng [c]
N/A	Tributyltin (TBT)	0.46	0.072	0.42	0.0074	--	--
N/A	Trichlorinated Ethanes	18,000 [e]	--	--	--	(see individual compounds)	
120-82-1	Trichlor***o***benzene 1,2,4	(see Chlorinated benzenes)				~~35~~ ***0.071*** µg ***[c]***	~~70~~ ***0.076*** µg ***[c]***
71-55-6	Trichloroethane 1,1,1	--	--	31,200	--	~~Note 1~~ ***10 mg [l]***	~~--~~***200 mg***
79-00-5	Trichloroethane 1,1,2	--	9,400	--	--	~~0.59~~ ***0.55*** µg [c]	~~16~~ ***8.9*** µg [c]
79-01-6	Trichloroethylene	45,000	21,900	2,000	--	~~2.5~~ ***0.6*** µg [c]	~~30~~ ***7*** µg [c]
75-69-4	Trichlorofluoromethane	(see Halomethanes)				10 mg	860 mg

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
95-95-4	Trichlorophenol 2,4,5	--	--	--	--	1.0 µg [j]	1.0 µg [j]
88-06-2	Trichlorophenol 2,4,6	--	970	--	--	1.5 µg [c]	2.0 µg [c, j]
75-01-4	Vinyl Chloride	--	--	--	--	~~0.025~~ ***0.022*** µg [c]	~~2.4~~ ***1.6*** µg [c]
1330-20-7	***Xylene, Total***	***--***	***--***	***--***	***--***	***Note l***	***--***
7440-66-6	Zinc [i]	30.0 [f, d]	30.0 [f, d]	90[d]	81[d]	5,000 µg [j]	5,000 µg [j]

Env-Wq 1703.22 Notes For Table 1703-1. The following shall apply to Table 1703-1:

(a) The letter "a" shall indicate that the freshwater and saltwater aquatic life criteria for ammonia are shown in Env-Wq 1703.25 through Env-Wq 1703.32.

(b) The letter "b" shall indicate that the criteria refer to the inorganic form only.

(c) The letter "c" shall indicate that these criteria for the protection of human health are based on carcinogenicity using a ***target*** risk ~~factor~~ of one in 1,000,000, ***except for arsenic which shall be based on a target risk of one in 100,000,*** while the human health criteria without this footnote are based on systemic toxicity. Other ***target*** risk***s*** ~~factors~~ shall be allowed only as specified in Env-Wq 1703.20.

(d) The letter "d" shall indicate that criteria for these metals are expressed as a function of the water effect ratio (WER) as defined in 40 CFR 131.36(c), and that because the values displayed in Table 1703-1 correspond to a WER of 1.0, metals criteria for different WERs shall be determined using the procedures described in the EPA publication "Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994, available as noted in Appendix B, provided that for copper, either of the following references, both available as noted in Appendix B, may ***also*** be used:

(1) The "Streamlined Water-Effect Ratio procedure for Discharges of Copper", EPA-822-R-01-005, dated March 2001; or

(2) The Biotic Ligand Model (freshwater only) as described in "Aquatic Life Ambient Freshwater Quality Criteria - Copper", EPA-822-R-07-001, dated February 2007.

(e) The letter "e" shall indicate that the following classes of compounds have 2 or more isomers and the appropriate aquatic life criteria apply to the sum of the concentrations of each isomer:

(1) BHC;

(2) Chlorinated benzenes;

(3) Chlorinated naphthalenes;

(4) Chloroalkyl ethers;

(5) Dichlorobenzenes;

(6) Dichloroethylenes;

(7) Dichloropropanes;

(8) Dichloropropenes;

(9) Dinitrotoluenes;

(10) Haloethers;

(11) Halomethanes;

(12) Nitrophenols;

(13) Nitrosamines;

(14) PCB;

(15) Phthalate esters;

(16) Polynuclear aromatic hydrocarbons;

(17) Tetrachloroethanes; and

(18) Trichlorinatedethanes.

(f) The letter "f" shall indicate that the freshwater aquatic criteria for these metals are expressed as a function of the total hardness, as mg/~~l~~***L*** $CaCO_3$ of the surface water, and that because the values displayed in Table 1703-1 correspond to a total hardness of 20 mg/~~l~~***L*** the aquatic life criteria for other hardness values expressed as calcium carbonate shall be calculated using the equations and tables in Env-Wq 1703.23 and Env-Wq 1703.24.

(g) The letter "g" shall indicate that if the methylmercury concentration in the edible portion of the aquatic species of concern exceeds 0.3 mg/kg, a risk assessment shall be conducted to determine whether a consumption advisory should be issued for the surface water. If a consumption advisory is issued by the department, the surface water shall be considered in non-attainment of the fish and/or shellfish consumption designated uses and in violation of these surface water quality regulations.

(h) The letter "h" shall indicate that the freshwater aquatic life criteria for pentachlorophenol are expressed as a function of pH. Values displayed in Table 1703-1 correspond to a pH value of 6.5. For other pH values, the formulas shown in Env-Wq 1703.~~32~~***33*** shall be used.

(i) The letter "i" shall indicate that the values presented for aquatic life protection are dissolved metals and for hardness-dependent metals are based on a hardness of 20 mg/L. To convert dissolved to total recoverable metal, the equations and tables in Env-Wq 1703.23 shall be used. To calculate dissolved or total recoverable fresh water criteria for hardness-dependent metals for hardness values other than 20 mg/l, the equations and tables shown in Env-Wq 1703.23 and Env-Wq 1703.24 shall be used.

(j) The letter "j" shall indicate that these human health criteria prevent taste and odor effects in the surface water and in fish and other aquatic life as prohibited in Env-Wq 1703.03(c)(1)c. and (3).

(k) The letter "k" shall indicate that ***the acute*** ~~these~~ criteria are based on EPA's 304(a) criteria in the 1980 documents listed below and were derived to be used as instantaneous maximum values, or to be applied after division by 2, to obtain a value comparable to an acute criterion ***as a 1-hour average*** ~~derived using the 1985 Guidelines,~~ when assessment is done using an averaging period:

(1) Aldrin/Dieldrin, document number 440/5-80-019;

(2) Chlordane, document number 440/5-80-027;

(3) DDT, document number 440/5-80-038;

(4) Endosulfan, document number 440/5-80-046;

(5) Endrin, document number 440/5-80-047;

(6) gamma-BHC (lindane), document number 440/5-80-054

(7)(~~6~~) Heptachlor, document number 440/5-80-052;

(8)~~(7)~~ Hexachlorocyclohexane, document number 440/5-80-054; or

(9)~~(8)~~ Silver, document number 440/5-80-071.

(*l*) The letter "*l*" shall indicate that there is a more stringent drinking water maximum contaminant level (MCL) specified in Env-Dw 700, so if the surface water is a source for a public water system as defined in RSA 485:1-a, XV or is within 20 miles upstream of any active surface water intake for a public water system, the department shall use the MCL values shown in table 1703-2A, below, for the water and fish ingestion human health criteria. ***The following criteria are to be met as a running annual average except for Nitrite-N and Nitrite-N + Nitrate-N which are instantaneous acute criteria***:

Table 1703-2A: MCL Values for Water and Fish Ingestion Criteria

CAS Number	Chemical Name	MCL (Units per Liter)
15972-60-8	***Alachlor (Lasso)***	***2 ug***
116-06-3	***Aldicarb (Temik)***	***3 ug***
1646-87-3	***Aldicarb sulfoxide***	***4 ug***
1646-88-4	***Aldicarb sulfone (aldoxycarb)***	***2 ug***
1912-24-9	***Atrazine (Atranex, Crisazine)***	***3 ug***
7440-41-7	Beryllium	4 µg
7440-43-9	Cadmium	5 µg
1563-66-2	***Carbofuran (Furadon, 4F)***	***40 ug***
7782-50-5	Chlorine (as Cl_2)	4 mg
10599-90-3	***Chloramines, as Cl2***	***4 mg***
10049-04-4	***Chlorine Dioxide, as ClO2***	***0.8 mg***
94-75-7	Chlorophenoxy herbicides (2,4-D)	70 µg
93-72-1	Chlorophenoxy herbicides (2,4,5-TP)	50 µg
18540-29-9	Chromium+6	see Chromium Total
16065-83-1	Chromium+3	see Chromium Total
7440-47-3	Chromium Total (equal to the sum of Chromium+3 plus Chromium+6)	100 µg
75-99-0	***Dalapon***	***200 ug***
96-12-8	***Dibromochloropropane (DBCP)***	***0.2 ug***
95-50-1	Dichlorobenzene (1,2)	600 µg
106-46-7	Dichlorobenzene(1,4)	75 µg
107-06-2	Dichloroethane (1,2)	5 µg
75-35-4	Dichloroethylene(1,1)	7 µg
156-59-2	***Dichloroethylene (1,2-cis)***	***70 ug***
156-60-5	Dichloroethylene(1,2-Trans)	100 µg
88-85-7	***Dinoseb***	***7 ug***
85-00-7	***Diquat***	***20 ug***
103-23-1	***Di(2-ethylhexyl)adipate***	***400 ug***
145-73-3	***Endothall***	***100 ug***
106-93-4	***Ethylene Dibromide (EDB)***	***0.05 ug***
16984-48-8	***Fluoride***	***4 mg***
58-89-9	gamma-BHC (Lindane)	0.2 µg

Table 1703-2A: MCL Values for Water and Fish Ingestion Criteria

CAS Number	Chemical Name	MCL (Units per Liter)
1071-83-6	***Glyphosate***	***700 ug***
~~72435~~	~~Methoxychlor~~	~~40 µg~~
74-87-3	***Methyl Chloride***	***5 ug***
1634-04-4	***Methyl tertiary-butyl ether (MtBE)***	***13 ug***
14797-65-0	***Nitrite-N***	***1 mg***
14797-55-8	***Nitrate-N***	***10 mg***
14797-55-8 + 14797-65-0	***Nitrate-N + Nitrite-N***	***10 mg***
23135-22-0	***Oxamyl (Vydate)***	***200 ug***
355-46-4	***Perfluorohexane sulfonic acid (PFHxS)***	***18 ng***
375-95-1	***Perfluorononanoic acid (PFNA)***	***11 ng***
1763-23-1	***Perfluorooctane sulfonic acid (PFOS)***	***15 ng***
335-67-1	***Perfluorooctanoic Acid (PFOA)***	***12 ng***
1918-02-1	***Picloram***	***500 ug***
7782-49-2	Selenium	50 µg
122-34-9	***Simazine***	***4 ug***
100-42-5	***Styrene***	***100 ug***
~~108883~~	~~Toluene~~	~~1 mg~~
71-55-6	Trichloroethane 1,1,1	200 µg
1330-20-7	***Xylene, Total***	***10 mg***

(m) The letter "m" shall indicate that ~~this~~***these*** criteria ~~is~~***are*** expressed as micrograms of free cyanide per liter.

(n) The letter "n" shall indicate that ~~this~~***these*** criteria appl***y***~~ies~~ to total PCBs or the sum of all of its congener or isomer or homolog or Arochlor analyses.

(o) ***The letter "o" shall indicate that the freshwater aquatic life criteria for selenium are shown in Env-Wq 1703.34.*** ~~The letter "o" shall indicate that the freshwater acute criteria for selenium shall be calculated using the values for the fraction f~~$_1$ ~~of selenite and f~~$_2$ ~~of selenate measured in the receiving water. To calculate the acute criteria, in µg/l, the number 1 shall be divided by the sum of the fractions f~~$_1$ ~~divided by 185.9 and f~~$_2$ ~~divided by 12.83, as follows:~~

~~Acute Criteria = (f~~$_1$~~/185.9) + (f~~$_2$~~/12.83)~~

(p) The letter "p" shall indicate that these human health criteria for silver shall be for the protection of humans from argyria.

(q) The letter "q" shall indicate that this value is expressed as total cyanide.

(r) The letter "r" shall indicate that this data was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.

(s) ~~The~~ ***Subject to (1) and (2), below, the*** letter "s" shall indicate that this value ~~is~~ is expressed as acid-soluble aluminum.

(1) Where waterbody specific pH, dissolved organic carbon and hardness are available, sample specific total aluminum criteria shall be determined using the procedures described in the EPA publication "Final Aquatic Life Ambient Water Quality Criteria for Aluminum", EPA-822-R-18-

001, dated December 2018, available as noted in Appendix B, provided that for aluminum, either of the following references shall be used to calculate the site-specific criteria:

a. The "Aluminum Criteria Calculator V2.0 (Excel)(xlsm)", dated December 2018; or

b. The "Aluminum Criteria Calculator R Code and Data V2.0(R)", dated November 15, 2019.

(2) For characterizing ambient waters using the criteria in (1), above, analytical methods that measure the bioavailable fraction of aluminum may be used in accordance with this paragraph where permitted by applicable federal regulations. The bioavailable fraction of aluminum shall be measured, as scientifically appropriate, using a less aggressive initial acid digestion than done for total recoverable aluminum, such as to a pH of approximately 4 or lower, that includes the measurement of amorphous aluminum hydroxide yet minimizes the measurement of mineralized forms of aluminum such as aluminum silicates associated with suspended sediment particles or clays.

(t) The letter "t" shall indicate that the total concentration of DDT and its metabolites shall not exceed this value.

(u) The letter "u" shall indicate that the chronic criterion of 20 mg/L shall be the minimum value except where alkalinity is naturally lower, in which case the criterion shall not be lower than 25 percent of the natural level.

(v) Unless otherwise indicated in Env-Wq 1703.22 (k), (o), or Env-Wq 1703.26(c), the protection of aquatic life concentration values in Table 1703-1 are acute as a 1-hour average and chronic as a 4-day average, both of which shall not to be exceeded more than once in three years.

(w) The letter "w" shall indicate that for arsenic, the first value is for freshwaters and the second value is for marine waters as it relates to protection of human health.

Env-Wq 1703.23 Conversion Factors For Metals.

(a) Dissolved metal shall be determined by multiplying total recoverable metal by the conversion factor listed in Table 1703-2 for that metal, shown in equation form as follows:

Dissolved Metal = Total Recoverable Metal x Conversion Factor

(b) Total recoverable metals shall be determined by dividing dissolved metals by the conversion factor listed in table 1703-2, shown in equation form as follows:

Total Recoverable Metal = Dissolved Metal / Conversion Factor

(c) The conversion factors in Table 1703-2 shall be used as translators to go from the dissolved metals criteria listed in Table 1703-1 to permit limits expressed as total recoverable metals by dividing dissolved metal by the conversion factor.

(d) If the hardness of the receiving water is different than 20 mg/~~l~~***L***, then aquatic life criteria for hardness-dependent metals shall be calculated as follows:

(1) The equations in Env-Wq 1703.24(a) and (b) shall be used in conjunction with the coefficients shown in Table 1703-3 to calculate the total recoverable metal for freshwater;

(2) The equations shown in (a) and (b), above, shall be used in conjunction with the factors shown in Table 1703-2 to convert total recoverable metal to dissolved metal or dissolved metal to total recoverable metal;

(3) For hardness less than 20 mg/~~l~~***L***, a hardness of 20 mg/~~l~~***L*** shall be used in the equations; and

(4) For hardness values greater than 400 mg/~~l~~***L***, a hardness of 400 mg/~~l~~***L*** shall be used in the equations.

(e) Table 1703-2 shall be as follows, provided that the conversion factors for cadmium and lead shall be no greater than 1.0:

Table 1703-2: Factors to Convert Total Recoverable Metals to Dissolved Metals

	FRESHWATER Conversion Factors		**MARINE Conversion Factors**	
	Acute	**Chronic**	**Acute**	**Chronic**
Arsenic	1.0	1.0	1.0	1.0
Cadmium	1.136672 - [(Ln Hardness)(0.041838)]	1.101672 - [(Ln Hardness)(0.041838)]	0.994	0.994
Chromium (+3)	0.316	0.860	-	-
Chromium (+6)	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203 - [(Ln Hardness)(0.145712)]	1.46203 - [(Ln Hardness)(0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium	-	-	0.998	0.998
Silver	0.85	-	0.85	-
Zinc	0.978	0.986	0.946	0.946

Env-Wq 1703.24 Freshwater Aquatic Life Criteria For Metals. To calculate freshwater aquatic life criteria for total recoverable metals, the equations described in (a) and (b), below, shall be used in conjunction with the coefficients shown in (c), Table 1703-3, below, provided that the values used for hardness in the equations shall be as specified in Env-Wq 1703.23 (d):

(a) To calculate the acute criteria, in ug/~~l~~***L***, for the metals shown Table 1703-3, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression "m_a" multiplied by the natural logarithm (ln) of the hardness and to which product the value "b_a" shall be added, as follows:

Acute Criteria = e^x where $x = (m_a [\ln (\text{hardness})] + b_a)$

(b) To calculate the chronic criteria, in ug/~~l~~***L***, for the metals shown in Table 1703-3, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression "m_c" multiplied by the natural logarithm of the hardness and to which product the value "b_c" shall be added, as follows:

Chronic Criteria = e^x where $x = (m_c [\ln (\text{hardness})] + b_c)$

(c) Table 1703-3 shall be as follows:

Table 1703-3: Coefficients in Equations for Calculating Total Recoverable Aquatic Life Criteria for Metals

	m_a	b_a	m_c	b_c
Cadmium	0.9789	-3.866	0.7977	-3.909
Copper	0.9422	-1.700	0.8545	-1.702
Chromium+3	0.8190	3.7256	0.8190	***0***.6848
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59	-------	-------
Zinc	0.8473	0.884	0.8473	0.884

Env-Wq 1703.25 Freshwater Acute Aquatic Life Criteria For Ammonia.

(a) Subject to (b) through (d), below, to determine freshwater acute aquatic life criteria for ammonia, in milligrams of nitrogen per liter (mg N/l), the applicant shall use:

(1) Table 1703-4A,where salmonids in the genus Oncorhynchus are or might be present; and

(2) Table 1703-4B, where salmonids in the genus Oncorhynchus are absent.

(b) The freshwater acute water quality criteria for ammonia in Table 1703-4A where salmonids in the genus Oncorhynchus are or might be present have been calculated by taking the lesser of the value resulting from dividing 0.275 by the sum of one plus 10 raised to the power of 7.204 minus the pH, and adding the resulting value to the value found by dividing 39.0 by the sum of one plus 10 raised to the power of the pH minus 7.204, to the value resulting from dividing 0.0114 by the sum of one plus 10 raised to the power of the pH minus 7.204, and adding the resulting value found by dividing 1.6181 by the sum of one plus 10 raised to the power of the pH minus 7.204 and multiplying this value by 0.7249 multiplied by the value resulting from multiplying 23.12 by 10 raised to the power of 0.036 multiplied by value of 20 minus the temperature, as shown in the following equation:

Freshwater Acute Criteria, Salmonids in the Genus Onchorhynchus Present =

$$\text{MIN} \{ [0.275 / (1+10^{7.204\text{-pH}}) + 39.0 / (1+10^{\text{pH-}7.204})], \\ [0.7249 \times [0.0114/(1+10^{7.204\text{-pH}}) + 1.6181 / (1+10^{\text{pH-}7.204})] \times (23.12 \times 10^{0.036 \times (20\text{-T})})] \}$$

Where MIN indicates the lesser of the two values separated by a comma.

(c) The freshwater acute water quality criteria for ammonia in table 1703-4B where salmonids in the genus Oncorhynchus are absent have been calculated by dividing 0.0114 by the sum of one plus 10 raised to the power of 7.204 minus the pH, and adding the resulting value to the value found by dividing 1.6181 by the sum of one plus 10 raised to the power of the pH minus 7.204, and multiplying this value by 0.7249 multiplied by the lesser of 51.93 or the value resulting from multiplying 23.12 by 10 raised to the power of 0.036 multiplied by value of 20 minus the temperature as shown in the following equation:

Freshwater Acute Criteria, Salmonids in the Genus Onchorhynchus Absent =

$$\{0.7249 \times [0.0114/(1+10^{7.204\text{-pH}}) + 1.6181 / (1+10^{\text{pH-}7.204})]\} \times \text{MIN} [51.93, (23.12 \times 10^{0.036 \times (20\text{-T})})]$$

Where MIN indicates the lesser of the 2 values separated by a comma.

(d) The equations described in (b) and (c), above, shall be used to calculate freshwater acute water quality criteria for ammonia at unlisted pH and temperature values.

(e) Table 1703-4A and table 1703-4B shall be as follows:

Table 1703-4A: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter
Salmonids in the Genus Oncorhynchus Present

pH	Temperature, Degrees C									
	0-14	**15**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	33	33	32	27	23	19	16	14	12	9.9
6.6	31	31	30	26	22	18	16	13	11	9.5
6.7	30	30	29	24	21	18	15	13	11	9.0
6.8	28	28	27	23	20	17	14	12	10	8.5
6.9	26	26	25	21	18	15	13	11	9.4	7.9
7.0	24	24	23	20	17	14	12	10	8.6	7.3
7.1	22	22	21	18	15	13	11	9.3	7.9	6.7
7.2	20	20	19	16	14	12	9.8	8.3	7.1	6.0

Table 1703-4A: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter Salmonids in the Genus Oncorhynchus Present										
pH	**Temperature, Degrees C**									
	0-14	**15**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
7.3	18	18	17	14	12	10	8.7	7.4	6.3	5.3
7.4	15	15	15	13	11	9.0	7.7	6.5	5.5	4.7
7.5	13	13	13	11	9.2	7.8	6.6	5.6	4.8	4.0
7.6	11	11	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5
7.7	9.6	9.6	9.3	7.9	6.7	5.7	4.8	4.1	3.5	3.0
7.8	8.1	8.1	7.9	6.7	5.6	4.8	4.0	3.4	2.9	2.5
7.9	6.8	6.8	6.6	5.6	4.7	4.0	3.4	2.9	2.4	2.1
8.0	5.6	5.6	5.4	4.6	3.9	3.3	2.8	2.4	2.0	1.7
8.1	4.6	4.6	4.5	3.8	3.2	2.7	2.3	2.0	1.7	1.4
8.2	3.8	3.8	3.7	3.1	2.7	2.3	1.9	1.6	1.4	1.2
8.3	3.1	3.1	3.1	2.6	2.2	1.9	1.6	1.3	1.1	0.96
8.4	2.6	2.6	2.5	2.1	1.8	1.5	1.3	1.1	0.93	0.79
8.5	2.1	2.1	2.1	1.8	1.5	1.3	1.1	0.90	0.77	0.65
8.6	1.8	1.8	1.7	1.5	1.2	1.0	0.88	0.75	0.63	0.54
8.7	1.5	1.5	1.4	1.2	1.0	0.87	0.74	0.62	0.53	0.45
8.8	1.2	1.2	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37
8.9	1.0	1.0	1.0	0.85	0.72	0.61	0.52	0.44	0.37	0.32
9.0	0.88	0.88	0.86	0.73	0.62	0.52	0.44	0.37	0.32	0.27

Table 1703-4B: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter, Salmonids in the Genus Oncorhynchus Absent											
pH	**Temperature, Degrees C**										
	0-10	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	51	44	37	32	27	23	19	16	14	12	9.9
6.6	49	42	36	30	26	22	18	16	13	11	9.5
6.7	46	40	34	29	24	21	18	15	13	11	9.0
6.8	44	38	32	27	23	20	17	14	12	10	8.5
6.9	41	35	30	25	21	18	15	13	11	9.4	7.9
7.0	38	33	28	23	20	17	14	12	10	8.6	7.3
7.1	34	30	25	21	18	15	13	11	9.3	7.9	6.7
7.2	31	27	23	19	16	14	12	9.8	8.3	7.1	6.0
7.3	27	24	20	17	14	12	10	8.7	7.4	6.3	5.3
7.4	24	21	18	15	13	11	9.0	7.7	6.5	5.5	4.7
7.5	21	18	15	13	11	9.2	7.8	6.6	5.6	4.8	4.0
7.6	18	15	13	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5
7.7	15	13	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5	2.9
7.8	13	11	9.3	7.9	6.7	5.6	4.8	4.0	3.4	2.9	2.5
7.9	11	9.1	7.7	6.6	5.6	4.7	4.0	3.4	2.9	2.4	2.1
8.0	8.8	7.6	6.4	5.4	4.6	3.9	3.3	2.8	2.4	2.0	1.7
8.1	7.2	6.3	5.3	4.5	3.8	3.2	2.7	2.3	2.0	1.7	1.4
8.2	6.0	5.2	4.4	3.7	3.1	2.7	2.3	1.9	1.6	1.4	1.2
8.3	4.9	4.3	3.6	3.1	2.6	2.2	1.9	1.6	1.3	1.1	0.96
8.4	4.1	3.5	3.0	2.5	2.1	1.8	1.5	1.3	1.1	0.93	0.79
8.5	3.3	2.9	2.4	2.1	1.8	1.5	1.3	1.1	0.90	0.77	0.65
8.6	2.8	2.4	2.0	1.7	1.5	1.2	1.0	0.88	0.75	0.63	0.54
8.7	2.3	2.0	1.7	1.4	1.2	1.0	0.87	0.74	0.62	0.53	0.45
8.8	1.9	1.7	1.4	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37

Table 1703-4B: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter, Salmonids in the Genus Oncorhynchus Absent											
pH	**Temperature, Degrees C**										
	0-10	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.9	1.6	1.4	1.2	1.0	0.85	0.72	0.61	0.52	0.44	0.37	0.32
9.0	1.4	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37	0.32	0.27

Env-Wq 1703.26 Freshwater Chronic Aquatic Life Criteria For Ammonia.

(a) Subject to (b) through (d), below, Table 1703-4C shall be used to determine freshwater chronic aquatic life criteria for ammonia, in mg N/l.

(b) The freshwater chronic water quality criteria for ammonia in Table 1703-4C have been calculated by adding the value found by dividing 0.0278 by the sum of one plus 10 raised to the power of 7.688 minus the pH to the value found by dividing 1.1994 by one plus 10 raised to the power of pH minus 7.688, and multiplying the resulting value by 0.8876 multiplied by the value resulting from multiplying 2.126 by 10 raised to the power of 0.028 times the value of 20 minus the greater of the temperature or 7, as shown in the following equation:

Freshwater Chronic Criteria for Ammonia:

$$\text{Criteria} = 0.8876 \times [0.0278/(1+10^{7.688-pH}) + 1.1994/(1+10^{pH-7.688})] \times [2.126 \times 10^{0.028 \times (20-MAX(T,7))}]$$

Where MAX indicates the greater of the two values separated by a comma.

(c) The chronic criteria in Table 1703-4C represent a 30-day rolling average, but the highest 4-day average within any 30-day averaging period shall not exceed 2.5 times the chronic criteria.

(d) The equation described in (b), above, shall be used to calculate criteria at unlisted pH and temperature values.

(e) Table 1703-4C shall be as follows:

Table 1703-4C: Freshwater Chronic Aquatic Life Criteria For Ammonia in mg N/l													
pH	**Temperature, Degrees C**												
	0-7	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	4.9	4.6	4.1	3.6	3.1	2.8	2.4	2.1	1.9	1.6	1.5	1.3	1.1
6.6	4.8	4.5	4.0	3.5	3.1	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.1
6.7	4.8	4.5	3.9	3.5	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1
6.8	4.6	4.4	3.8	3.4	3.0	2.6	2.3	2.0	1.8	1.6	1.4	1.2	1.1
6.9	4.5	4.2	3.7	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0
7.0	4.4	4.1	3.6	3.2	2.8	2.4	2.2	1.9	1.7	1.5	1.3	1.1	0.99
7.1	4.2	3.9	3.5	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.95
7.2	4.0	3.7	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0	0.90
7.3	3.8	3.5	3.1	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.1	0.97	0.85
7.4	3.5	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0	0.90	0.79
7.5	3.2	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.95	0.83	0.73
7.6	2.9	2.8	2.4	2.1	1.9	1.6	1.4	1.3	1.1	0.98	0.86	0.76	0.67
7.7	2.6	2.4	2.2	1.9	1.7	1.5	1.3	1.1	1.0	0.88	0.78	0.68	0.60
7.8	2.3	2.2	1.9	1.7	1.5	1.3	1.2	1.0	0.89	0.79	0.69	0.61	0.53
7.9	2.1	1.9	1.7	1.5	1.3	1.2	1.0	0.89	0.79	0.69	0.61	0.53	0.47
8.0	1.8	1.7	1.5	1.3	1.1	1.0	0.88	0.78	0.68	0.60	0.53	0.44	0.41
8.1	1.5	1.5	1.3	1.1	0.99	0.87	0.76	0.67	0.59	0.52	0.46	0.40	0.35
8.2	1.3	1.2	1.1	0.96	0.84	0.74	0.65	0.57	0.50	0.44	0.39	0.34	0.30
8.3	1.1	1.1	0.93	0.82	0.72	0.63	0.55	0.49	0.43	0.38	0.33	0.29	0.26
8.4	0.95	0.89	0.79	0.69	0.61	0.53	0.47	0.41	0.36	0.32	0.28	0.25	0.22

Table 1703-4C: Freshwater Chronic Aquatic Life Criteria For Ammonia in mg N/l													
pH	**Temperature, Degrees C**												
	0-7	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.5	0.80	0.75	0.67	0.58	0.51	0.45	0.40	0.35	0.31	0.27	0.24	0.21	0.18
8.6	0.68	0.64	0.56	0.49	0.43	0.38	0.33	0.29	0.26	0.23	0.20	0.18	0.15
8.7	0.57	0.54	0.47	0.42	0.37	0.32	0.28	0.25	0.22	0.19	0.17	0.15	0.13
8.8	0.49	0.46	0.40	0.35	0.31	0.27	0.24	0.21	0.19	0.16	0.14	0.13	0.11
8.9	0.42	0.39	0.34	0.30	0.27	0.23	0.21	0.18	0.16	0.14	0.12	0.11	0.09
9.0	0.36	0.34	0.30	0.26	0.23	0.20	0.18	0.16	0.14	0.12	0.11	0.09	0.08

Env-Wq 1703.27 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 10 g/kg. The values shown in Table 1703-5 shall be used to determine saltwater acute aquatic life criteria for ammonia, in milligrams of NH_3 per liter (mg NH_3/l), for a salinity of 10 g/kg:

Table 1703-5: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 10 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	270	191	131	92	62	44	29	21
7.2	175	121	83	58	40	27	19	13
7.4	110	77	52	35	25	17	12	8.3
7.6	69	48	33	23	16	11	7.7	5.6
7.8	44	31	21	15	10	7.1	5.0	3.5
8.0	27	19	13	9.4	6.4	4.6	3.1	2.3
8.2	18	12	8.5	5.8	4.2	2.9	2.1	1.5
8.4	11	7.9	5.4	3.7	2.7	1.9	1.4	1.0
8.6	7.3	5.0	3.5	2.5	1.8	1.3	0.98	0.75
8.8	4.6	3.3	2.3	1.7	1.2	0.92	0.71	0.56
9.0	2.9	2.1	1.5	1.1	0.85	0.67	0.52	0.44

Env-Wq 1703.28 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 20 g/kg. The values shown in Table 1703-6 shall be used to determine saltwater acute aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 20 g/kg:

Table 1703-6: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 20 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	291	200	137	96	64	44	31	21
7.2	183	125	87	60	42	29	20	14
7.4	116	79	54	37	27	18	12	8.7
7.6	73	50	35	23	17	11	7.9	5.6
7.8	46	31	23	15	11	7.5	5.2	3.5
8.0	29	20	14	9.8	6.7	4.8	3.3	2.3
8.2	19	13	8.9	6.2	4.4	3.1	2.1	1.6
8.4	12	8.1	5.6	4.0	2.9	2.0	1.5	1.1
8.6	7.5	5.2	3.7	2.7	1.9	1.4	1.0	0.77
8.8	4.8	3.3	2.5	1.7	1.3	0.94	0.73	0.56
9.0	3.1	2.3	1.6	1.2	0.87	0.69	0.54	0.44

Env-Wq 1703.29 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 30 g/kg. The values shown in Table 1703-7 shall be used to determine saltwater acute aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 30 g/kg:

Table 1703-7: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 30 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	312	208	148	102	71	48	33	23
7.2	196	135	94	64	44	31	21	15
7.4	125	85	58	40	27	19	13	9.4
7.6	79	54	37	25	21	12	8.5	6.0
7.8	50	33	23	16	11	7.9	5.4	3.7
8.0	31	21	15	10	7.3	5.0	3.5	2.5
8.2	20	14	9.6	6.7	4.6	3.3	2.3	1.7
8.4	12.7	8.7	6.0	4.2	2.9	2.1	1.6	1.1
8.6	8.1	5.6	4.0	2.7	2.0	1.4	1.1	0.81
8.8	5.2	3.5	2.5	1.8	1.3	1.0	0.75	0.58
9.0	3.3	2.3	1.7	1.2	0.94	0.71	0.56	0.46

Env-Wq 1703.30 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 10 g/kg. The values shown in Table 1703-8 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 10 g/kg:

Table 1703-8: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH_3/l; Salinity = 10 g/kg								
pH	~~**Tempterature**~~ ***Temperature*** **(°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	41	29	20	14	9.4	6.6	4.4	3.1
7.2	26	18	12	8.7	5.9	4.1	2.8	2.0
7.4	17	12	7.8	5.3	3.7	2.6	1.8	1.2
7.6	10	7.2	5.0	3.4	2.4	1.7	1.2	0.84
7.8	6.6	4.7	3.1	2.2	1.5	1.1	0.75	0.53
8.0	4.1	2.9	2.0	1.40	0.97	0.69	0.47	0.34
8.2	2.7	1.8	1.3	0.87	0.62	0.44	0.31	0.23
8.4	1.7	1.2	0.81	0.56	0.41	0.29	0.21	0.16
8.6	1.1	0.75	0.53	0.37	0.27	0.20	0.15	0.11
8.8	0.69	0.50	0.34	0.25	0.18	0.14	0.11	0.08
9.0	0.44	0.31	0.23	0.17	0.13	0.10	0.08	0.07

Env-Wq 1703.31 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 20 g/kg. The values shown in Table 1703-9 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 20 g/kg:

Table 1703-9: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 20 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	44	30	21	14	9.7	6.6	4.7	3.1
7.2	27	19	13	9.0	6.2	4.4	3.0	2.1
7.4	18	12	8.1	5.6	4.1	2.7	1.9	1.3
7.6	11	7.5	5.3	3.4	2.5	1.7	1.2	0.84
7.8	6.9	4.7	3.4	2.3	1.6	1.1	0.78	0.53
8.0	4.4	3.0	2.1	1.5	1.0	0.72	0.50	0.34
8.2	2.8	1.9	1.3	***0***.94	***0***.66	***0***.47	***0***.31	***0***.24
8.4	1.8	1.2	***0***.84	***0***.59	***0***.44	***0***.30	***0***.22	***0***.16
8.6	1.1	***0***.78	***0***.56	***0***.41	***0***.28	***0***.20	***0***.15	***0***.12
8.8	***0***.72	***0***.50	***0***.37	***0***.26	***0***.19	***0***.14	***0***.11	***0***.08
9.0	***0***.47	***0***.34	***0***.24	***0***.18	***0***.13	***0***.10	***0***.08	***0***.07

Env-Wq 1703.32 <u>Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 30g/kg</u>. The values shown in table 1703-10 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 30 g/kg:

Table 1703-10: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 30 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	47	31	22	15	11	7.2	5.0	3.4
7.2	29	20	14	9.7	6.6	4.7	3.1	2.2
7.4	19	13	8.7	5.9	4.1	2.9	2.0	1.4
7.6	12	8.1	5.6	3.7	3.1	1.8	1.3	0.90
7.8	7.5	5.0	3.4	2.4	1.7	1.2	0.81	0.56
8.0	4.7	3.1	2.2	1.6	1.1	0.75	0.53	0.37
8.2	3.0	2.1	1.4	1.0	0.69	0.50	0.34	0.25
8.4	1.9	1.3	0.90	0.62	0.44	0.31	0.23	0.17
8.6	1.2	0.84	0.59	0.41	0.30	0.22	0.16	0.12
8.8	0.78	0.53	0.37	0.27	0.20	0.15	0.11	0.09
9.0	0.50	0.34	0.26	0.19	0.14	0.11	0.08	0.07

Env-Wq 1703.33 <u>Freshwater Aquatic Life Criteria for Pentachlorophenol</u>.

(a) To calculate the freshwater aquatic life acute criteria, in ug/~~l~~***L***, for pentachlorophenol, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression 1.005 multiplied by the pH and to which product the value of 4.869 shall be subtracted, as follows:

$$\text{Acute Criteria} = e^{x} \text{ where}$$
$$x = [\ 1.005\ (pH) - 4.869\ ]$$

(b) To calculate the freshwater aquatic life chronic criteria, in ug/~~l~~***L***, for pentachlorophenol, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression 1.005 multiplied by the pH and to which product the value of 5.134 shall be subtracted, as follows:

$$\text{Chronic Criteria} = e^{x} \text{ where}$$
$$x = [\ 1.005\ (pH) - 5.134\ ]$$

Env-Wq 1703.34 <u>Freshwater Aquatic Life Criteria for Selenium</u>. Compliance with the freshwater aquatic life criteria for selenium shall be determined using egg-ovary fish tissue measurements, if available and applicable, or, in the alternative using, whole-body or muscle fish tissue measurements, if available, and if neither are available then using the water column values shown in table 1703-11, below, for the freshwater aquatic life protection criteria:

Table 1703-11: <u>Freshwater Selenium Ambient Chronic Water Quality Criteria for Protection of Aquatic Life</u>

Media	***Fish Tissue***		***Water Column***	
Measurement	***Egg/Ovary***	***Fish Whole Body or Muscle***	***Monthly Average Exposure***	***Intermittent Exposure***
Criteria	***15.1 mg/kg dw***	***8.5 mg/kg dw whole body or***	***1.5 µg/L in lentic aquatic systems***	$Criteria_{int\ exp} = [Criteria_{monthly\ average} - C_{bkgrnd}(1-f_{int})]\ /\ f_{int}$

		11.3 mg/kg dw muscle (skinless, boneless filet)	***3.1 µg/L in lotic aquatic systems***	

Env-Wq 1703.35 Notes for Table 1703-11

(a) Fish tissue measures, egg/ovary and whole-body or muscle, are instantaneous measures expressed as steady-state and are not to be exceeded.

(b) Water column values are based on the total of the dissolved species of selenium in water. Water column values are the applicable criterion in the absence of fish tissue in a steady-state condition and are not to be exceeded more than once in 3-years.

(c) Intermittent exposure criteria (Criteria$_{int\ exp}$) is the Criteria$_{monthly}$ average from the monthly measurements, for either lentic or lotic waters, minus the C$_{bkgrnd}$ which is the average background selenium concentration times one minus the f$_{int}$ which is the fraction of any 30-day period during which elevated selenium concentrations occur, divided by the f$_{int}$.

PART Env-Wq 1704 ALTERNATIVE SITE-SPECIFIC CRITERIA

Env-Wq 1704.01 Purpose. The purpose of this part is to establish a procedure for determining alternative site-specific criteria in the following cases:

(a) For toxic substances not listed in Env-Wq 1703.21 through Env-Wq 1703.33;

(b) Where site-specific information is available and substantiates the use of different criteria; or

(c) Where new information that was not considered in the development of the criteria becomes available.

Env-Wq 1704.02 Procedures ***for Site-Specific Human Health Criteria***. The procedure for determining alternative site-specific criteria for the protection of human health shall be as specified in EPA's "Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," EPA 822-B-00-004, dated October 2000, and the following accompanying technical support documents, all of which are available as noted in Appendix B:

(a) "Volume 1: Risk Assessment", EPA 822-B-00-005, dated October 2000;

(b) "Volume 2: Development of National Bioaccumulation Factors", EPA-822-R-03-030, dated December 2003; and

(c) "Volume 3: Development of Site-Specific Bioaccumulation Factors", EPA-822-R-09-008, dated September 2009.

Env-Wq 1704.03 Procedures for Site-Specific Nutrient Criteria.

(a) Subject to the criteria in Env-Wq 1703.14, Env-Wq 1703.25 through 1703.33 and the procedure in Env-Wq 1704.03(b), the following are acceptable procedures for determining alternative site-specific nutrient criteria:

(1) Adopting the nutrient target concentration or load from an EPA approved Total Maximum Daily Load (TMDL) study pursuant to 40 CFR 130.7;

(2) Adopting the nutrient target concentration or load from an Advance Restoration Plan;

(3) Adopting one of the following federal requirements:

a. Criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

b. The ambient targets and commensurate flows applied in permits issued pursuant to 40 CFR 122;

(4) Approaches in the "Nutrient Criteria Technical Guidance Manual Rivers and Streams", EPA-822-B-00-002 dated July 2000, available as noted in Appendix B;

(5) Approaches in the "Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs", EPA-822-B00-001 dated April 2000, available as noted in Appendix B;

(6) Approaches in the "Nutrient Criteria Technical Guidance Manual Estuary and Coastal Marine Waters", EPA-822-B00-003 dated October 2001, available as noted in Appendix B;

(7) Approaches in the "Nutrient Criteria Technical Guidance Manual Wetlands", EPA-822-B-08-001 dated June 2008, available as noted in Appendix B; and

(8) Approaches in "Using Stressor-response Relationships to Derive Numeric Nutrient Criteria", EPA-820-S-10-001 dated November 2010, available as noted in Appendix B.

(b) Modeling conducted to determine alternative site-specific nutrient criteria shall be conducted as specified in EPA's "Guidance on the Development, Evaluation, and Application of Environmental Models", EPA-100-K-09-003 dated March 2009, available as noted in Appendix B.

Env-Wq 1704.0~~3~~***4*** Modifications to Surface Water Quality Standards. If the department determines, based on scientifically valid documentation, that alternative site-specific criteria will protect the existing and designated uses of the waterbody, the department shall revise these rules to incorporate those criteria.

PART Env-Wq 1705 ~~FLOW~~ ***PERMITTING RELATED*** STANDARDS

Env-Wq 1705.01 Assimilative Capacity.

(a) Subject to (b) ***and Env-Wq 1705.03***, below, the department shall hold not less than 10 percent of the assimilative capacity of each surface water in reserve to provide for future needs.

(b) For purposes of combined sewer overflows, the department shall determine compliance based on 99 percent of the assimilative capacity of the receiving surface water.

Env-Wq 1705.02 ~~Low Flow~~ ***Dilution and*** Conditions ***for Permitting***.

(a) The ***ambient upstream*** flow used to calculate permit limits shall be as specified in (b) through ~~(d)~~ ***(g)***, below.

(b) For tidal waters, the low flow condition shall be equivalent to the conditions that result in a dilution that is exceeded 99% of the time.

(c) For non-tidal rivers and streams, permit limits for all human health criteria for carcinogens shall be developed based on the long-term harmonic mean flow, which is the number of daily flow measurements divided by the sum of the reciprocals of the daily flows.

(d) ~~For for non-tidal rivers and streams,~~ ~~permit~~ ***Permit*** limits ***to meet*** ~~for all aquatic life and human health~~ ***nutrient*** criteria ~~for non-carcinogens shall be based on 7Q10 flow~~ ***including, but not limited to, nitrogen and phosphorus species, shall be based on the following downstream ambient targets and flows:***

(1) The ambient nutrient target used in the reasonable potential analysis conducted pursuant to 40 CFR 122.43(d) shall be based on one of the following methods provided that existing and designated uses are fully protected:

a. Site-specific criteria adopted pursuant to Env-Wq 1704;

b. An EPA approved Total Maximum Daily Load (TMDL) study pursuant to 40 CFR 130.7;or

c. One of the following federal requirements if deemed by the department to be protective of all existing and designated uses:

i. Criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

ii. Permits issued pursuant to 40 CFR 122; and

(2) The flows for nutrients used in the reasonable potential analysis shall be commensurate to, as applicable:

a. site-specific nutrient criteria adopted pursuant to Env-Wq 1704;

b. established conditions for the nutrient target in an EPA approved TMDL;

c. nutrient target used in criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

d. nutrient target used in permits issued pursuant to 40 CFR 122.

(e) For non-tidal rivers and streams, permit limits to prevent ammonia toxicity in aquatic life shall be based on a flow equal to the 7Q10 flow.

(f) Nutrient effluent permit limits may be based on the 7Q10 flow if the nutrient limit is needed to achieve compliance with other water quality criteria that must have permit limits based on the 7Q10 flow in accordance with (g) below.

(g) For non-tidal rivers and streams, permit limits for all non-nutrient aquatic life criteria and human health criteria for non-carcinogens shall be based on the 7Q10 flow except as described in Env-Wq 1705.02(d)(2) through Env-Wq 1705.02(f), above.

(h) To the maximum extent practicable, data used for setting permit limits and calculating reasonable potential pursuant to 40 CFR 122.44(d)(1)(ii) shall be based upon:

(1) Data, modeling or reasonable estimates of the ambient condition representative in space and time of the limiting conditions as defined in (a) through (g) above, for a particular criterion; and

(2) Data, modeling or reasonable estimates of the ambient condition representative of the conditions on which a criterion is based.

Env-Wq 1705.03 <u>Restoration Permitting</u>.

(a) Temporary and infrequent impacts resulting from ecological restoration projects approved by the department are exempt from the assimilative capacity requirements of Env-Wq 1705.01 and dilution requirements of Env-Wq 1705.02.

(b) Any water quality or water quantity impacts from ecological restoration projects approved by the department shall be minimized to the extent practicable and be treated or controlled using best management practices approved by the department.

PART Env-Wq 1706 SAMPLING AND ANALYSIS

Env-Wq 1706.01 <u>Procedures</u>.

(a) Unless alternative procedures are specified in the surface water discharge permit, all procedures used for the purpose of collecting, preserving, and analyzing samples shall be as specified in 40 CFR Part 136 for wastewater and 40 CFR Part 141 for drinking water.

(b) All methods approved in 40 CFR 136 for bacteria testing, as well as analytical methods approved for use in national shellfish sanitation program as specified pursuant to RSA 485-A:8, V are approved methods for NPDES permit compliance.

PART Env-Wq 1707 MIXING ZONES

Env-Wq 1707.01 Designation of Mixing Zones.

(a) Because RSA 485-A:8, I prohibits the discharge of any sewage or other wastes into class A waters, mixing zones shall be prohibited in such waters.

(b) For class B waters, the department shall designate a limited area or volume of the surface water as a mixing zone if the applicant provides sufficient scientifically valid documentation to allow the department to independently determine that all criteria in Env-Wq 1707.02 have been met.

Env-Wq 1707.02 Criteria for Approval of Mixing Zones. The department shall not approve a mixing zone unless the proposed mixing zone:

(a) Meets the criteria in Env-Wq 1703.03(c)(1);

(b) Does not interfere with biological communities or populations of indigenous species;

(c) Does not result in the accumulation of pollutants in the sediments or biota;

(d) Allows a zone of passage for swimming and drifting organisms;

(e) Does not interfere with existing and designated uses of the surface water;

(f) Does not impinge upon spawning grounds or nursery areas, or both, of any indigenous aquatic species;

(g) Does not result in the mortality of any plants, animals, humans, or aquatic life within the mixing zone;

(h) Does not exceed the chronic toxicity value of 1.0 TUc at the mixing zone boundary; and

(i) Does not result in an overlap with another mixing zone.

Env-Wq 1707.03 Conditions for Mixing Zones. If the department approves a mixing zone, the department shall include such conditions as are needed to ensure that the criteria on which the approval is based are met.

Env-Wq 1707.04 Technical Standards. Mixing zones shall be established in accordance with “Technical Support Document for Water Quality-based Toxics Control”, EPA/505/2-90-001, dated March 1991, available as noted in Appendix B.

PART Env-Wq 1708 ANTIDEGRADATION

Env-Wq 1708.01 Purpose. The purpose of these antidegradation provisions is to ensure that the following requirements of 40 CFR 131.12 are met:

(a) Existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected;

(b) Where the quality of a surface water exceeds the level necessary to support recreation in and on the water and propagation of fish, shellfish, and wildlife, such quality shall be maintained and protected, subject to the following:

(1) The department shall not approve a proposed discharge or activity that would cause a significant change in water quality as specified in Env-Wq 1708.09 unless the department finds, after full satisfaction of the intergovernmental coordination and public participation requirements and the

analysis required by Env-Wq 1708.10, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the surface water is located; and

(2) The department shall not approve any proposed discharge or activity that might cause degradation or lower water quality, without such conditions as are necessary to ensure that:

a. Water quality will be adequate to fully protect existing uses;

b. The highest statutory and regulatory requirements will be achieved for all new and existing point sources; and

c. All cost effective and reasonable best management practices for nonpoint source control will be implemented;

(c) Where high quality ~~surface~~ waters constitute an outstanding resource waters (ORW), that water quality shall be maintained and protected; and

(d) In those cases where a potential water quality impairment is associated with a thermal discharge, the antidegradation provisions shall ensure that the requirements of Section 316 of the Clean Water Act are met.

Env-Wq 1708.02 Applicability. Antidegradation shall apply to:

(a) Any proposed new or increased activity, including point source and nonpoint source discharges of pollutants, that would lower water quality or adversely affect existing or designated uses;

(b) Any proposed increase in loadings to a waterbody when the proposal is associated with existing activities;

(c) Any increase in flow alteration over an existing alteration; and

(d) Any hydrologic modifications, such as dam construction and water withdrawals.

Env-Wq 1708.03 Protection of Existing Uses.

(a) A proposed discharge or activity shall not eliminate any existing uses or the water quality needed to maintain and protect those uses.

(b) The department shall determine the existing uses for the waters in question using the information provided pursuant to Env-Wq 1708.07.

Env-Wq 1708.04 Protection of Water Quality in ORW.

(a) Surface waters of national forests and surface waters designated as natural under RSA 483:7-a, I, shall be considered outstanding resource waters (ORW).

(b) Subject to (c), below, water quality shall be maintained and protected in surface waters that constitute ORW.

(c) The department shall allow a limited ***activity, or*** point or nonpoint source discharge to an ORW only if:

(1) The discharge ***or activity*** will result in no more than temporary and short-term changes in water quality, wherein "temporary and short term" means that degradation is limited to the shortest possible time;

(2) The discharge ***or activity*** will not permanently degrade water quality or result at any time in water quality lower than that necessary to protect the existing and designated uses in the ORW; and

(3) All practical means of minimizing water quality degradation are implemented.

Env-Wq 1708.05 Protection of Class A Waters.

(a) As specified in RSA 485-A:8, I, discharges of sewage or waste to class A waters shall be prohibited.

(b) Proposed new or increased activities that the department determines do not involve the discharge of sewage or waste shall be reviewed in accordance with this part.

Env-Wq 1708.06 Protection of Water Quality in High Quality Waters.

(a) Subject to (b) through (d), below, high quality waters shall be maintained and protected.

(b) The department shall evaluate and authorize insignificant changes in water quality as specified in Env-Wq 1708.09.

(c) The department shall allow degradation of significant increments of water quality, as determined in accordance with Env-Wq 1708.09, in high quality waters only if the applicant can demonstrate to the department, in accordance with Env-Wq 1708.10, that allowing the water quality degradation is necessary to accommodate important economic or social development in the area in which the receiving waters are located.

(d) If the waterbody is class A water, the requirements of Env-Wq 1708.05 also shall apply.

Env-Wq 1708.07 Submittal of Data. The applicant shall provide all information necessary to:

(a) Identify all existing uses, including:

(1) Freshwater, estuarine, and marine aquatic life present in the affected surface waters;

(2) Other wildlife that use or otherwise are dependent on the affected surface waters;

(3) Presence of water quality and physical habitat that support, or would support, aquatic life or other animal or plant life;

(4) Presence of indigenous species and communities;

(5) Presence of a specialized use of the waterbody, such as a spawning area or as a habitat for a federally- or state-listed threatened or endangered species;

(6) Use of the surface waters for recreation in or on the water, such as fishing, swimming, and boating, or use of the surface waters for commercial activity; and

(7) Whether or not current conditions or uses of the surface waters conflict with achieving and maintaining goal uses of the CWA at Section 101(a)(2) and the primary CWA objective to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters;

(b) Determine the level of water quality necessary to maintain and protect all uses identified in (a), above;

(c) Evaluate the potential impacts on existing uses due to the proposed discharge or activity by itself, and in combination with other discharges or activities presently occurring;

(d) Ensure that existing uses and the level of water quality necessary to protect those uses will be maintained and protected;

(e) Evaluate the magnitude, duration, and upstream and downstream extent of any lowering of high quality water due to the proposed discharge or activity by itself, and in combination with other discharges or activities presently occurring;

(f) Evaluate other factors as necessary to determine whether the proposed activity would cause significant or insignificant degradation, in accordance with Env-Wq 1708.09;

(g) If the discharge or activity is determined by the department to be significant, in accordance with Env-Wq 1708.08 and Env-Wq 1708.09, determine if a proposed lowering of water quality is necessary to achieve important economic or social development in accordance with Env-Wq 1708.10; and

(h) Ensure that all water quality criteria applicable to the waterbody in question will not be violated.

Env-Wq 1708.08 Assessing Waterbodies.

(a) The applicant shall characterize the existing water quality and determine whether there is remaining assimilative capacity for each parameter in question.

(b) Existing water quality shall be calculated in accordance with Env-Wq 1705.02, based on point sources discharging at their allowed loadings and the highest loadings anticipated from nonpoint sources.

(c) Where flows will or might be altered, existing conditions shall be established based on the existing maximum allowed water withdrawals or impoundment, diversion, or fluctuation of stream flow, as applicable.

(d) Remaining assimilative capacity shall be evaluated by comparing existing water quality, as specified in (b) and (c), above, to the state's water quality criteria.

(e) If the type and frequency of the proposed discharge or activity will or might cause the waterbody to be impacted at flows other than those listed in Env-Wq 1705.02, the applicant shall evaluate the impact of the proposed discharge at those other flows.

(f) Subject to (h), below, if the department determines, based on the information submitted, that there is no remaining assimilative capacity for a specific parameter, no further degradation with regard to that parameter shall be allowed.

(g) Subject to (h), below, if the department determines, based on the information submitted, that there is some remaining assimilative capacity, then the department shall proceed in accord with Env-Wq 1708.09.

(h) Determinations made pursuant to (f) or (g), above, shall account for Env-Wq 1705.01, which requires the department to reserve no less than 10% of a surface water's assimilative capacity.

Env-Wq 1708.09 Significant or Insignificant Determination.

(a) Any discharge or activity that is projected to use 20% or more of the remaining assimilative capacity for a water quality ***criterion*** ~~parameter, in terms of either concentration or mass of pollutants, or volume or flow rate for water quantity,~~ shall be considered a significant lowering of water quality.

(b) The department shall not approve a discharge or activity that will cause a significant lowering of water quality unless the applicant demonstrates, in accordance with Env-Wq 1708.10, that the proposed lowering of water quality is necessary to achieve important economic or social development in the area where the waterbody is located.

(c) Subject to (e), below, any applicant proposing an activity that will cause an insignificant lowering of water quality shall not be required to demonstrate that the activity is necessary to provide important economic or social development, provided the applicant implements best management practices to minimize degradation.

(d) Activities allowed under (c), above shall include, but not be limited to:

(1) Short term or intermittent discharges such as hydrostatic testing of pipelines, fire pump test water, and uncontaminated stormwater discharges or site clean-up activities;

(2) Permanent discharges such as uncontaminated noncontact cooling water, uncontaminated groundwater seepage, or unchlorinated or dechlorinated swimming pool water;

(3) Facilities whose nonpoint source runoff is controlled through the use of best management practices; and

(4) Any discharge or activity that is projected to use less than 20% of the remaining assimilative capacity for a water quality ***criterion*** ~~parameter, in terms of either concentration or mass for pollutants or volume or flow rate for water quantity~~.

(e) If the department determines based on the following factors that the effect of a discharge ***or activity*** results in a greater impact to the water quality than that normally found in insignificant discharges ***or activities***, the department shall determine that the proposed activity or discharge is significant, regardless of the proposed consumption of the remaining assimilative capacity, and require the applicant to demonstrate, in accordance with Env-Wq 1708.10, that a lowering of water quality is necessary to achieve an important economic or social development:

(1) The magnitude, duration, and spatial extent of the proposed change in water quality;

(2) The cumulative lowering of water quality over time resulting from the proposed activity in combination with previously approved activities;

(3) The possible additive or synergistic effects of the activity in combination with existing activities;

(4) The magnitude of the mass load independent of the total assimilative capacity or change in receiving water pollutant concentration;

(5) The toxic or bioaccumulative characteristics of the pollutant(s) in question;

(6) The potential to stress sensitive biological resources such as indigenous species, rare species, and threatened or endangered species and their habitat;

(7) The potential to stress sensitive recreational uses or water supply uses; or

(8) The quality and value of the resource.

Env-Wq 1708.10 Alternatives Analysis; Determination of Net Economic or Social Benefits.

(a) For purposes of this section, the following definitions shall apply:

(1) "Activity" means any of the activities listed in Env-Wq 1708.02 as being subject to this part, including all associated construction;

(2) "Area in which the water-body is located" means the directly affected municipality(ies) and, if necessary to quantify the net social and economic benefits of the activity, one or more of the municipalities that abut the directly affected municipality(ies), as determined by the applicant in consultation with the department;

(3) "Directly affected municipality(ies)" means the municipality or municipalities in which the waterbody that will be impacted by the activity is located; and

(4) "High value resource" means a natural or developed resource that is of particular value to the nation, region, state, or area in which the waterbody is located, including but not limited to state- or federally-listed threatened or endangered species, state or federal parks, public freshwater or saltwater beaches, and lands that are subject to conservation easements.

(b) For any activity that is determined to result in a significant impact to the existing water quality pursuant to Env-Wq 1708.09, the applicant shall provide documentation in accordance with (c) through (f), below, to demonstrate that:

(1) Lowering the water quality is necessary to accommodate the activity;

(2) The activity will provide net economic or social benefits in the area in which the waterbody is located; and

(3) The net social and economic benefits of constructing and operating or otherwise engaging in the activity outweigh the environmental impact that could be caused by the lower water quality.

(c) To determine whether the criteria specified in (b)(1)-(3), above, have been met, the applicant shall complete an alternatives analysis as described in (d), below, and submit the analysis and a request for approval of the preferred alternative to the department together with technically and scientifically valid supporting information.

(d) The alternatives analysis required by (c), above, shall describe the net social and economic benefits, as described in (e), below, and the water quality impacts, as described in (f), below, of constructing and operating or otherwise engaging in the activity and all practicable alternatives, including but not limited to the following:

(1) Alternative methods of production or operation;

(2) Improved process controls;

(3) Water conservation practices;

(4) Wastewater minimization technologies;

(5) Non-discharging alternatives;

(6) Improved wastewater ~~treatment~~ facility operation;

(7) Alternative methods of treatment, including advanced treatment beyond applicable technology requirements of the Clean Water Act;

(8) Alternative sites, and associated water quality impacts at those sites; and

(9) For activities that involve alteration of terrain, alternative site design that incorporates low impact development elements, including but not limited to creating less impermeable area or infiltrating or reusing stormwater.

(e) To determine whether the activity will provide net social and economic benefits in the area in which the waterbody is located, the applicant shall submit information on, and the department shall evaluate, each of the following:

(1) Whether the activity is consistent with municipal and regional master plans and economic development strategies; and

(2) An explanation of the effect that constructing and operating or otherwise engaging in the activity will have, or an explanation of why there will be no effect, on the following factors:

a. Public and social services;

b. Public health and safety;

c. Employment;

d. Tourism and recreation; and

e. Other social or economic factors that are specific to the area in which the waterbody is located.

(f) To determine the environmental impacts of lower water quality, the applicant shall submit information on, and the department shall evaluate, each of the following:

(1) Relative to designated uses, the sensitivity of existing and designated uses to the effects of constructing and operating or otherwise engaging in of the activity;

(2) Relative to pollutants, whether any pollutants are expected to be discharged as a result of constructing and operating or otherwise engaging in the activity and, if so, the nature of the pollutants and the anticipated fate and transport of the pollutants in the waterbody;

(3) Relative to water quality, whether water quality is expected to change as a result of constructing and operating or otherwise engaging in activity, and if so, the estimated degree of change in water quality;

(4) Relative to high value resources, whether any high value resources are present that would be affected by constructing and operating or otherwise engaging in the activity, and if so, the degree to which such resources are expected to be affected;

(5) Relative to flow characteristics or hydrologic modifications, whether any alterations to existing flows or other hydrologic modifications are expected as a result of constructing and operating or otherwise engaging in the proposed activity, and if so, the impacts of such alterations or modifications;

(6) Relative to water treatment technology, whether the activity incorporates any such technology other than passive stormwater treatment best management practices and, if so, the reliability of the treatment technology proposed, and the risk management plan for non-standard situations such as accidents, upsets, or failures; and

(7) Relative to any other factors that are specific to the affected waterbody or the area in which the waterbody is located, a description of the factor and an explanation of the effect of constructing and operating or otherwise engaging in the proposed activity on that factor.

(g) After reviewing the information submitted pursuant to (c) through (f), above, the department shall make a preliminary determination to:

(1) Approve the request, if it determines that the criteria specified in (b)(1)-(3), above, have been met; or

(2) Deny the request, if it determines that the criteria specified in (b)(1)-(3), above, have not been met.

(h) If the department's preliminary determination is to approve the applicant's request, the department shall provide the opportunity for public comment on its preliminary decision in accordance with Env-Wq 1708.11.

Env-Wq 1708.11 Public Participation and Intergovernmental Coordination.

(a) The department shall provide the opportunity for public comment and an opportunity to request a public hearing on preliminary decisions to allow any significant lowering of water quality determined in accordance with Env-Wq 1708.09(b) or (e).

(b) The department shall issue a written notice to the public, the municipality in which the activity is located or proposed to be located, and all potentially affected municipalities of a preliminary decision to allow a significant lowering of water quality.

(c) The notice provided pursuant to (b), above, shall:

(1) Invite written comments to be submitted to the department;

(2) Be posted by the department on its website and in at least one public place in the municipality in which the proposed activity will occur;

(3) Contain the information specified in (d), below; and

(4) For activities related to state surface water discharge permits, be a part of the normal public participation procedures associated with the issuance of the permit.

(d) The notice provided pursuant to (b), above, shall include the following information:

(1) A description of the proposed activity;

(2) A description of each surface water that would be affected and its use classification;

(3) A summary of the antidegradation provisions in these rules;

(4) A determination that existing uses and the water quality necessary thereto will be maintained and protected;

(5) A summary of the expected impacts on high quality waters, if any;

(6) A determination that where a lowering of water quality is allowed, all applicable water quality criteria will be met, designated uses will be protected, and any higher water quality achievable by the most stringent applicable technology-based requirements will be maintained;

(7) A summary of any other information that is relevant to how the activity complies or does not comply with the requirements of these rules;

(8) The summary of the important economic or social development that will be achieved by allowing the proposed activity, if applicable;

(9) A summary of the alternatives analysis and a finding that the lowering of water quality is necessary to provide a net economic and social benefit;

(10) The deadlines for submitting a request for public hearing and submitting written comments; and

(11) The name, address, and telephone number of the department employee to whom all written comments or requests for public hearing can be sent.

(e) To fulfill intergovernmental coordination, the department shall send a copy of the public notice to the following agencies and request comments:

(1) NH department of ***natural and cultural*** resources~~ and economic development~~;

(2) NH department of health and human services;

(3) NH fish and game department;

(4) NH ~~office~~ ***department*** of energy~~ and planning~~;

(5) Local river ***management*** advisory committees, if applicable;

(6) US EPA Region I;

(7) US Army Corps of Engineers;

(8) US Fish and Wildlife Service;

(9) National Marine Fisheries Service;

(10) National Park Service; and

(11) Natural Resources Conservation Service.

(f) The department shall:

(1) Prepare a summary of all comments received as a result of public participation and intergovernmental coordination and provide responses; and

(2) Post the summary of comments and responses on its website.

(g) If the department receives a request to hold a public hearing, the department shall issue public notice and conduct a public hearing in accordance with the provisions of Env-C 200 that apply to non-adjudicative proceedings.

(h) Following this public participation process, the department shall consider all comments and other information submitted during the process and make a final decision to allow or deny the proposed impact on water quality.

(i) The department shall notify the applicant in writing of its decision. If the application is denied and the applicant wishes to pursue the project, the applicant shall:

(1) Revise the submittal to decrease or eliminate the projected impact to high quality waters and resubmit the application for consideration under the full review process; or

(2) Appeal the decision as a permitting decision pursuant to RSA 21-O:14.

Env-Wq 1708.12 Transfer of Water.

(a) In this section, "transfer" means the intentional conveyance of water from one surface water to another surface water for the purpose of increasing the volume of water available ~~for withdrawal from~~ ***in*** the receiving surface water. The term does not include the transfer of stormwater, for the purpose of managing stormwater during construction, between basins created or otherwise lawfully used for stormwater detention or treatment, or both, and does not include the discharge of stormwater from a detention or treatment basin to a surface water.

(b) A transfer shall be subject to (c) and (d), below, if one or more of the following apply:

(1) The transfer was not in active operation, as determined pursuant to (f) through (i), below, prior to the effective date of the 2011 readoption of this section, August 23, 2011;

(2) The transfer is causing or contributing to a violation of surface water quality standards in the source water or receiving water; or

(3) A change that could impact any designated use of the source water or receiving water is made to the transfer on or after August 23, 2011 such that a water quality certification is required under RSA 485-A:12, III or IV.

(c) The transfer of water from one surface water to another shall be allowed only if all of the following conditions are met:

(1) The transferred water does not contain exotic aquatic species or other species of aquatic life that could result in a violation of Env-Wq 1703.19, relative to the integrity of the biological and aquatic community, in the receiving water;

(2) Existing and designated uses will be maintained and supported in the source water and in the receiving water;

(3) The withdrawal from the source water and transfer to the receiving water either:

a. Will not result in any degradation of water quality; or

b. Have both been reviewed under the process specified in Env-Wq 1708.10 and determined by the department to meet the criteria specified for approval in Env-Wq 1708.10(b)(1)-(3); and

(4) A water conservation plan that meets the water conservation requirements set forth in Env-Wq 2101 has been approved by the department and is being complied with.

(d) Transferred water may be treated to comply with the requirements of this section.

(e) The transfer of water shall not constitute a discharge under RSA 485-A:8, I, or RSA 485-A:13, I(a) if:

(1) The transfer is not subject to (c) and (d), above, pursuant to (b), above; or

(2) All of the conditions specified in (c), above, are met.

(f) A transfer shall be deemed to have been in active operation prior to August 23, 2011 if all of the following are true:

(1) The infrastructure necessary for the transfer is in place and in usable condition;

(2) Water has been transferred for at least one day in each of at least 3 years from 2000 through 2011; and

(3) At the time of its original initiation, the transfer complied with applicable legal requirements.

(g) If a transfer does not meet the conditions specified in (f), above, the person responsible for the transfer may request the department to make a determination that the transfer was in active operation by submitting the following information in writing:

(1) The reason(s) why the infrastructure necessary for the transfer is not in place or is not in usable condition, if applicable;

(2) The total time span, in years, over which the transfer has occurred from the first known transfer to the present;

(3) The most recent year during which the transfer occurred; and

(4) Why, based on the information provided in (1)-(3), above, it would be a fair and just result for the department to determine that the transfer qualifies as a transfer that was in active operation prior to August 23, 2011.

(h) If the department determines, based on information provided pursuant to (g), above, that it would be fair and just to determine that the transfer qualifies as a transfer that was in active operation prior to August 23, 2011, then the department shall make that determination.

(i) The department shall notify the person who requested a determination pursuant to (g), above, in writing of its decision.

PART Env-Wq 1709 CHANGE IN DESIGNATED USES

Env-Wq 1709.01 Definition. For purposes of this part, "change in designated use" means the removal of a designated use that is not an existing use, or the establishment of subcategories of a designated use.

Env-Wq 1709.02 Use Attainability Analysis Required. Before determining whether to propose a change in designated use, the department shall conduct a use attainability analysis in accordance with 40 CFR § 131.10.

Env-Wq 1709.03 Process to Propose Change in Designated Use.

(a) Based on the information obtained as a result of the use attainability analysis performed pursuant to Env-Wq 1709.02, the department shall determine whether a change in a designated use should be proposed as specified in (b), below.

(b) The department shall make the determination required by (a), above, when attaining a designated use is not feasible based on 40 CFR 131.10(g), as reprinted in Appendix F.

(c) If the department determines that a change in designated use should be proposed, the department shall conduct a non-adjudicative public hearing in accordance with the provisions of Env-C 200 applicable to non-adjudicative hearings to receive public comment on the determination.

(d) If the department continues to believe after the public comment period that a change in designated use should be proposed, the department shall propose that the change in designated use be made.

APPENDIX A: STATE OR FEDERAL STATUTES OR REGULATIONS IMPLEMENTED

Rule Section(s)	**State Statute or Federal Statute or Regulation Implemented**
Env-Wq 1701 (also see specific section listed below)	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq.*
Env-Wq 1701.03	RSA 485-A:13, I(a); 33 U.S.C. 1251 *et seq.*; 40 CFR § 122.47
Env-Wq 1701.04	RSA 485-A:13, I(a); 40 CFR § 131.14
Env-Wq 1702	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq.*
Env-Wq 1703	RSA 485-A:4, V; RSA 485-A:8, I, II, & III; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1704	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1705	RSA 485-A:4, V; RSA 485-A:6, VII; RSA 485-A:8, VI; RSA 485-A:13, I(a); 33 U.S.C. 1251 et seq
Env-Wq 1706	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1707	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1708	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1709	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*

APPENDIX B: INCORPORATED REFERENCES

Rule (Env-Wq)	Reference	Obtain At:
1703.05(c)	"EPA Combined Sewer Overflow (CSO) Control Policy", EPA 830-B-94-001, dated April, 1994	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at https://nepis.epa.gov/Exe/ZyNET.exe/2000407X.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000011%5C2000407X.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(d) intro	"Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003QI5.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\91thru94\Txt\00000011\20003QI5.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(d) (1)	"Streamlined Water-Effect Ratio procedure for Discharges of Copper", EPA-822-R-01-005, dated March 2001	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/901Q0I00.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Quer

Rule (Env-Wq)	Reference	Obtain At:
		y=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C00thru05%5CTxt%5C00000012%5C901Q0I00.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(d) (2)	"Aquatic Life Ambient Freshwater Quality Criteria - Copper", EPA-822-R-07-001, dated February 2007	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1000PXC.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\06thru10\Txt\00000002\P1000PXC.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(s)	"Final Aquatic Life Ambient Water Quality Criteria For Aluminum", EPA-822-R-18-001, dated December 2018	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P100VWXJ.txt?ZyActionD=ZyDocument&Client=EPA&Index=2016%20Thru%202020&Docs=&Query=Final%20Aquatic%20Life%20Ambient%20Water%20Quality%20Criteria%20Aluminum%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C16THRU20%5CTXT%5C00000010%5CP100VW

Rule (Env-Wq)	Reference	Obtain At:
		XJ.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1703.22(s)(1)a	The "Aluminum Criteria Calculator V2.0 (Excel)(xlsm)", dated December 2018	Available at no charge from EPA at https://www.epa.gov/wqc/2018-final-aquatic-life-criteria-aluminum-freshwater
1703.22(s)(1)b	The "Aluminum Criteria Calculator R Code and Data V2.0", dated November 15, 2019	Available at no charge from EPA at https://www.epa.gov/wqc/2018-final-aquatic-life-criteria-aluminum-freshwater
1704.02 intro	"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," EPA 822-B-00-004, dated October 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003D2R.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000001\20003D2R.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(a)	"Volume 1: Risk Assessment", EPA 822-B-00-005, dated October 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003D81.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000001\20003D81.txt&User=ANONYMOUS&Password=anonymous&Sort

Rule (Env-Wq)	Reference	Obtain At:
		Method=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(b)	"Volume 2: Development of National Bioaccumulation Factors", EPA-822-R-03-030, dated December 2003	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1005EZQ.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000022\P1005EZQ.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(c)	"Volume 3: Development of Site-Specific Bioaccumulation Factors", EPA-822-R-09-008, dated September 2009	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1005CAF.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=Methodology%20Deriving%20Ambient%20Water%20Quality%20Criteria%20Protection%20Human%20Health%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\ZYFILES\INDEX%20DATA\06THRU10\TXT\00000011\P1005CAF.txt&User=ANONYMOUS&Password=anonymous&SortMethod=f%3Atitle&MaximumDocuments=15&FuzzyDegree=-1&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionE&Back=ZyActionS&Ba

Rule (Env-Wq)	Reference	Obtain At:
		ckDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(4)	"Nutrient Criteria Technical Guidance Manual Rivers and Streams", EPA-822-B-00-002 dated July 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003CVP.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=EPA822B00002%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000001%5C20003CVP.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(5)	"Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs", EPA-822-B00-001 dated April 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003COV.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=Nutrient%20Criteria%20Technical%20Guidance%20Manual%20Lakes%20Reservoirs%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000001%5C20003COV.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(6)	"Nutrient Criteria Technical Guidance Manual Estuary and Coastal Marine Waters", EPA-822-B00-003 dated October 2001	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003FDF.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=EPA822B00002%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000004%5C20003FDF.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(7)	"Nutrient Criteria Technical Guidance Manual Wetlands", EPA-822-B-08-001 dated June 2008	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P1002DY6.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005&Docs=&Query=EPA822B08001%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000005%5CP1002DY6.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(8)	"Using Stressor-response Relationships to Derive Numeric Nutrient Criteria", EPA-820-S-10-001 dated November 2010	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P100IK1N.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005&Docs=&Query=EPA822B08001%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000034%5CP100IK1N.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(b)	"Guidance on the Development, Evaluation, and Application of Environmental Models", EPA-100-K-09-003 dated March 2009	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P1003E4R.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=Guidance%20Development%20Evaluation%20Application%20Environmental%20Models%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000007%5CP1003E4R.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1707.04	"Technical Support Document for Water Quality-based Toxics Control", EPA/505/2-90-001, dated March 1991	Available at no charge from: https://www3.epa.gov/npdes/pubs/owm0264.pdf

APPENDIX C: STATUTORY DEFINITIONS

RSA 485-A:2:

VI. "Industrial waste" means any liquid, gaseous or solid waste substance resulting from any process of industry, manufacturing trade or business or from development of any natural resources.

VIII. "Other wastes" means garbage, municipal refuse, decayed wood, sawdust, shavings, bark, lime, ashes, offal, oil, tar, chemicals and other substances other than sewage or industrial wastes, and any other substance harmful to human, animal, fish or aquatic life.

X. "Sewage" means the water-carried waste products from buildings, public or private, together with such groundwater infiltration and surface water as may be present.

XIV. "Surface waters of the state" means perennial and seasonal streams, lakes, ponds, and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, water courses, and other bodies of water, natural or artificial.

XVI. "Waste" means industrial waste and other wastes.

XIX. "Wastewater facilities" means the structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes, and dispose of the effluent and sludge.

RSA 482-A:2:

X. "Wetlands" means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

APPENDIX D: FEDERAL DEFINITIONS

40 CFR 122.2:

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 *et seq.*)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. It does not mean:

(a) Sewage from vessels; or

(b) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well [that is] used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

NOTE: Radioactive materials covered by the Atomic Energy Act are those encompassed in its definition of source, byproduct, or special nuclear materials. Examples of materials not covered include radium and accelerator-produced isotopes. See *Train v. Colorado Public Interest Research Group, Inc.*, 426 U.S. 1 (1976).

APPENDIX E: SUMMARY OF BACTERIA STANDARDS FROM RSA 485-A:8

Type of Waters	Standard
Class A other than designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli (E. coli) per 100 milliliters, unless naturally occurring; or (2) 153 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Class B other than designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 126 E. coli per 100 milliliters, unless naturally occurring; or (2) 406 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Class A or Class B at designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 47 E. coli per 100 milliliters, unless naturally occurring; or (2) 88 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Tidal waters used for swimming	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 35 enterococci per 100 milliliters, unless naturally occurring; or (2) 104 enterococci per 100 milliliters in any one sample, unless naturally occurring.
Tidal waters used for growing or taking of shellfish for human consumption	Same as for tidal waters used for swimming, PLUS must not exceed a geometric mean most probable number (MPN) of 14 organisms per 100 ml for fecal coliform, nor shall more than 10 percent of the samples exceed an MPN of 28 per 100 ml for fecal coliform, or

Type of Waters	Standard
	other values of equivalent protection based on sampling and analytical methods used by the department of environmental services shellfish program and approved in the latest revision of the National Shellfish Sanitation Program, Guide For The Control of Molluscan Shellfish.

APPENDIX F: CRITERIA FOR DETERMINATION OF CHANGE IN DESIGNATED USE

40 CFR §131.10 Designation of uses.

(g) States may remove a designated use which is not an existing use, as defined in § 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

Exhibit 3b

Cross-reference table – Env-Wq 1700 rule effective 12-01-2016 to IP Changes as of September 10, 2024

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
CHAPTER Env-Wq 1700	Added references to RSA 485-A:6, XIV & XV	XIV and XV were added to RSA 485-A:6 since the last updates to Env-Wq 1700 in 2016.	Aug-29, 2024 Meeting
PART Env-Wq 1701 PURPOSE; APPLICABILITY; COMPLIANCE SCHEDULES	Added "VARIANCES"	To reflect content addition.	Jan-14, 2021 (slides 59-66)
PART Env-Wq 1701 PURPOSE	Added references to RSA 485-A:8, II-a	II-a was added to RSA 485-A:8 since the last updates to Env-Wq 1700 in 2016.	Aug-29, 2024 Meeting
Env-Wq 1701.02 Applicability. (b)(1)	Struck "~~of any pollutant~~"	The certainty of a discharge and the requirement of a "pollutant" is inconsistent with Section 401 of the Clean Water Act (CWA) and case law.	Nov-4, 2021 (slide 14)
Env-Wq 1701.02	Added Env-Wq 1701.02 (a)(1) (a)(2) (a)(3)	Describes the legally constructed artificial waters are not surface waters under Env-Wq 1700.	Jun-13, 2023 Meeting Aug-29, 2024 Meeting
Env-Wq 1701.03 Compliance Schedules in NPDES Permits. (a)(2)	Clarifying text. Modify list to become; (b)(2)a. (b)(2)b. (b)(2)c.	Clarity to eliminate confusion.	Jan-13, 2022 Meeting
Env-Wq 1701.03 Compliance Schedules in NPDES Permits. (b)(2)	Clarifying text. (b)(2)	Clarify that all agencies agreement is necessary.	Jan-13, 2022 Meeting
Not applicable, new section.	New Section Env-Wq 1701.04 Variances	Variances are allowed under the CWA without explicit authorization in State WQStds. Added here for transparency.	Jan-14, 2021 (slides 59-66)

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Env-Wq 1702.02 "Acute toxicity"	Struck definition	Not used in the rules.	Jun-13, 2023 Meeting
Env-Wq 1702.04 [now .03] "Assimilative capacity"	Modified text	Create consistency between definition and Env-Wq 1708 by stipulating concentration or mass, and adding flow or volume.	Jan-13, 2022 Meeting
Env-Wq 1702.07 [now .06] "Best management practices"	Added "***hydrologic modification"***	WQStds include water quantity.	Jun-13, 2023 Meeting
Env-Wq 1702.18 [now .17] "Discharge" means: (a)	Clarifying text Struck "~~pollutant~~" Added "***flow***"	The certainty of a discharge and the requirement of a "pollutant" is inconsistent with Section 401 of the CWA and case law. WQStds include water quantity.	Nov-4, 2021 (slide 14)
Env-Wq 1702.19 [now .18] "Dissolved oxygen"	Change "mg/l" to "mg/L"	Corrected scientific notation.	Jun-13, 2023 Meeting
Env-Wq 1702.26 [now .25] "Mixing zone"	Struck "~~wastewater~~"	Inclusion of the term "wastewater" in the 2016 mixing zone definition could be misinterpreted to mean that mixing zones only apply to wastewater treatment facility discharges and not to other discharges such as those from construction projects or stormwater activities.	Nov-4, 2021 (slide 12)
Env-Wq 1702.41 "Publicly owned treatment works (POTW)"	Struck definition	Not used in the rules.	Jun-13, 2023 Meeting
Env-Wq 1702.47 "Toxicity test"	Struck definition	Not used in the rules.	Jun-13, 2023 Meeting
Not applicable, new section.	Added Env-Wq 1702.47 "Wastewater facility" definition.	Terminology used in Env-Wq 1700 but not defined. Refers to the RSA 485-A:2, XIX definition.	Jun-13, 2023 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (*some pre-2018 materials are still being added to the new website)*
Env-Wq 1702.50 [now .48] "Water quality standards"	Added "and antidegradation requirements."	To be consistent with the three fundamental parts of water quality standards under the CWA.	Jun-13, 2023 Meeting
Env-Wq 1702.51 [now .49] "Wetland"	"Wetland" to "Wetlands"	To be consistent with the RSA 482-A:2, X definition.	Jun-13, 2023 Meeting
Env-Wq 1703.01 Water Use Classifications; Designated Uses. (d)	Clarification	WQStds include all water quantity measures, not just "flow".	Jun-13, 2023 Meeting
Env-Wq 1703.03 General Water Quality Criteria. (c)	Struck phrase.	"Unless otherwise specifically allowed by a statute, rule, order, or permit" was added in the 2016 updates but not approved by EPA as CWA has specific limitations on how WQStds can be modified (variances, use attainability analysis, compliance schedules).	Jun-13, 2023 Meeting
Env-Wq 1703.04 Class-Specific Criteria. (a)	Struck phrase.	"unless otherwise specifically allowed by a statute, rule, order, or permit" was added in the 2016 updates but not approved by EPA as CWA has specific limitations on how WQStds can be modified (variances, use attainability analysis, compliance schedules).	Jun-13, 2023 Meeting
Env-Wq 1703.06 Bacteria. (c)	Added text	To align to the changes that were made to RSA 485:A8,V in 2021.	Jan-14, 2021 (slides 67-71) Jul-8, 2021 (slide 43) Nov-4, 2021 (slide 27)
Env-Wq 1703.07 Dissolved Oxygen. (b)	Correction	"…subject to (c) ~~and~~ ***through*** (e),…"	Jun-13, 2023 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Env-Wq 1703.07 Dissolved Oxygen. (b)(1)	Struck text.	Removed “as specified in RSA 485-A:8, II” which no longer specifies the specific numeric values but rather leaves that to the commissioner.	**Oct-13, 2016** NHDES-Current Crit., History, Other NE States, Issues. Mtg.sum. **Feb-9 2017** Pennsylvania Apprch. Mtg.sum. **Apr-13, 2017** NHDES-Why D.O.; NHDES-D.O. and temp.; NHF&G-FW Fish/Life stages; EPA 1986 FW Crit. Doc. Mtg. sum. **Sep-8, 2017** SB127- a) D.O.%Sat. removed, b) NHDES to adopt D.O. criteria **Oct-12, 2017** EPA-Glen Thursby – Va. Prov. Apprch. Mtg. sum. **Feb 2018** – NHDES DO data to EPA **Jan-11, 2018** NHDES-Update (slide 6). NHFG to generate species info. **Apr-12, 2018** NHDES-Update Mtg. sum. **Oct-11, 2018** NHDES-Update Mtg. sum. **Dec 2018** – Marine Fish Info; NHFG to NHDES to EPA **Apr-11, 2019** NHDES-Marine Discussion & Additional materials **Jul-25, 2019** NHDES-Status of EPA work update Mtg. sum. & Additional materials **Dec-6, 2019** EPA presentation on GBE data and VPA larval recruitment & Additional materials **Dec 2019** Legislation in process changing “dissolved oxygen concentration” to “dissolved oxygen” **Apr-9, 2020** NHDES-Attainment goal level. Conc & %Sat equivalency. Baseline criteria. **Jan-14, 2021** NHDES-Summary in context of triennial review (slides 72-76)

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (*some pre-2018 materials are still being added to the new website)*
Env-Wq 1703.15 Gross Beta Radioactivity.	Env-Wq 1703.15 Radionuclide Contaminants.	Major change to 1703.15-1703.17 as the old radionuclide criteria were based on a predecessor to the Safe DW Act. 1703.15 used to house the "Radionuclide Contaminants" MCLs. New text directly references the drinking water MCLs and that the criteria apply just to the 20-miles upstream of PWS surface waters	Jul-8, 2021 (slides 21-22) Nov-4, 2021 (slides 16-21) Aug-29, 2024 Meeting
Env-Wq 1703.16 Strontium 90.	Env-Wq 1703.16 Average Annual Concentrations Assumed to Produce a Total Body or Organ Dose of 4 mrem/year.	Major change to 1703.15-1703.17 as the old radionuclide criteria were based on a predecessor to the Safe DW Act. 1703.16 used to house the ""Average Annual Concentrations Assumed to Produce a Total Body or Organ Dose of 4 mrem/year" MCLs. New text directly references the drinking water MCLs and that the criteria apply just to the 20-miles upstream of PWS surface waters	Jul-8, 2021 (slides 21-22) Nov-4, 2021 (slides 16-21) Aug-29, 2024 Meeting
Env-Wq 1703.17 Radium 226.	Env-Wq 1703.16 Cyanotoxins. (a) (a)(1) (a)(2) (b) (c)	Major change to 1703.15-1703.17 as the old radionuclide criteria were based on a predecessor to the Safe DW Act. 1703.17 used to house the cyanotoxin criteria derived from EPA 304(a) guidance.	Jul-25, 2019 - Cyanobacteria (slides 1-28) Oct-1, 2020 Written update EPA Cyanotoxins Tech. Document Support draft Jan-14, 2021 (slides 48-50) Nov-4,2021 (slide 22)
Env-Wq 1703.20 Risk Factors for Human Health Criteria.	Revised terminology.	"Target Risk" rather than "Risk Factors" is now the standard terminology used by toxicologists and risk assessors.	Aug-29, 2024 Meeting
Env-Wq 1703.20 Risk Factors for Human Health Criteria. (a)	Added text.	Added, "Except as provided in (d) below…" to account for the new (d).	Jun-13, 2023 Meeting
Env-Wq 1703.20 Risk Factors for Human Health Criteria. (b)	Added text.	Added, "Except as provided in (d) below…" to account for the new (d).	Jun-13, 2023 Meeting

Rule Effective 12-01-2016 Section Modified	**Proposed Revisions**	**Comments**	**WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (****some pre-2018 materials are still being added to the new website)***
Env-Wq 1703.20 Risk Factors for Human Health Criteria. (c)	Clarification	2016 language is ambiguous and lead to many conversations and a fair bit of confusion.	Nov-4, 2021 (slide 15)
Not applicable, new section.	Added Env-Wq 1703.20 (d)	Revises the target risk for arsenic used by the department.	Jun-13, 2023 Meeting
Column Header: Protection of Aquatic Life Concentration in micrograms per liter (µg/l)	Change "ug/l" to "ug/L"	Corrected scientific notation.	Jan-13, 2022 Meeting
CAS Numbers	Revamped CAS Numbers	Corrected format to include hyphens. For instance, 83329 should be 83-32-9.	Jun-13, 2023 Meeting
Column Header: Protection of Aquatic Life Concentration in micrograms per liter (µg/l)	New note (v)	Added default toxins criteria frequency and duration statement for aquatic life designated use.	Nov-4, 2021 (slide 11)
Table 1703-1 *-added rows-*	Additional rows	Additional rows where MCLs exist in Env-Dw 702-706 and there was no corresponding row in Table 1703-1.	Jan-14, 2021 (slides 55-58) Jul-8, 2021 (slides 21-22)
Table 1703-1 *-Many rows-*	Updated Human Health Criteria	Many rows updated with most current "Water & Fish Ingestion" and "Fish Consumption Only" criteria.	Jan-14, 2021 (slides 46-47) Jul-8, 2021 (slides 11-16)
Table 1703-1 *-Many rows-*	"l" to "*l*" "Note l" to "Note *l*" "note *l*" to "Note *l*" "note l" to "Note *l*"	Created consistent use of "Note *l*" including some cases where 2016 rules missed adding italics to "l".	Jan-13, 2022 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Table 1703-1 CAS No: 7429905 Chemical Name: Aluminum	Note "s" revised	New criteria are variable dependent upon DOC, pH and hardness.	Oct-17, 2017 (mtg. sum.) EPA introduced draft 304(a) guidance Apr-11, 2019 (mtg.sum.) Jul-25, 2019 Mass. proposal Oct-1, 2020 Written update EPA Aluminum Tech. Support Document draft & NHDES sampling. Jan-14, 2021 (slides 51-54) Nov-4, 2021 (slide 23) Jun-13, 2023 (slides 9-38) Aug-29, 2024 Meeting
Table 1703-1 CAS No: 7440382 Chemical Name: Arsenic	Updated Human Health Criteria	Revised Human Health Criteria for "Water & Fish Ingestion" and "Fish Consumption Only" criteria. Differentiated between fresh and marine waters.	Jun-13, 2023 (slides 40-46)
Table 1703-1 CAS No: 70776033 Chemical Name: Chlorinated napthalenes	Added in the missing "h". Chlorinated nap**h**thalenes	Typo	Jan-13, 2022 Meeting
Table 1703-1 CAS No: N/A Chemical Name: Dinitro-o-cresol (2,4)	Deleted line	This name is an older synonym to Dinitro-o-cresol (4,6) (CASNO 534521) that was mistakenly left here between 2002 and 2015. Dinitro-o-cresol (4,6) (CASNO 534521) remains.	Nov-4, 2021 (slide 10)
Table 1703-1 Chemical Name: Endosulfans	Added Endosulfan and restructured alpha-Endosulfan and beta-Endosulfan	Restructuring of Endosulfan and its isomers, alpha-Endosulfan and beta-Endosulfan as the aquatic life criteria apply to the sum of the isomers, not the components individually while the HHC apply to the individual isomers.	Aug-29, 2024 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Table 1703-1 CAS No: 193395 Chemical Name: Ideno(1,2,3-cd)Pyrene	Added in the missing "n". I***n***deno(1,2,3-cd)Pyrene	Typo	Jan-13, 2022 Meeting
Table 1703-1 CAS No: 72435 Chemical Name: Methoxychlor Human Health, "Water & Fish Ingestion"	Deleted "*l*"	Updated 304(a) guidance value is below the MCL → "*l*" no longer applies	Jan-13, 2022 Meeting
Table 1703-1 CAS No: 108883 Chemical Name: Toluene Human Health, "Water & Fish Ingestion"	Deleted "*l*"	Updated 304(a) guidance value is below the MCL → "*l*" no longer applies.	Jan-13, 2022 Meeting
Table 1703-1 CAS No: 120821 Chemical Name: Trichlorbenzene 1,2,4"	Added in the missing "o". Trichlor***o***benzene 1,2,4	Typo.	Aug-29, 2024 Meeting
Table 1703-1 CAS No: 71556 Chemical Name: Trichloroethane 1,1,1 Human Health, "Fish Consumption Only"	Deleted "*l*"	Note "*l*" removed as it only applies to "Water & Fish Ingestion".	Jan-13, 2022 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (***some pre-2018 materials are still being added to the new website)**
Table 1703-1 CAS No: 88062 Chemical Name: Trichlorophenol 2,4,6 Human Health, "Fish Consumption Only"	Deleted "*c*"	Note "c" is removed as the 2 ug/L is based on organoleptic while the cancer-based FC value is 2.8 ug/L	Jan-13, 2022 Meeting
Env-Wq 1703.22 (c)	Revised text.	1 – "Target Risk" rather than "Risk Factors" is now the standard terminology used by toxicologists and risk assessors. 2 – Inserted text for the target risk now being used for the arsenic HHC.	Aug-29, 2024 Meeting
Env-Wq 1703.22 (d)	Added "also"	Clarification	Jan-13, 2022 Meeting
Env-Wq 1703.22 (f)	Change "mg/l" to "mg/L"	Corrected scientific notation.	Caught during Aug-29, 2024 meeting
Env-Wq 1703.22 (h)	"1703.32" → "1703.33"	Typo correction.	Jan-13, 2022 Meeting
Env-Wq 1703.22 (k)	Revised text.	1 – Explicitly stated "acute" criteria and the "1-hour average." 2 – Added the EPA reference document for gamma-BHC (lindane).	Jan-13, 2022 Meeting
Env-Wq 1703.22 (*l*)	Added, "The following criteria are to be met as…"	Added to align with MCL criteria frequency and duration assessment.	Jan-13, 2022 Meeting
Table 1703-2A:	Additional rows Removed rows	Rows added where MCLs in Env-Dw 702-706 were previously missing in Env-Wq 1700. Two rows removed as updated "Water & Fish Ingestion" criteria are below the MCL → "Note *l*" no longer apples.	Jan-14, 2021 (slides 55-58) Jul-8, 2021 (slides 21-22) Jan-13, 2022 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Env-Wq 1703.22 (o)	Modified	Selenium note from 2016 now directs to the new section Env-Wq 1703.34. Too complicated to be just a note.	Oct-1, 2020 Written update EPA Selenium Tech. Support materials in draft July-8, 2021 (slides 32-43)
Env-Wq 1703.22 (s)	Modified	Aluminum note rewritten to align with the updated 304(a) aluminum guidance variable dependent upon DOC, pH and hardness.	Oct-17, 2017 (mtg. sum.) EPA introduced draft 304(a) guidance Apr-11, 2019 (mtg.sum.) Jul-25, 2019 Mass. proposal Oct-1, 2020 Written update EPA Aluminum Tech. Support Document draft & NHDES sampling. Jan-14, 2021 (slides 51-54) Nov-4, 2021 (slide 23) Jan-13, 2022 Meeting Aug-29, 2024 Meeting
Not applicable, new section.	Added Env-Wq 1703.22 (v)	Added default toxins criteria frequency and duration statement for aquatic life designated use.	Nov-4, 2021 (slide 11)
Not applicable, new section.	Added Env-Wq 1703.22 (w)	Added a note about the different arsenic values for each of the HHC endpoints.	Aug-29, 2024 Meeting
Table 1703-3: Row: Chromium+3 Column: b_c	".6848" → "***0***.6848	Technical correction.	Jan-13, 2022 Meeting
Table 1703-8:	"Tempterature" → "Temperature"	Typo correction.	Jan-13, 2022 Meeting
Table 1703-8:	Number format corrections.	Many values that are less than 1 were missing their leading zero, as in, ".94" to "0.94"	Aug-29, 2024 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Not applicable, new section.	Env-Wq 1703.34 Freshwater Aquatic Life Criteria for Selenium. Table 1703-11: Freshwater Selenium Ambient Chronic Water Quality Criteria for Protection of Aquatic Life Env-Wq 1703.35 Notes for Table 1703-11	Selenium sections to align with updated 304(a) guidance. Too complicated to be just a note at Env-Wq 1703.22 (o).	Oct-1, 2020 Written update EPA Selenium Tech. Support materials in draft July-8, 2021 (slides 32-43) Jan-13, 2022 Meeting Aug-29, 2024 Meeting
Env-Wq 1704.02 Procedures	Clarification.	Added text to clarify the 1704.02 contains the procedures "for site specific human health criteria".	Aug-29, 2024 Meeting
Env-Wq 1704.03	Existing Env-Wq 1704.03 renumbered to Env-Wq 1704.04.	Renumbered section to make space for new Env-Wq 1704.03.	Aug-29, 2024 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Env-Wq 1704.03	New Env-Wq 1704.03 Procedures for Site-Specific Nutrient Criteria. (a) (a)(1) (a)(2) (a)(3) (a)(3)a. (a)(3)b. (a)(4) (a)(5) (a)(6) (a)(7) (a)(8) (b)	This new section houses the acceptable procedures for determining alternative site-specific nutrient criteria, including reference to a series of EPA guidance documents.	Aug-29, 2024 Meeting

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
PART Env-Wq 1705 FLOW STANDARDS	Renamed to PART Env-Wq 1705 PERMITTING RELATED STANDARDS	Heading changed to reflect content of the Part.	**Sep-08, 2017** - SB127-Nutrient limits based on flow > 7Q10 **Oct-17, 2021** Mtg. sum. Topic was introduced at WQSAC meeting. **Jan-11, 2018** NHDES-Background (slides 7-20); EPA-Permit Limits Calcs (slides 1-12); Clifton Bell-Alternatives (slides 1-21) **Apr-12, 2018** - NHDES-Recap (slides 1-13) & Applying other States Targets to a NH permit site (slides 1-3) **Oct-11, 2018** NHDES-Alternative scenarios (slides 1-77) **Apr-11, 2019** NHDES-Update Mtg. sum. **Jul-25, 2019** Nutrient permitting cont. (slides 1-25) & Additional materials **Dec-6, 2019** Additional materials **Jan-14, 2021** NHDES-Summary in context of triennial review (slides 77-82) **Nov-4, 2021** Rules framework (slide 24) Jan-13, 2022 Meeting Aug-29, 2024 Meeting
Env-Wq 1705.01 Assimilative Capacity.	Revised text	Env-Wq 1705.01(a) - Added "and Env-Wq 1705.03," for the new Env-Wq 1705.03.	*See Env-Wq 1705 above*
Env-Wq 1705.02 Low Flow Conditions for Permitting.	Renamed to Env-Wq 1705.02 Dilution and Nutrient Conditions for Permitting.	To reflect content.	*See Env-Wq 1705 above*
Env-Wq 1705.02 (a)	Added text	Clarify	*See Env-Wq 1705 above*

Rule Effective 12-01-2016 Section Modified	Proposed Revisions	Comments	WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (**some pre-2018 materials are still being added to the new website)*
Env-Wq 1705.02 (d)	Moved to Env-Wq 1705.02 (g), Modified	Provide for permitting toxins.	*See Env-Wq 1705 above*
Env-Wq 1705.02 (d)	New Env-Wq 1705.02 (d) (d)(1) (d)(1)a. (d)(1)b. (d)(1)c. (d)(1)c.i. (d)(1)c.ii. (d)(2) (d)(2)a. (d)(2)b. (d)(2)c. (d)(2)d.	New river nutrient permitting framework nutrient targets and flows to be used in the reasonable potential analysis.	*See Env-Wq 1705 above*
Not applicable, new section.	Env-Wq 1705.02 (e)	Provide for permitting ammonia as a toxin to aquatic life based on 7Q10.	*See Env-Wq 1705 above*
Not applicable, new section.	Env-Wq 1705.02 (f)	Allowing for 7Q10 to be used in nutrient permitting if needed to achieve compliance with other water quality criteria that must have permit limits based on the 7Q10 flow.	*See Env-Wq 1705 above*
Not applicable, new section.	Env-Wq 1705.02 (g)	Provide for permitting all non-nutrient aquatic life criteria and human health criteria for non-carcinogens based on 7Q10.	*See Env-Wq 1705 above*
Not applicable, new section.	Env-Wq 1705.02 (h) (h)(1) (h)(2)	Pertaining to data used for permitting.	*See Env-Wq 1705 above*

Rule Effective 12-01-2016 Section Modified	**Proposed Revisions**	**Comments**	**WQSIE Discussions & Activities (Presentations by NHDES unless otherwise noted) (****some pre-2018 materials are still being added to the new website)***
Not applicable, new section.	Env-Wq 1705.03 Restoration Activities (a) (b)	Pertaining to ecological restoration.	*See Env-Wq 1705 above*
Env-Wq 1706.01 Procedures.	Text that was Env-Wq 1706.01 is now Env-Wq 1706.01 (a), and Env-Wq 1706.01 (b) has been added.	To align to the changes that were made to RSA 485:A8,V in 2021.	Jan-14, 2021 (slides 67-71) Jul-8, 2021 (slide 43) Nov-4, 2021 (slide 27)
Env-Wq 1708.01 (c)	Struck "surface".	Creating consistent language in the rules.	Jun-13, 2023 Meeting
Env-Wq 1708.04 Protection of Water Quality in ORW.	Env-Wq 1708.04 (c) (c)(1) (c)(2)	Clarifying when ORW related provisions apply to be consistent with Env-Wq 1701.02 Applicability.	Jun-13, 2023 Meeting
Env-Wq 1708.09 Significant or Insignificant Determination.	Env-Wq 1708.09 (a) (d)(4)	Clarify that antidegradation significant or insignificant determinations provisions under the CWA apply to all criteria.	Aug-29, 2024 Meeting
Env-Wq 1708.10 Alternatives Analysis; Determination of Net Economic or Social Benefits.	Env-Wq 1708.10 (d)(6)	Aling with the defined terms in Env-Wq 1702.	Aug-29, 2024 Meeting
Env-Wq 1708.11 Public Participation and Intergovernmental Coordination.	Env-Wq 1708.11 (e)(1) (e)(4) (e)(5)	Update the organization names.	Aug-29, 2024 Meeting
Env-Wq 1708.12 Transfer of Water. (a)	Edit	As written, the definition could be an issue for Instream Flow Program activities and perhaps transfers to surface waters aiming to groundwater recharge.	Nov-4, 2021 (slide 13)

Exhibit 4

Readopt with amendment Env-Wq 1700, eff. 12-1-16 (Document #12042), to read as follows:

CHAPTER Env-Wq 1700 SURFACE WATER QUALITY REGULATIONS

Statutory Authority: RSA 485-A:6, I, XI-c, XIV & XV and RSA 485-A:8, VI

PART Env-Wq 1701 PURPOSE; APPLICABILITY; COMPLIANCE SCHEDULES; VARIANCES

Env-Wq 1701.01 Purpose. The purpose of these rules is to establish water quality standards for the state's surface water uses as set forth in RSA 485-A:8, I, II-a, II, III, and V. These standards are intended to protect public health and welfare, enhance the quality of water and serve the purposes of the federal Clean Water Act, 33 U.S.C. 1251 et seq., and RSA 485-A. These standards provide for the protection and propagation of fish, shellfish, and wildlife, and provide for such uses as recreational activities in and on the surface waters, public water supplies, agricultural and industrial uses, and navigation in accord with RSA 485-A:8, I and II.

Env-Wq 1701.02 Applicability. These rules shall apply to:

(a) All surface waters except:

(1) Artificial bodies of water for management of stormwater provided they are legally designed and constructed in accordance with all applicable permits and other legal requirements;

(2) Bodies of water that are exempt from permitting pursuant to RSA 482-A:3, IV(b); and

(3) Wastewater facilities designed and constructed to convey or treat sewage or waste, as defined in RSA 485-A:2, X and RSA 485-A:2, XVI respectively, and permitted in accordance with RSA 485-A:13; and

(b) Any person who:

(1) Causes any point or nonpoint source discharge to surface waters;

(2) Undertakes hydrologic modifications, such as dam construction or water withdrawals; or

(3) Undertakes any other activity that affects the beneficial uses or the water quality of surface waters.

Env-Wq 1701.03 Compliance Schedules in NPDES Permits.

(a) A national pollutant discharge elimination system (NPDES) permit issued or renewed for a discharge to New Hampshire surface waters, as defined herein, shall not specify a schedule leading to compliance with New Hampshire or federal surface water quality standards, or both, unless:

(1) The permittee cannot comply with the permit limits or other requirements immediately upon issuance of the permit; and

(2) The compliance schedule is provided to afford the permittee adequate time to comply with one or more permit requirements or limitations that are:

a. New;

b. Newly interpreted; or

c. Revised water quality standards that became effective after issuance of the original discharge permit and after July 1, 1977.

(b) A compliance schedule established to meet any surface water quality standard that applies to the New Hampshire waters receiving the discharge shall:

(1) Include dates for specified tasks or activities leading to compliance;

(2) Include interim effluent limits; and

(3) Require compliance at the earliest practicable time.

Env-Wq 1701.04 Water Quality Standards Variances. Water quality standards variances as defined in 40 CFR 131.3(o) shall be issued in accordance with 40 CFR § 131.14 and the commissioner's rulemaking authority under RSA 485-A:6, I, XI-c, XIV and XV and RSA 485-A:8, VI.

PART Env-Wq 1702 DEFINITIONS

Env-Wq 1702.01 "7Q10" means "7Q10" as defined in RSA 485-A:2, XXIV, namely "the lowest average flow that occurs for 7 consecutive days on an annual basis with a recurrence interval of once in 10 years on average, expressed in terms of volume per time period."

Env-Wq 1702.02 "Antidegradation" means a provision of the water quality standards that maintains and protects existing water quality and uses.

Env-Wq 1702.03 "Assimilative capacity" means the chemical, physical, biological, and radiological alterations that can occur without causing violations of applicable water quality criteria or impairing any existing or designated uses.

Env-Wq 1702.04 "Benthic community" means the community of plants and animals that live on, over, or in the substrate of the surface water.

Env-Wq 1702.05 "Benthic deposit" means any sludge, sediment, or other organic or inorganic accumulations on the bottom of the surface water.

Env-Wq 1702.06 "Best management practices" means those practices that are determined, after problem assessment and examination of all alternative practices and technological, economic, and institutional considerations, to be the most effective practicable means of preventing or reducing the amount of pollution, including hydrologic modification, generated by point or nonpoint sources to a level compatible with water quality goals.

Env-Wq 1702.07 "Biological integrity" means the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

Env-Wq 1702.08 "Biota" means species of plants or animals occurring in surface waters.

Env-Wq 1702.09 "Chronic toxicity" means an adverse effect, such as reduced reproductive success or growth or poor survival of sensitive life stages, that occurs as a result of prolonged exposure to a toxic substance.

Env-Wq 1702.10 "Class A and B waters" means those surface waters that are legislatively classified as Class A or B waters pursuant to RSA 485-A:8, I, II, and III.

Env-Wq 1702.11 "Clean Water Act (CWA)" means the federal Clean Water Act, Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117, Pub. L. 100-4, and 33 U.S.C. 1251 et seq.

Env-Wq 1702.12 "Community" means one or more populations co-occurring in surface waters.

Env-Wq 1702.13 "Criterion" means:

(a) A designated concentration of a pollutant;

(b) A narrative statement concerning that pollutant that when not exceeded, will protect an organism, a population, a community, or a prescribed water use; or

(c) A numeric value or narrative statement related to other characteristics of the surface waters, such as flow and biological community integrity.

Env-Wq 1702.14 "Cultural eutrophication" means the human-induced addition of wastes that contain nutrients to surface waters, resulting in excessive plant growth or a decrease in dissolved oxygen, or both.

Env-Wq 1702.15 "Department" means the department of environmental services.

Env-Wq 1702.16 "Designated uses" means those uses specified in water quality standards for each waterbody or segment whether or not such uses are presently occurring. The term includes the following:

(a) "Swimming and other recreation in and on the water", meaning the surface water is suitable for swimming, wading, boating of all types, fishing, surfing, and similar activities;

(b) "Fish consumption", meaning the surface water can support a population of fish free from toxicants and pathogens that could pose a human health risk to consumers;

(c) "Shellfish consumption", meaning the tidal surface water can support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers;

(d) "Aquatic life integrity", meaning the surface water can support aquatic life, including a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region;

(e) "Wildlife", meaning the surface water can provide habitat capable of supporting any life stage or activity of undomesticated fauna on a regular or periodic basis; and

(f) "Potential drinking water supply", meaning the surface water could be suitable for human intake and meet state and federal drinking water requirements after adequate treatment.

Env-Wq 1702.17 "Discharge" means:

(a) Additions, introductions, leakage, spillage, emissions, or flow to surface waters, either directly, or indirectly through the groundwater, whether done intentionally, unintentionally, negligently, or otherwise; or

(b) The placing of a pollutant in a location where the pollutant is likely to enter surface waters.

Env-Wq 1702.18 "Dissolved oxygen" means the oxygen dissolved as a gas in sewage, water, or other liquid expressed in milligrams per liter (mg/L), parts per million (ppm), or percent saturation.

Env-Wq 1702.19 "Effluent limitation(s)" means any restriction(s) imposed by the department pursuant to RSA 485-A on quantities, discharge rates, characteristics, or concentrations of pollutants, or any combination thereof, that are allowed to be discharged to surface waters.

Env-Wq 1702.20 "Epilimnion" means the upper, well-circulated warm layer of a thermally stratified lake, pond, impoundment, or reservoir.

Env-Wq 1702.21 "Existing uses" means those uses, other than assimilation or waste transport, that actually occurred in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards.

Env-Wq 1702.22 "High quality waters" means any surface water whose water quality is better than required by any aquatic life or human health water quality criteria contained in these rules or other criteria assigned to the surface water, or whose qualities and characteristics make the surface water critical to the propagation or survival of important living natural resources.

Env-Wq 1702.23 "Industrial waste" means "industrial waste" as defined in RSA 485-A:2, VI, as reprinted in Appendix C.

Env-Wq 1702.24 "Maintain and protect" means to preserve the existing and designated uses of surface waters.

Env-Wq 1702.25 "Mixing zone" means a defined area or volume of the surface water surrounding or adjacent to a discharge where the surface water, as a result of the discharge, might not meet all applicable water quality standards.

Env-Wq 1702.26 "Most sensitive use" means the use that is most susceptible to degradation by a specific pollutant, combination of pollutants, or activity, such as drinking, swimming, boating, fish and aquatic life propagation, fish consumption by higher level consumers including humans, or irrigation.

Env-Wq 1702.27 "Naturally-occurring conditions" means conditions that exist in the absence of human influences.

Env-Wq 1702.28 "Nephelometric turbidity unit (NTU)" means a standard used to measure the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through water, as measured by a nephelometer.

Env-Wq 1702.29 "Noncontact cooling water" means water used for cooling that does not come into direct contact with any raw material, intermediate product, waste product, or finished product and to which no pollutants, other than heat, have been added.

Env-Wq 1702.30 "Nonpoint source" means any source other than a point source.

Env-Wq 1702.31 "No observed effect concentration (NOEC)" means the highest measured continuous concentration, in percent, of an effluent at which no adverse effects are observed on the aquatic test organisms.

Env-Wq 1702.32 "Nuisance species" means any species of flora or fauna living in or near the water whose noxious characteristics or presence in sufficient number or mass prevent or interfere with a designated use of those surface waters.

Env-Wq 1702.33 "Other wastes" means "other wastes" as defined in RSA 485-A:2, VIII, as reprinted in Appendix C.

Env-Wq 1702.34 "Outstanding resource water (ORW)" means surface waters of exceptional recreational or ecological significance.

Env-Wq 1702.35 "pH" means a measure of the hydrogen ion concentration in a solution, expressed as the logarithm to the base 10, of the reciprocal of the hydrogen ion concentration in gram moles per liter.

Env-Wq 1702.36 "Point source" means a discernible, confined, and discrete conveyance from which pollutants are or might be discharged, excluding return flows from irrigated agriculture or agricultural stormwater runoff. The term includes, but is not limited to, a pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft.

Env-Wq 1702.37 "Pollutant" means "pollutant" as defined in 40 CFR 122.2, as reprinted in Appendix D.

Env-Wq 1702.38 "Pollution" means the man-made or man-induced alteration of the chemical, physical, biological, or radiological integrity of water.

Env-Wq 1702.39 "Population" means a group of individuals of one biological species co-occurring in time and space.

Env-Wq 1702.40 "Radionuclide" means a radioactive atomic nucleus specified by its atomic number, atomic mass, and energy state.

Env-Wq 1702.41 "Sewage" means "sewage" as defined in RSA 485-A:2, X, as reprinted in Appendix C.

Env-Wq 1702.42 "Surface waters" means "surface waters of the state" as defined in RSA 485-A:2, XIV, as reprinted in Appendix C, and waters of the United States as defined in 40 CFR 122.2.

Env-Wq 1702.43 "Tainting substance" means any material that can impart objectionable taste, odor, or color to the flesh of fish or other edible aquatic organisms.

Env-Wq 1702.44 "Tidal waters" means those portions of the Atlantic Ocean within the jurisdiction of the state, and all other surface waters subject to the rise and fall of the tide.

Env-Wq 1702.45 "Toxic unit chronic (TU_c)" means the reciprocal of the effluent dilution that causes no unacceptable effect to the test organisms by the end of the chronic exposure period, which can be calculated by dividing 100 by the chronic NOEC value.

Env-Wq 1702.46 "Waste" means "waste" as defined in RSA 485-A:2, XVI, as reprinted in Appendix C.

Env-Wq 1702.47 "Wastewater facilities" means "wastewater facilities" as defined in RSA 485-A:2, XIX, as reprinted in Appendix C, namely "the structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes, and dispose of the effluent and sludge."

Env-Wq 1702.48 "Water quality standards" means the combination of designated uses of surface waters, the water quality criteria for such surface waters based upon such uses, and antidegradation requirements.

Env-Wq 1702.49 "Wetlands" means "wetlands" as defined in RSA 482-A:2, X, as reprinted in Appendix C. Wetlands include, but are not limited to, swamps, marshes, bogs, and similar areas as delineated in accordance with Env-Wt 100 et seq.

Env-Wq 1702.50 "Zone of passage" means an area bordering a mixing zone that is free from pollutants and allows for unobstructed movement of aquatic organisms.

PART Env-Wq 1703 WATER QUALITY STANDARDS

Env-Wq 1703.01 Water Use Classifications; Designated Uses.

(a) All surface waters shall be classified as provided in RSA 485-A:8, based on the standards established therein for class A and class B waters. Each classification shall identify the most sensitive use it is intended to protect.

(b) All surface waters shall be restored to meet the water quality criteria for their designated classification including existing and designated uses, and to maintain the chemical, physical, and biological integrity of surface waters.

(c) All surface waters shall provide, wherever attainable, for the protection and propagation of fish, shellfish, and wildlife, and for recreation in and on the surface waters.

(d) Unless alterations in water quantity, including but not limited to flow rate, volume, area, or depth are caused by naturally-occurring conditions, surface water quantity shall be maintained at levels that protect existing uses and designated uses.

Env-Wq 1703.02 Wetlands Criteria.

(a) Subject to (b), below, wetlands shall be subject to the criteria listed in this part.

(b) Wherever the naturally-occurring conditions of the wetlands are different from the criteria listed in these rules, the naturally-occurring conditions shall be the applicable water quality criteria.

Env-Wq 1703.03 General Water Quality Criteria.

(a) The presence of pollutants in the surface waters shall not justify further introduction of pollutants from point or nonpoint sources, alone or in any combination.

(b) Once classified, state surface waters shall retain their legislated classification until such time as they are reclassified in accordance with RSA 485-A:10, even if they fail to meet any or all of the general, class-specific, or toxic criteria contained in this part.

(c) The following physical, chemical, and biological criteria shall apply to all surface waters:

(1) All surface waters shall be free from substances in kind or quantity that:

a. Settle to form harmful benthic deposits;

b. Float as foam, debris, scum, or other visible substances;

c. Produce odor, color, taste, or turbidity that is not naturally occurring and would render the surface water unsuitable for its designated uses;

d. Result in the dominance of nuisance species; or

e. Interfere with recreational activities;

(2) The level of radioactive materials in all surface waters shall not be in concentrations or combinations that would:

a. Be harmful to human, animal, or aquatic life or the most sensitive designated use;

b. Result in radionuclides in aquatic life exceeding the recommended limits for consumption by humans; or

c. Exceed limits specified in EPA's national drinking water regulations or subtitle Env-Dw, whichever are more stringent; and

(3) Tainting substances shall not be present in concentrations that individually or in combination are detectable by taste and odor tests performed on the edible portions of aquatic organisms.

Env-Wq 1703.04 Class-Specific Criteria.

(a) In addition to the general water quality criteria specified in Env-Wq 1703.03, the class-specific criteria specified in Env-Wq 1703.05 through Env-Wq 1703.33 shall apply to all surface waters.

(b) The surface waters in each classification shall satisfy all criteria applicable to the lower classification(s).

Env-Wq 1703.05 Combined Sewer Overflows.

(a) An applicant for a surface water discharge permit under RSA 485-A:13 who asserts that class B criteria cannot reasonably be met at all times in the receiving water due to combined sewer overflows shall conduct a use attainability analysis (UAA) in accordance with 40 CFR §131.10 and submit the UAA to the department.

(b) If, after public notice and comment, the department determines, based on the UAA and any public comments received, that the UAA supports the establishment of less stringent criteria, the department shall recommend a change in the classification of the waterbody to the legislature.

(c) Exceedances of class B criteria and uses due to combined sewer overflows shall be limited to those identified in the long-term combined sewer overflow plan developed in accordance with "EPA Combined Sewer Overflow (CSO) Control Policy", EPA 830-B-94-001, dated April, 1994, available as noted in Appendix B, after full implementation of the control measures.

Env-Wq 1703.06 Bacteria.

(a) Uses and criteria associated with bacteria shall be as set forth in RSA 485-A:8, I, II, and V, as summarized in Appendix E.

(b) Subject to (d), below, the bacteria criteria shall be applied at the end of a wastewater facility's discharge pipe.

(c) Tidal waters shall meet the national shellfish sanitation program, guide for the control of molluscan shellfish within the shellfish beds as specified in RSA 485-A:8, V.

(d) For any combined sewer overflow that discharges into non-tidal surface waters, a bacteria criteria of 1,000 Escherichia coli per 100 milliliters shall apply at the end of the combined sewer overflow's discharge pipe.

Env-Wq 1703.07 Dissolved Oxygen.

(a) Class A waters shall have a dissolved oxygen content of at least 75% saturation, based on a daily average, and an instantaneous minimum of at least 6 mg/L at any place or time except as naturally occurs.

(b) Except as naturally occurs and subject to (c) through (e), below, class B waters shall have a dissolved oxygen content of:

(1) At least 75% of saturation, based on a daily average; and

(2) An instantaneous minimum dissolved oxygen concentration of at least 5 mg/L.

(c) In areas identified by the New Hampshire fish and game department (NHF&G) as cold water fish spawning areas of species whose early life stages are buried in the gravel on the bed of the surface water, the 7 day mean dissolved oxygen concentration shall be at least 9.5 mg/L and the instantaneous minimum dissolved oxygen concentration shall be at least 8 mg/L for the period from October 1 of one year to May 14 of the next year, provided that the time period shall be extended to June 30 for a specific discharge to a specific waterbody if modeling done in consultation with the NHF&G determines the extended period is necessary to protect spring spawners or late hatches of fall spawners, or both.

(d) Unless naturally occurring or subject to (a), above, surface waters within the top 25 percent of depth of thermally unstratified lakes, ponds, impoundments, and reservoirs or within the epilimnion shall contain a dissolved oxygen content of at least 75 percent saturation, based on a daily average and an instantaneous minimum dissolved oxygen content of at least 5 mg/L. Unless naturally occurring, the dissolved oxygen content below those depths shall be consistent with that necessary to maintain and protect existing and designated uses.

(e) As specified in RSA 485-A:8, III, waters in a temporary partial use area established under RSA 485-A:8, II as a surface water that is receiving a combined sewer overflow discharge shall contain not less than 5 parts per million of dissolved oxygen for the duration of the discharge and up to 3 days following cessation of the discharge.

Env-Wq 1703.08 Benthic Deposits.

(a) Class A waters shall contain no benthic deposits, unless naturally occurring.

(b) Class B waters shall contain no benthic deposits that have a detrimental impact on the benthic community, unless naturally occurring.

Env-Wq 1703.09 Oil and Grease.

(a) Class A waters shall contain no oil or grease, unless naturally occurring.

(b) Class B waters shall contain no oil or grease in such concentrations that would impair any existing or designated uses.

Env-Wq 1703.10 Color.

(a) Class A waters shall contain no color, unless naturally occurring.

(b) Class B waters shall contain no color in such concentrations that would impair any existing or designated uses, unless naturally occurring.

Env-Wq 1703.11 Turbidity.

(a) Class A waters shall contain no turbidity, unless naturally occurring.

(b) Class B waters shall not exceed naturally occurring conditions by more than 10 NTUs.

(c) Turbidity in waters identified in RSA 485-A:8, III shall comply with the applicable long-term combined sewer overflow plan prepared in accordance with Env-Wq 1703.05(c).

(d) For purposes of state enforcement actions, if a discharge causes or contributes to an increase in turbidity of 10 NTUs or more above the turbidity of the receiving water upstream of the discharge or otherwise outside of the visible discharge, a violation of the turbidity standard shall be deemed to have occurred.

Env-Wq 1703.12 Slicks, Odors, and Surface Floating Solids.

(a) Class A waters shall contain no slicks, odors, or surface floating solids unless naturally occurring.

(b) Class B waters shall contain no slicks, odors, or surface floating solids that would impair any existing or designated use, unless naturally occurring.

(c) Slicks, odors, and surface floating solids in waters in temporary partial use areas shall comply with the applicable long-term combined sewer overflow plan prepared in accordance with Env-Wq 1703.05(c).

Env-Wq 1703.13 Temperature.

(a) There shall be no change in temperature in class A waters, unless naturally occurring.

(b) Temperature in class B waters shall be as specified in RSA 485-A:8, II and VIII.

Env-Wq 1703.14 Nutrients.

(a) Class A waters shall contain no phosphorus or nitrogen unless naturally occurring.

(b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.

(c) Existing discharges containing phosphorus or nitrogen, or both, which encourage cultural eutrophication shall be treated to remove the nutrient(s) to ensure attainment and maintenance of water quality standards.

(d) There shall be no new or increased discharge of phosphorus into lakes or ponds.

(e) There shall be no new or increased discharge containing phosphorus or nitrogen to tributaries of lakes or ponds that would contribute to cultural eutrophication or growth of weeds or algae in such lakes and ponds.

Env-Wq 1703.15 Radionuclide Contaminants. Waters within 20 miles upstream of any active surface water intake for a public water system as defined in RSA 485:1-a, XV shall not exceed the drinking water maximum contaminant level (MCL) for radionuclides contaminants, as specified in Env-Dw 703.01.

Env-Wq 1703.16 Beta Particle and Photon Radioactivity from Man-Made Sources. Waters within 20 miles upstream of any active surface water intake for a public water system as defined in RSA 485:1-a, XV shall not exceed the annual dose equivalent for beta particle and photon radioactivity, as specified in Env-Dw 703.03.

Env-Wq 1703.17 Cyanotoxins.

(a) The recreational human health criteria to protect swimming and other recreation in and on the water from excessive microcystin and cylindrospermopsin toxins shall be as follows:

(1) Microcystin shall not exceed 8 μg/L in 3 or more 10-day periods during a calendar 12-month period; or

(2) Cylindrospermopsin shall not exceed 15 μg/L in 3 or more 10-day periods during a calendar 12-month period.

(b) The values in (a)(1) and (2) shall be concentrations not to be exceeded more than once in 5-years.

(c) Other cyanotoxins shall be evaluated based on known health risks and potential for cyanotoxin production and accumulation.

Env-Wq 1703.18 pH.

(a) The pH of class A waters shall be as naturally occurs.

(b) As specified in RSA 485-A:8, II, the pH of class B waters shall be 6.5 to 8.0 unless due to natural causes.

(c) As specified in RSA 485-A:8, III, the pH of waters in temporary partial use areas shall be 6.0 to 9.0 unless due to natural causes.

Env-Wq 1703.19 Biological and Aquatic Community Integrity.

(a) All surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

(b) Differences from naturally-occurring conditions shall be limited to non-detrimental differences in community structure and function.

Env-Wq 1703.20 Target Risk for Human Health Criteria.

(a) Except as provided in (c) below, the department shall use a target risk of one in 1,000,000 when determining human health criteria.

(b) When establishing an alternative target risk the department shall not allow more risk than allowed by one in 100,000.

(c) The department shall use a target risk of one in 100,000 when determining human health criteria for arsenic.

Env-Wq 1703.21 Water Quality Criteria for Toxic Substances.

(a) Unless naturally occurring or allowed under Env-Wq 1707, all surface waters shall be free from toxic substances or chemical constituents in concentrations or combinations that:

(1) Injure or are inimical to plants, animals, humans, or aquatic life; or

(2) Persist in the environment or accumulate in aquatic organisms to levels that result in harmful concentrations in:

a. Edible portions of fish, shellfish, or other aquatic life; or

b. Wildlife that might consume aquatic life.

(b) Unless allowed under Env-Wq 1707 or naturally occurring, concentrations of toxic substances in all surface waters shall not exceed the recommended safe exposure levels of the most sensitive surface water use shown in Table 1703-1, subject to the notes in Env-Wq 1703.22, as follows:

Table 1703-01: Water Quality Criteria for Toxic Substances

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
83-32-9	Acenaphthene	1,700	520	970	710	20 µg [j]	20 µg [j]
107-02-8	Acrolein	3	3	55	--	3 µg	400 µg
107-13-1	Acrylonitrile	7,550	2,600	--	--	0.061 µg [c]	7 µg [c]
15972-60-8	Alachlor (Lasso)	--	--	--	--	Note l	--
116-06-3	Aldicarb (Temik)	--	--	--	--	Note l	--
1646-87-3	Aldicarb sulfoxide	--	--	--	--	Note l	--
1646-88-4	Aldicarb sulfone(aldoxycarb)	--	--	--	--	Note l	--
309-00-2	Aldrin	3.0 [k]	--	1.3 [k]	--	0.0007 ng [c]	0.0007 ng [c]
N/A	Alkalinity	--	20,000 [u]	--	--	--	--
7429-90-5	Aluminum	750 [s]	87 [s]	--	--	--	--
7664-41-7	Ammonia [a]	Note a	Note a	Note a	Note a	--	--
62-53-3	Aniline	28	14	77	37	--	--
120-12-7	Anthracene	(see Polynuclear Aromatic Hydrocarbons)				300 µg	400 µg
7440-36-0	Antimony	9,000	1,600	--	--	5.6 µg	640 µg
7440-38-2	Arsenic	340 [d, i]	150 [d, i]	69 [d, i]	36 [d, i]	0.19/0.18 µg [b, c, w]	4.1/2.2 µg [b, c, w]
1332-21-4	Asbestos	--	--	--	--	7,000,000 fibres [c]	--
1912-24-9	Atrazine (Atranex, Crisazine)	--	--	--	--	Note l	--
7440-39-3	Barium	--	--	--	--	1.0 mg	--
71-43-2	Benzene	5,300	--	5,100	700	2.1 µg [c]	58 µg [c]
92-87-5	Benzidine	2,500	--	--	--	0.14 ng [c]	11 ng [c]
56-55-3	Benzo(a) Anthracene	(see Polynuclear Aromatic Hydrocarbons)				0.0012 µg [c]	0.0013 µg [c]
50-32-8	Benzo(a) Pyrene	(see Polynuclear Aromatic Hydrocarbons)				0.00012 µg [c]	0.00013 µg [c]
205-99-2	Benzo(b) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				0.0012 µg [c]	0.0013 µg [c]
192-97-2	Benzo(e) Pyrene	(see Polynuclear Aromatic Hydrocarbons)				--	--
191-24-2	Benzo(g,h,i) Perylene	(see Polynuclear Aromatic Hydrocarbons)				--	--
205-82-3	Benzo(j) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				--	--
207-08-9	Benzo(k) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				0.012 µg [c]	0.013 µg [c]
7440-41-7	Beryllium	130	5.3	--	--	Note l	--

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
608-73-1	BHC (Hexachloro-cyclohexane)	100 [ek]	--	0.34 [ek]	--	(see individual compounds)	
319-84-6	alpha-BHC	(see BHC (Hexachloro-cyclohexane))				0.36 ng [c]	0.39 ng [c]
319-85-7	beta-BHC	(see BHC (Hexachloro-cyclohexane))				8 ng [c]	14 ng [c]
319-86-8	delta-BHC	(see BHC (Hexachloro-cyclohexane))				0.0123 µg	0.0414 µg
58-89-9	gamma-BHC (Lindane)	0.95	0.08 [k]	0.16 [k]	--	4.2 µg [l]	4.4 µg
608-73-1	technical-BHC	(see Hexachlorocyclo-hexane-(Technical))				(see Hexachlorocyclo-hexane-(Technical))	
111-91-1	Bis (2-Chloroethoxy) methane	(see Chloroalkyl ethers)				--	--
111-44-4	Bis (2-Chloroethyl) Ether	(see Chloroalkyl ethers)				0.03 µg [c]	2.2 µg [c]
108-60-1	Bis (2-Chloroiso- propyl) ether	(see Chloroalkyl ethers)				200 µg	4,000 µg
117-81-7	Bis (2-Ethylhexyl)Phthalate	(see Phthalate esters)				0.32 µg [c]	0.37 µg [c]
75-25-2	Bromoform	(see Halomethanes)				7 µg [c]	120 µg [c]
101-55-3	4-Bromophenyl phenyl ether	(see Haloethers)				--	--
85-68-7	Butyl benzyl phthalate	(see Phthalate esters)				0.1 µg[c]	0.1 µg[c]
7440-43-9	Cadmium [i]	0.39 [f, d]	0.21 [f, d]	33 [d]	7.9 [d]	Note 1	--
63-25-2	Carbaryl	2.1	2.1	1.6	--	--	--
1563-66-2	Carbofuran (Furadon, 4F)	--	--	--	--	Note l	--
56-23-5	Carbon Tetrachloride	35,200	--	50,000	--	0.4 µg [c]	5 µg [c]
57-74-9	Chlordane	2.4 [k]	0.0043 [k]	0.09 [k]	0.004 [k]	0.31 ng [c]	0.32 ng [c]
N/A	Chlorinated benzenes	250 [e]	50 [e]	160 [e]	129 [e]	(see individual compounds)	
108-90-7	Chlorobenzene	(See Chlorinated benzenes)				20 µg [j]	20 µg [j]
16887-00-6	Chlorides	860,000	230,000	--	--	--	--
70776-03-3	Chlorinated naphthalenes	1,600[e]	--	7.5[e]	--	(see individual compounds)	
7782-50-5	Chlorine	19	11	13	7.5	Note 1	--
10049-04-4	Chlorine Dioxide, as ClO_2	--	--	--	--	Note l	--
N/A	Chloroalkyl ethers	238,000[e]	--	--	--	(see individual compounds)	
10599-90-3	Chloramines, as Cl_2	--	--	--	--	Note l	--
111-44-4	Chloroethyl ether (Bis-2)	(see Bis (2-Chloroethyl) Ether)				(see Bis (2-Chloroethyl) Ether)	
110-75-8	Chloroethyl vinyl ether-2	(see Chloroalkyl ethers)				--	--
124-48-1	Chlorodibromomethane	(see Halomethanes)				0.8 µg [c]	21 µg [c]
111-91-1	Chloroethoxy methane (Bis-2)	(see Bis (2-Chloroethoxy) methane)				(see Bis (2-Chloroethoxy) methane)	
67-66-3	Chloroform	28,900	1,240	(see Halomethanes)		60 µg [c]	2,000 µg [c]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
108-60-1	Chloroisopropyl ether (Bis-2)	(see Bis (2-Chloroisopropyl) ether)				(see Bis (2-Chloroisopropyl) ether)	
59-50-7	p-Chloro-m-cresol	(see 3-Methyl-4-chlorophenol)				(see 3-Methyl-4-chlorophenol)	
542-88-1	Chloromethyl ether (Bis)	(see Chloroalkyl ethers)				0.15 ng [c]	17 ng [c]
91-58-7	Chloronaphthalene 2	(see Chlorinated naphthalenes)				800 µg	1,000 µg
95-57-8	Chlorophenol 2	4,380	2,000	--	--	0.1 µg [j]	0.1 µg [j]
108-43-0	Chlorophenol 3	--	--	--	--	0.1 µg [j]	0.1 µg [j]
106-48-9	Chlorophenol 4	--	--	29,700	--	0.1 µg [j]	0.1 µg [j]
93-72-1	Chlorophenoxy herbicides (2,4,5-TP)	--	--	--	--	100 µg [l]	400 µg
94-75-7	Chlorophenoxy herbicides (2,4-D)	--	--	--	--	1,300 µg [l]	12,000 µg
7005-72-3	Chlorophenyl phenyl ether 4	(see Haloethers)				--	--
2921-88-2	Chlorpyrifos	0.083	0.041	0.011	0.0056	--	--
59-50-7	Chloro-4 Methyl-3 Phenol	(see 3-Methyl-4-chlorophenol)				(see 3-Methyl-4-chlorophenol)	
18540-29-9	Chromium+6	16 [d, i]	11 [d, i]	1,100 [d, i]	50 [d, i]	Note l	--
16065-83-1	Chromium+3	152 [f, d, i]	19.8 [f, d ,i]	10300	--	Note l	--
218-01-9	Chrysene	(see Polynuclear Aromatic Hydrocarbons)				0.12 µg [c]	0.13 µg [c]
7440-50-8	Copper [i]	2.9 [f, d]	2.3 [f, d]	4.8 [d]	3.1 [d]	1,000 µg [j]	1,000 µg [j]
57-12-5	Cyanide	22[m]	5.2[m]	1.0[m]	1.0[m]	4 µg [q]	400 µg [q]
72-55-9	DDE(4,4')	1050	--	14	--	0.018 ng [c]	0.018 ng [c]
72-54-8	DDD(4,4')	0.6	--	3.6	--	0.12 ng [c]	0.12 ng [c]
50-29-3	DDT(4,4')	1.1[k, t]	0.001[k, t]	0.13[k, t]	0.001[k, t]	0.03 ng [c]	0.03 ng [c]
75-99-0	Dalapon	--	--	--	--	Note l	--
8065-48-3	Demeton	--	0.1	--	0.1	--	--
333-41-5	Diazinon	0.17	0.17	0.82	0.82	--	--
53-70-3	Dibenzo(a,h)Anthracene	(see Polynuclear Aromatic Hydrocarbons)				0.12 ng [c]	0.13 ng[c]
96-12-8	Dibromochloropropane (DBCP)	--	--	--	--	Note l	--
84-74-2	Dibutyl Phthalate	(see Di-n-butyl Phthalate)				(see Di-n-butyl Phthalate)	
N/A	Dichlorobenzenes	1,120[e]	763[e]	1,970[e]	--	(see individual compounds)	
95-50-1	Dichlorobenzene(1,2)	(see Dichlorobenzenes)				1,000 µg [l]	3,000 µg
541-73-1	Dichlorobenzene(1,3)	(see Dichlorobenzenes)				7 µg	10 µg
106-46-7	Dichlorobenzene(1,4)	(see Dichlorobenzenes)				300 µg [l]	900 µg
91-94-1	Dichlorobenzidine(3,3')	--	--	--	--	0.049 µg [c]	0.15 µg [c]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (μg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
75-27-4	Dichlorobromomethane	(see Halomethanes)				0.95 μg [c]	27 μg [c]
75-71-8	Dichlorodifluoromethane	(see Halomethanes)				6.9 mg [c]	570 mg [c]
107-06-2	Dichloroethane(1,2)	118,000	20,000	113,000	--	9.9 μg [c, l]	650 μg [c]
25323-30-2	Dichloroethylenes	11,600 [e]	--	224,000 [e]	--	(see individual compounds)	
75-35-4	Dichloroethylene(1,1)	(see Dichloroethylenes)				300 μg [l]	20,000 μg
156-59-2	Dichloroethylene (1,2-cis)	-- -- -- --(see Dichloroethylenes)				Note l	--
156-60-5	Dichloroethylene (1,2-Trans)	(see Dichloroethylenes)				100 μg [l]	4,000 μg
576-24-9	Dichlorophenol(2,3)	--	--	--	--	0.04 μg [j]	0.04 μg [j]
120-83-2	Dichlorophenol(2,4)	2020	365	--	--	0.3 μg [j]	0.3 μg [j]
583-78-8	Dichlorophenol(2,5)	--	--	--	--	0.5 μg [j]	0.5 μg [j]
87-65-0	Dichlorophenol(2,6)	--	--	--	--	0.2 μg [j]	0.2 μg [j]
95-77-2	Dichlorophenol(3,4)	--	--	--	--	0.3 μg [j]	0.3 μg [j]
26638-19-7	Dichloropropanes	23,000 [e]	5,700 [e]	10,300 [e]	3,040 [e]	(see individual compounds)	
78-87-5	Dichloropropane(1,2)	(see Dichloropropanes)				0.9 μg [c]	31 μg [c]
26952-23-8	Dichloropropenes	6,060 [e]	244 [e]	790 [e]	--	(see individual compounds)	
542-75-6	Dichloropropene(1,3)	(see Dichloropropenes)				0.27 μg [c]	12 μg [c]
60-57-1	Dieldrin	0.24	0.056[k]	0.71[k]	0.0019[k]	0.0012 ng [c]	0.0012 ng [c]
84-66-2	Diethyl Phthalate	--	--	--	--	600 μg	600 μg
105-67-9	Dimethyl Phenol(2,4)	1,300	530	270	110	100 μg	400 μg [j]
131-11-3	Dimethyl Phthalate	(see Phthalate esters)				2,000 μg	2,000 μg
84-74-2	Di-n-butyl Phthalate	(see Phthalate esters)				20 μg	30 μg
N/A	Dinitrotoluenes	330 [e]	230 [e]	590 [e]	370 [e]	(see individual compounds)	
121-14-2	Dinitrotoluene(2,4)	(see Dinitrotoluenes)				0.049 μg [c]	1.7 μg [c]
606-20-2	Dinitrotoluene(2,6)	(see Dinitrotoluenes)				--	--
534-52-1	Dinitro-o-cresol (4,6)	(see 2 Methyl-4,6-Dinitrophenol)				(see 2 Methyl-4,6-Dinitrophenol)	
25550-58-7	Dinitrophenols	(see Nitrophenols)				10 μg	1,000 μg
51-28-5	Dinitrophenol(2,4)	(see Nitrophenols)				10 μg	300 μg
117-84-0	Di-n-octyl phthalate	(see Phthalate esters)				--	--
88-85-7	Dinoseb	--	--	--	--	Note l	--
85-00-7	Diquat	--	--	--	--	Note l	--
1746-01-6	2,3,7,8-TCDD (Dioxin)	--	--	--	--	0.000005 ng [c]	0.0000051 ng [c]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
122-66-7	Diphenylhydrazine(1,2)	270	--	--	--	0.03 µg [c]	0.2 µg [c]
103-23-1	Di(2-ethylhexyl)adipate	--	--	--	--	Note l	--
117-81-7	Di-2-ethylhexyl phthalate	(see Bis (2-Ethylhexy)Phthalate)				(see Bis (2-Ethylhexy)Phthalate)	
115-29-7	Endosulfan	0.22 [k, r]	0.056 [k, r]	0.034 [k, r]	0.0087 [k, r]	(see individual compounds)	
959-98-8	alpha-Endosulfan	(see Endosulfan)				20 µg	30 µg
33213-65-9	beta-Endosulfan	(see Endosulfan)				20 µg	40 µg
1031-07-8	Endosulfan Sulfate	--	--	--	--	20 µg	40 µg
145-73-3	Endothall	--	--	--	--	Note l	--
72-20-8	Endrin	0.086	0.036	0.037 [k]	0.0023 [k]	0.03 µg	0.03 µg
7421-93-4	Endrin Aldehyde	--	--	--	--	1 µg	1 µg
100-41-4	Ethylbenzene	32000	--	430	--	68 µg	130 µg
106-93-4	Ethylene Dibromide (EDB)	--	--	--	--	Note l	--
206-44-0	Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				20 µg	20 µg
86-73-7	Fluorene	(see Polynuclear Aromatic Hydrocarbons)				50 µg	70 µg
16984-48-8	Flouride	--	--	--	--	Note l	--
1071-83-6	Glyphosate	--	--	--	--	Note l	--
86-50-0	Guthion	--	0.01	--	0.01	--	--
N/A	Haloethers	360 [e]	122 [e]	--	--	(see individual compounds)	
N/A	Halomethanes	11,000 [e]	--	12,000 [e]	6,400 [e]	(see individual compounds)	
76-44-8	Heptachlor	0.52 [k]	0.0038 [k]	0.053 [k]	0.0036 [k]	0.0059 ng [c]	0.0059 ng [c]
1024-57-3	Heptachlor Epoxide	0.52 [k]	0.0038 [k]	0.053 [k]	0.0036 [k]	0.032 ng [c]	0.032 ng [c]
67-72-1	Hexachloroethane	980	540	940	--	0.1 µg [c]	0.1 µg [c]
118-74-1	Hexachlorobenzene	(see Chlorinated benzenes)				0.079 ng [c]	0.079 ng [c]
87-68-3	Hexachlorobutadiene	90	9.3	32	--	0.01 µg [c]	0.01 µg [c]
608-73-1	Hexachlorocyclo-hexane-(Technical)	(see BHC (Hexachloro-cyclohexane))				0.0066 µg	0.01 µg
77-47-4	Hexachlorocyclopentadiene	7	5.2	7	--	1.0 [j]	1.0 [j]
193-39-5	Indeno(1,2,3-cd)Pyrene	(see Polynuclear Aromatic Hydrocarbons)				0.0012 µg [c]	0.0013 µg [c]
7439-89-6	Iron	--	1000	--	--	0.3 mg [j]	--
78-59-1	Isophorone	117,000	--	12,900	--	34 µg [c]	1,800 µg [c]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
7439-92-1	Lead [i]	10.5 [f, d]	0.41 [f, d]	210 [d]	8.1 [d]	--	--
121-75-5	Malathion	--	0.1	--	0.1	--	--
7439-96-5	Manganese	--	--	--	--	50 µg [j]	100 µg
7439-97-6	Mercury	1.4 [d, i]	0.77 [d, i]	1.8 [d, i]	0.94 [d, i]	0.05 µg	0.051 µg
72-43-5	Methoxychlor	--	0.03	--	0.03	0.02 µg	0.02 µg
74-83-9	Methyl Bromide	(see Halomethanes)				100 µg	10,000 µg
74-87-3	Methyl Chloride	(see Halomethanes)				--	--
1634-04-4	Methyl tertiary-butyl ether (MtBE)	--	--	--	--	Note l	--
75-09-2	Methylene Chloride	(see Halomethanes)				20 µg [cl]	1,000 µg [c]
22967-92-6	Methylmercury	(see Mercury)				--	0.3 mg/kg [g]
534-52-1	2 Methyl-4,6-Dinitrophenol	(see Nitrophenols)				2 µg	30 µg
1570-64-5	2-Methyl-4-chlorophenol	--	--	--	--	1,800 µg [j]	1,800 µg [j]
59-50-7	3-Methyl-4-chlorophenol	30	--	--	--	500 µg [j]	2,000 µg [j]
615-74-7	3-Methyl-6-chlorophenol	--	--	--	--	20 µg [j]	20 µg [j]
2385-85-5	Mirex	--	0.001	--	0.001	--	--
91-20-3	Naphthalene	2,300	620	2,350	--	--	--
7440-02-0	Nickel [i]	120.0 [f, d]	13.3 [f, d]	74 [d]	8.2 [d]	610 µg	4,600 µg
14797-65-0	Nitrite-N	--	--	--	--	Note l	--
14797-55-8	Nitrate-N	--	--	--	--	10 mg[l]	--
14797-55-8 + 14797-65-0	Nitrate-N + Nitrite-N	--	--	--	--	Note l	--
98-95-3	Nitrobenzene	27000	--	6680	--	10 µg	30 µg[j]
25154-55-6	Nitrophenols	230 [e]	150 [e]	4,850 [e]	--	(see individual compounds)	
88-75-5	Nitrophenol 2	(see Nitrophenols)				--	--
100-02-7	Nitrophenol 4	(see Nitrophenols)				--	--
N/A	Nitrosamines	5,850 [e]	--	3,300,000 [e]	--	0.8 ng	1.24 µg
924-16-3	Nitrosodibutylamine N	(see Nitrosamines)				6.3 ng [c]	220 ng [c]
55-18-5	Nitrosodiethylamine N	(see Nitrosamines)				0.8 ng [c]	1,240 ng [c]
62-75-9	Nitrosodimethylamine N	(see Nitrosamines)				0.69 ng [c]	3 µg [c]
621-64-7	Nitrosodi-n-propylamine N	(see Nitrosamines)				0.005 µg [c]	0.51 µg [c]
86-30-6	Nitrosodiphenylamine N	(see Nitrosamines)				3.3 µg [c]	6 µg [c]
930-55-2	Nitrosopyrrolidine N	(see Nitrosamines)				16 ng [c]	34,000 ng [c]
84852-15-3	Nonylphenol	28	6.6	7	1.7	--	--

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
56-38-2	Parathion	0.065	0.013	--	--	--	--
1336-36-3	PCB	2.0 [e, n]	0.014 [e, n]	10.0 [e, n]	0.03 [e, n]	0.064 ng [c, n]	0.064 ng [c, n]
N/A	PCB-1242	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1254	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1221	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1248	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1260	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1016	(see PCB)				(see PCB)	(see PCB)
76-01-7	Pentachloroethane	7240	1100	390	281	--	--
608-93-5	Pentachlorobenzene	(see Chlorinated benzenes)				0.1 µg	0.1 µg
87-86-5	Pentachlorophenol	5.28 [h]	4.05 [h]	13	7.9	0.03 µg [c]	0.04 µg [c]
85-01-8	Phenanthrene	(see Polynuclear Aromatic Hydrocarbons)				--	--
108-95-2	Phenol	10,200	2,560	5,800	--	300 µg [j]	300 µg [j]
N/A	Phthalate Esters	940 [e]	3 [e]	2,944 [e]	3.4 [e]	--	--
1336-36-3	Polychlorinated Biphenyls	(see PCBs)				(see PCB)	(see PCB)
N/A	Polynuclear Aromatic Hydrocarbons	--	--	300 [e]	--	(see individual compounds)	
23135-22-0	Oxamyl (Vydate)	--	--	--	--	Note l	--
355-46-4	Perfluorohexane sulfonic acid (PFHxS)	--	--	--	--	Note l	--
375-95-1	Perfluorononanoic acid (PFNA)	--	--	--	--	Note l	--
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	--	--	--	--	Note l	--
335-67-1	Perfluorooctanoic Acid (PFOA)	--	--	--	--	Note l	--
1918-02-1	Picloram	--	--	--	--	Note l	--
129-00-0	Pyrene	(see Polynuclear Aromatic Hydrocarbons)				20 µg	30 µg
7782-49-2	Selenium	Note o	Note o	290[d,i]	71[d,i]	170 µg [l]	4,200 µg
7440-22-4	Silver	0.20[d,f, i, k]	--	1.9[d,i,k]	--	105 µg [p]	65 mg [p]
122-34-9	Simazine	--	--	--	--	Note l	--
100-42-5	Styrene	--	--	--	--	Note l	--
7783-06-4	Sulfide-Hydrogen Sulfide	--	2	--	2	--	--
95-94-3	Tetrachlorobenzene 1,2,4,5	(see Chlorinated benzenes)				0.03 µg	0.03 µg

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		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
79-34-5	Tetrachloroethane 1,1,2,2	(see Tetrachlor-oethanes)	2400	9020	--	0.2 µg [c]	3 µg [c]
25322-20-7	Tetrachloroethanes	9,320 [e]	--	--	--	(see individual compounds)	
127-18-4	Tetrachloroethylene	5,280	840	10,200	450	10 µg [c]	29 µg [c]
935-95-5	Tetrachlorophenol 2,3,5,6	--	--	440	--	--	--
58-90-2	Tetrachlorophenol 2,3,4,6	--	--	--	--	1.0 µg [j]	1.0 µg [j]
7440-28-0	Thallium	1,400	40	2,130	--	0.24 µg	0.47 µg
108-88-3	Toluene	17,500	--	6,300	5,000	57 µg	520 µg
8001-35-2	Toxaphene	0.73	0.0002	0.21	0.0002	0.70 ng [c]	0.71 ng [c]
N/A	Tributyltin (TBT)	0.46	0.072	0.42	0.0074	--	--
N/A	Trichlorinated Ethanes	18,000 [e]	--	--	--	(see individual compounds)	
120-82-1	Trichlorobenzene 1,2,4	(see Chlorinated benzenes)				0.071 µg [c]	0.076 µg [c]
71-55-6	Trichloroethane 1,1,1	--	--	31,200	--	10 mg [l]	200 mg
79-00-5	Trichloroethane 1,1,2	--	9,400	--	--	0.55 µg [c]	8.9 µg [c]
79-01-6	Trichloroethylene	45,000	21,900	2,000	--	0.6 µg [c]	7 µg [c]
75-69-4	Trichlorofluoromethane	(see Halomethanes)				10 mg	860 mg
95-95-4	Trichlorophenol 2,4,5	--	--	--	--	1.0 µg [j]	1.0 µg [j]
88-06-2	Trichlorophenol 2,4,6	--	970	--	--	1.5 µg [c]	2.0 µg [c,j]
75-01-4	Vinyl Chloride	--	--	--	--	0.022 µg [c]	1.6 µg [c]
1330-20-7	Xylene, Total	--	--	--	--	Note l	--
7440-66-6	Zinc [i]	30.0 [f, d]	30.0 [f, d]	90[d]	81[d]	5,000 µg [j]	5,000 µg [j]

Env-Wq 1703.22 Notes For Table 1703-1. The following shall apply to Table 1703-1:

(a) The letter "a" shall indicate that the freshwater and saltwater aquatic life criteria for ammonia are shown in Env-Wq 1703.25 through Env-Wq 1703.32;

(b) The letter "b" shall indicate that the criteria refer to the inorganic form only;

(c) The letter "c" shall indicate that these criteria for the protection of human health are based on carcinogenicity using a target risk of one in 1,000,000, except for arsenic which shall be based on a target risk of one in 100,000, while the human health criteria without this footnote are based on systemic toxicity. Other target risks shall be allowed only as specified in Env-Wq 1703.20;

(d) The letter "d" shall indicate that criteria for these metals are expressed as a function of the water effect ratio (WER), and that because the values displayed in Table 1703-1 correspond to a WER of 1.0, metals criteria for different WERs shall be determined using the procedures described in the EPA publication "Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994, available as noted in Appendix B, provided that for copper, either of the following references, both available as noted in Appendix B, may also be used:

(1) The "Streamlined Water-Effect Ratio procedure for Discharges of Copper", EPA-822-R-01-005, dated March 2001; or

(2) The Biotic Ligand Model, freshwater only, as described in "Aquatic Life Ambient Freshwater Quality Criteria - Copper", EPA-822-R-07-001, dated February 2007;

(e) The letter "e" shall indicate that the following classes of compounds have 2 or more isomers and the appropriate aquatic life criteria apply to the sum of the concentrations of each isomer:

(1) BHC;

(2) Chlorinated benzenes;

(3) Chlorinated naphthalenes;

(4) Chloroalkyl ethers;

(5) Dichlorobenzenes;

(6) Dichloroethylenes;

(7) Dichloropropanes;

(8) Dichloropropenes;

(9) Dinitrotoluenes;

(10) Haloethers;

(11) Halomethanes;

(12) Nitrophenols;

(13) Nitrosamines;

(14) PCB;

(15) Phthalate esters;

(16) Polynuclear aromatic hydrocarbons;

(17) Tetrachloroethanes; and

(18) Trichlorinatedethanes;

(f) The letter "f" shall indicate that the freshwater aquatic criteria for these metals are expressed as a function of the total hardness, as mg/L $CaCO_3$ of the surface water, and that because the values displayed in Table 1703-1 correspond to a total hardness of 20 mg/L the aquatic life criteria for other hardness values expressed as calcium carbonate shall be calculated using the equations and tables in Env-Wq 1703.23 and Env-Wq 1703.24;

(g) The letter "g" shall indicate that if the methylmercury concentration in the edible portion of the aquatic species of concern exceeds 0.3 mg/kg, a risk assessment shall be conducted to determine whether a consumption advisory should be issued for the surface water. If a consumption advisory is issued by the department, the surface water shall be considered in non-attainment of the fish or shellfish consumption designated uses and in violation of these surface water quality regulations;

(h) The letter "h" shall indicate that the freshwater aquatic life criteria for pentachlorophenol are expressed as a function of pH. Values displayed in Table 1703-1 correspond to a pH value of 6.5. For other pH values, the formulas shown in Env-Wq 1703.33 shall be used;

(i) The letter "i" shall indicate that the values presented for aquatic life protection are dissolved metals and for hardness-dependent metals are based on a hardness of 20 mg/L. To convert dissolved to total recoverable metal, the equations and tables in Env-Wq 1703.23 shall be used. To calculate dissolved or total recoverable fresh water criteria for hardness-dependent metals for hardness values other than 20 mg/l, the equations and tables shown in Env-Wq 1703.23 and Env-Wq 1703.24 shall be used;

(j) The letter "j" shall indicate that these human health criteria prevent taste and odor effects in the surface water and in fish and other aquatic life as prohibited in Env-Wq 1703.03(c)(1)c. and (3);

(k) The letter "k" shall indicate that the acute criteria are based on EPA's 304(a) criteria in the 1980 documents listed below and were derived to be used as instantaneous maximum values, or to be applied after division by 2, to obtain a value comparable to an acute criterion as a 1-hour average when assessment is done using an averaging period:

(1) Aldrin/Dieldrin, document number 440/5-80-019;

(2) Chlordane, document number 440/5-80-027;

(3) DDT, document number 440/5-80-038;

(4) Endosulfan, document number 440/5-80-046;

(5) Endrin, document number 440/5-80-047;

(6) Gamma-BHC (lindane), document number 440/5-80-054;

(7) Heptachlor, document number 440/5-80-052;

(8) Hexachlorocyclohexane, document number 440/5-80-054; or

(9) Silver, document number 440/5-80-071;

(l) The letter "l" shall indicate that there is a more stringent drinking water maximum contaminant level (MCL) specified in Env-Dw 700, so if the surface water is a source for a public water system as defined in RSA 485:1-a, XV or is within 20 miles upstream of any active surface water intake for a public water system, the department shall use the MCL values shown in Table 1703-2A, below, for the water and fish ingestion human health criteria. The following criteria shall be met as a running annual average except for Nitrite-N and Nitrite-N + Nitrate-N which shall be instantaneous acute criteria:

Table 1703-2A: MCL Values for Water and Fish Ingestion Criteria

CAS Number	Chemical Name	MCL (Units per Liter)
15972-60-8	Alachlor (Lasso)	2 µg
116-06-3	Aldicarb (Temik)	3 µg
1646-87-3	Aldicarb sulfoxide	4 µg
1646-88-4	Aldicarb sulfone (aldoxycarb)	2 µg
1912-24-9	Atrazine (Atranex, Crisazine)	3 µg
7440-41-7	Beryllium	4 µg
7440-43-9	Cadmium	5 µg
1563-66-2	Carbofuran (Furadon, 4F)	40 µg
7782-50-5	Chlorine (as Cl_2)	4 mg
10599-90-3	Chloramines, as Cl2	4 mg
10049-04-4	Chlorine Dioxide, as ClO2	0.8 mg
94-75-7	Chlorophenoxy herbicides (2,4-D)	70 µg
93-72-1	Chlorophenoxy herbicides (2,4,5-TP)	50 µg
18540-29-9	Chromium+6	see Chromium Total
16065-83-1	Chromium+3	see Chromium Total

Table 1703-2A: MCL Values for Water and Fish Ingestion Criteria

CAS Number	Chemical Name	MCL (Units per Liter)
7440-47-3	Chromium Total (equal to the sum of Chromium+3 plus Chromium+6)	100 µg
75-99-0	Dalapon	200 µg
96-12-8	Dibromochloropropane (DBCP)	0.2 µg
95-50-1	Dichlorobenzene (1,2)	600 µg
106-46-7	Dichlorobenzene(1,4)	75 µg
107-06-2	Dichloroethane (1,2)	5 µg
75-35-4	Dichloroethylene(1,1)	7 µg
156-59-2	Dichloroethylene (1,2-cis)	70 µg
156-60-5	Dichloroethylene(1,2-Trans)	100 µg
88-85-7	Dinoseb	7 µg
85-00-7	Diquat	20 µg
103-23-1	Di(2-ethylhexyl)adipate	400 µg
145-73-3	Endothall	100 µg
106-93-4	Ethylene Dibromide (EDB)	0.05 µg
16984-48-8	Fluoride	4 mg
58-89-9	gamma-BHC (Lindane)	0.2 µg
1071-83-6	Glyphosate	700 µg
75-09-2	Methylene Chloride	5 µg
1634-04-4	Methyl tertiary-butyl ether (MtBE)	13 µg
14797-65-0	Nitrite-N	1 mg
14797-55-8	Nitrate-N	10 mg
14797-55-8 + 14797-65-0	Nitrate-N + Nitrite-N	10 mg
23135-22-0	Oxamyl (Vydate)	200 µg
355-46-4	Perfluorohexane sulfonic acid (PFHxS)	18 ng
375-95-1	Perfluorononanoic acid (PFNA)	11 ng
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	15 ng
335-67-1	Perfluorooctanoic Acid (PFOA)	12 ng
1918-02-1	Picloram	500 µg
7782-49-2	Selenium	50 µg
122-34-9	Simazine	4 µg
100-42-5	Styrene	100 µg
71-55-6	Trichloroethane 1,1,1	200 µg
1330-20-7	Xylene, Total	10 mg

(m) The letter “m” shall indicate that these criteria are expressed as micrograms of free cyanide per liter;

(n) The letter “n” shall indicate that these criteria apply to total PCBs or the sum of all of its congener, isomer, homolog, or Arochlor analyses;

(o) The letter “o” shall indicate that the freshwater aquatic life criteria for selenium are shown in Env-Wq 1703.34;

(p) The letter “p” shall indicate that these human health criteria for silver shall be for the protection of humans from argyria;

(q) The letter “q” shall indicate that this value is expressed as total cyanide;

(r) The letter “r” shall indicate that this data was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan;

(s) Subject to (1) and (2), below, the letter "s" shall indicate that this value is expressed as acid-soluble aluminum:

(1) Where waterbody specific pH, dissolved organic carbon and hardness are available, sample specific total aluminum criteria shall be determined using the procedures described in the EPA publication "Final Aquatic Life Ambient Water Quality Criteria for Aluminum", EPA-822-R-18-001, dated December 2018, available as noted in Appendix B, provided that for aluminum, either of the following references shall be used to calculate the site-specific criteria:

a. The "Aluminum Criteria Calculator V2.0 (Excel)(xlsm)", dated December 2018, available as noted in Appendix B; or

b. The "Aluminum Criteria Calculator R Code and Data V2.0(R)", dated November 15, 2019, available as noted in Appendix B; and

(2) For characterizing ambient waters using the criteria in (1), above, analytical methods that measure the bioavailable fraction of aluminum may be used in accordance with this paragraph where permitted by applicable federal regulations. The bioavailable fraction of aluminum shall be measured, as scientifically appropriate, using a less aggressive initial acid digestion than done for total recoverable aluminum, such as to a pH of approximately 4 or lower, that includes the measurement of amorphous aluminum hydroxide yet minimizes the measurement of mineralized forms of aluminum such as aluminum silicates associated with suspended sediment particles or clays;

(t) The letter "t" shall indicate that the total concentration of DDT and its metabolites shall not exceed this value;

(u) The letter "u" shall indicate that the chronic criterion of 20 mg/L shall be the minimum value except where alkalinity is naturally lower, in which case the criterion shall not be lower than 25 percent of the natural level;

(v) Unless otherwise indicated in Env-Wq 1703.22 (k), (o), or Env-Wq 1703.26(c), the protection of aquatic life concentration values in Table 1703-1 are acute as a 1-hour average and chronic as a 4-day average, both of which shall not to be exceeded more than once in 3-years; and

(w) The letter "w" shall indicate that for arsenic, the first value is for freshwaters and the second value is for marine waters as it relates to protection of human health.

Env-Wq 1703.23 Conversion Factors For Metals.

(a) Dissolved metal shall be determined by multiplying total recoverable metal by the conversion factor listed in Table 1703-2 for that metal, shown in equation form as follows:

Dissolved Metal = Total Recoverable Metal x Conversion Factor

(b) Total recoverable metals shall be determined by dividing dissolved metals by the conversion factor listed in Table 1703-2, shown in equation form as follows:

Total Recoverable Metal = Dissolved Metal / Conversion Factor

(c) The conversion factors in Table 1703-2 shall be used as translators to go from the dissolved metals criteria listed in Table 1703-1 to permit limits expressed as total recoverable metals by dividing dissolved metal by the conversion factor.

(d) If the hardness of the receiving water is different than 20 mg/L, then aquatic life criteria for hardness-dependent metals shall be calculated as follows:

(1) The equations in Env-Wq 1703.24(a) and (b) shall be used in conjunction with the coefficients shown in Table 1703-3 to calculate the total recoverable metal for freshwater;

(2) The equations shown in (a) and (b), above, shall be used in conjunction with the factors shown in Table 1703-2 to convert total recoverable metal to dissolved metal or dissolved metal to total recoverable metal;

(3) For hardness less than 20 mg/L, a hardness of 20 mg/L shall be used in the equations; and

(4) For hardness values greater than 400 mg/L, a hardness of 400 mg/L shall be used in the equations.

(e) Table 1703-2 shall be as follows, provided that the conversion factors for cadmium and lead shall be no greater than 1.0:

Table 1703-2: Factors to Convert Total Recoverable Metals to Dissolved Metals

	FRESHWATER Conversion Factors		**MARINE Conversion Factors**	
	Acute	**Chronic**	**Acute**	**Chronic**
Arsenic	1.0	1.0	1.0	1.0
Cadmium	1.136672 - [(Ln Hardness)(0.041838)]	1.101672 - [(Ln Hardness)(0.041838)]	0.994	0.994
Chromium (+3)	0.316	0.860	-	-
Chromium (+6)	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203 - [(Ln Hardness)(0.145712)]	1.46203 - [(Ln Hardness)(0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium	-	-	0.998	0.998
Silver	0.85	-	0.85	-
Zinc	0.978	0.986	0.946	0.946

Env-Wq 1703.24 Freshwater Aquatic Life Criteria For Metals. To calculate freshwater aquatic life criteria for total recoverable metals, the equations described in (a) and (b), below, shall be used in conjunction with the coefficients shown in (c), Table 1703-3, below, provided that the values used for hardness in the equations shall be as specified in Env-Wq 1703.23(d):

(a) To calculate the acute criteria, in µg/L, for the metals shown Table 1703-3, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression "m_a" multiplied by the natural logarithm (ln) of the hardness and to which product the value "b_a" shall be added, as follows:

Acute Criteria = e^x where $x = (m_a [\ln (\text{hardness})] + b_a)$

(b) To calculate the chronic criteria, in µg/L, for the metals shown in Table 1703-3, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression "m_c" multiplied by the natural logarithm of the hardness and to which product the value "b_c" shall be added, as follows:

Chronic Criteria = e^x where $x = (m_c [\ln (\text{hardness})] + b_c)$

(c) Table 1703-3 shall be as follows:

Table 1703-3: Coefficients in Equations for Calculating Total Recoverable Aquatic Life Criteria for Metals

	m_a	b_a	m_c	b_c
Cadmium	0.9789	-3.866	0.7977	-3.909
Copper	0.9422	-1.700	0.8545	-1.702

	m_a	b_a	m_c	b_c
Chromium+3	0.8190	3.7256	0.8190	0.6848
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59	-------	-------
Zinc	0.8473	0.884	0.8473	0.884

Env-Wq 1703.25 Freshwater Acute Aquatic Life Criteria For Ammonia.

(a) Subject to (b) through (d), below, to determine freshwater acute aquatic life criteria for ammonia, in milligrams of nitrogen per liter (mg N/L), the applicant shall use:

(1) Table 1703-4A, where salmonids in the genus Oncorhynchus are or might be present; and

(2) Table 1703-4B, where salmonids in the genus Oncorhynchus are absent.

(b) The freshwater acute water quality criteria for ammonia in Table 1703-4A where salmonids in the genus Oncorhynchus are or might be present shall be calculated by taking the lesser of the value resulting from dividing 0.275 by the sum of one plus 10 raised to the power of 7.204 minus the pH, and adding the resulting value to the value found by dividing 39.0 by the sum of one plus 10 raised to the power of the pH minus 7.204, to the value resulting from dividing 0.0114 by the sum of one plus 10 raised to the power of the 7.204 minus pH, and adding the resulting value found by dividing 1.6181 by the sum of one plus 10 raised to the power of the pH minus 7.204 and multiplying this value by 0.7249 multiplied by the value resulting from multiplying 23.12 by 10 raised to the power of 0.036 multiplied by value of 20 minus the temperature, as shown in the following equation:

Freshwater Acute Criteria, Salmonids in the Genus Onchorhynchus Present =

$$\text{MIN}\ \{\ [0.275 / (1+10^{\,7.204\text{-pH}}) + 39.0 / (1+10^{\,\text{pH-}7.204})],\ [0.7249\ \text{x}[0.0114/(1+10^{\,7.204\text{-pH}}) + 1.6181 / (1+10^{\,\text{pH-}7.204})]\ \text{x}\ (23.12\ \text{x}\ 10^{\,0.036\ \text{x}(20\text{-T})})]\ \}$$

Where MIN indicates the lesser of the two values separated by a comma.

(c) The freshwater acute water quality criteria for ammonia in Table 1703-4B where salmonids in the genus Oncorhynchus are absent shall be calculated by dividing 0.0114 by the sum of one plus 10 raised to the power of 7.204 minus the pH, and adding the resulting value to the value found by dividing 1.6181 by the sum of one plus 10 raised to the power of the pH minus 7.204, and multiplying this value by 0.7249 multiplied by the lesser of 51.93 or the value resulting from multiplying 23.12 by 10 raised to the power of 0.036 multiplied by value of 20 minus the temperature as shown in the following equation:

Freshwater Acute Criteria, Salmonids in the Genus Onchorhynchus Absent =

$$\{0.7249\ \text{x}[0.0114/(1+10^{\,7.204\text{-pH}}) + 1.6181 / (1+10^{\,\text{pH-}7.204})]\}\ \text{x MIN}\ [\ 51.93, (23.12\ \text{x}\ 10^{\,0.036\ \text{x}(20\text{-T})})]$$

Where MIN indicates the lesser of the 2 values separated by a comma.

(d) The equations described in (b) and (c), above, shall be used to calculate freshwater acute water quality criteria for ammonia at unlisted pH and temperature values.

(e) Table 1703-4A and Table 1703-4B shall be as follows:

Table 1703-4A: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/L
Salmonids in the Genus Oncorhynchus Present

pH	Temperature, Degrees C									
	0-14	**15**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	33	33	32	27	23	19	16	14	12	9.9
6.6	31	31	30	26	22	18	16	13	11	9.5
6.7	30	30	29	24	21	18	15	13	11	9.0

Table 1703-4A: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/L Salmonids in the Genus Oncorhynchus Present										
pH	Temperature, Degrees C									
	0-14	15	16	18	20	22	24	26	28	30
6.8	28	28	27	23	20	17	14	12	10	8.5
6.9	26	26	25	21	18	15	13	11	9.4	7.9
7.0	24	24	23	20	17	14	12	10	8.6	7.3
7.1	22	22	21	18	15	13	11	9.3	7.9	6.7
7.2	20	20	19	16	14	12	9.8	8.3	7.1	6.0
7.3	18	18	17	14	12	10	8.7	7.4	6.3	5.3
7.4	15	15	15	13	11	9.0	7.7	6.5	5.5	4.7
7.5	13	13	13	11	9.2	7.8	6.6	5.6	4.8	4.0
7.6	11	11	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5
7.7	9.6	9.6	9.3	7.9	6.7	5.7	4.8	4.1	3.5	3.0
7.8	8.1	8.1	7.9	6.7	5.6	4.8	4.0	3.4	2.9	2.5
7.9	6.8	6.8	6.6	5.6	4.7	4.0	3.4	2.9	2.4	2.1
8.0	5.6	5.6	5.4	4.6	3.9	3.3	2.8	2.4	2.0	1.7
8.1	4.6	4.6	4.5	3.8	3.2	2.7	2.3	2.0	1.7	1.4
8.2	3.8	3.8	3.7	3.1	2.7	2.3	1.9	1.6	1.4	1.2
8.3	3.1	3.1	3.1	2.6	2.2	1.9	1.6	1.3	1.1	0.96
8.4	2.6	2.6	2.5	2.1	1.8	1.5	1.3	1.1	0.93	0.79
8.5	2.1	2.1	2.1	1.8	1.5	1.3	1.1	0.90	0.77	0.65
8.6	1.8	1.8	1.7	1.5	1.2	1.0	0.88	0.75	0.63	0.54
8.7	1.5	1.5	1.4	1.2	1.0	0.87	0.74	0.62	0.53	0.45
8.8	1.2	1.2	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37
8.9	1.0	1.0	1.0	0.85	0.72	0.61	0.52	0.44	0.37	0.32
9.0	0.88	0.88	0.86	0.73	0.62	0.52	0.44	0.37	0.32	0.27

Table 1703-4B: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/L, Salmonids in the Genus Oncorhynchus Absent											
pH	Temperature, Degrees C										
	0-10	12	14	16	18	20	22	24	26	28	30
6.5	51	44	37	32	27	23	19	16	14	12	9.9
6.6	49	42	36	30	26	22	18	16	13	11	9.5
6.7	46	40	34	29	24	21	18	15	13	11	9.0
6.8	44	38	32	27	23	20	17	14	12	10	8.5
6.9	41	35	30	25	21	18	15	13	11	9.4	7.9
7.0	38	33	28	23	20	17	14	12	10	8.6	7.3
7.1	34	30	25	21	18	15	13	11	9.3	7.9	6.7
7.2	31	27	23	19	16	14	12	9.8	8.3	7.1	6.0
7.3	27	24	20	17	14	12	10	8.7	7.4	6.3	5.3
7.4	24	21	18	15	13	11	9.0	7.7	6.5	5.5	4.7
7.5	21	18	15	13	11	9.2	7.8	6.6	5.6	4.8	4.0
7.6	18	15	13	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5
7.7	15	13	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5	2.9
7.8	13	11	9.3	7.9	6.7	5.6	4.8	4.0	3.4	2.9	2.5
7.9	11	9.1	7.7	6.6	5.6	4.7	4.0	3.4	2.9	2.4	2.1
8.0	8.8	7.6	6.4	5.4	4.6	3.9	3.3	2.8	2.4	2.0	1.7
8.1	7.2	6.3	5.3	4.5	3.8	3.2	2.7	2.3	2.0	1.7	1.4
8.2	6.0	5.2	4.4	3.7	3.1	2.7	2.3	1.9	1.6	1.4	1.2
8.3	4.9	4.3	3.6	3.1	2.6	2.2	1.9	1.6	1.3	1.1	0.96
8.4	4.1	3.5	3.0	2.5	2.1	1.8	1.5	1.3	1.1	0.93	0.79

Table 1703-4B: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/L, Salmonids in the Genus Oncorhynchus Absent											
pH	**Temperature, Degrees C**										
	0-10	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.5	3.3	2.9	2.4	2.1	1.8	1.5	1.3	1.1	0.90	0.77	0.65
8.6	2.8	2.4	2.0	1.7	1.5	1.2	1.0	0.88	0.75	0.63	0.54
8.7	2.3	2.0	1.7	1.4	1.2	1.0	0.87	0.74	0.62	0.53	0.45
8.8	1.9	1.7	1.4	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37
8.9	1.6	1.4	1.2	1.0	0.85	0.72	0.61	0.52	0.44	0.37	0.32
9.0	1.4	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37	0.32	0.27

Env-Wq 1703.26 Freshwater Chronic Aquatic Life Criteria For Ammonia.

(a) Subject to (b) through (d), below, Table 1703-4C shall be used to determine freshwater chronic aquatic life criteria for ammonia, in mg N/L.

(b) The freshwater chronic water quality criteria for ammonia in Table 1703-4C have been calculated by adding the value found by dividing 0.0278 by the sum of one plus 10 raised to the power of 7.688 minus the pH to the value found by dividing 1.1994 by one plus 10 raised to the power of pH minus 7.688, and multiplying the resulting value by 0.8876 multiplied by the value resulting from multiplying 2.126 by 10 raised to the power of 0.028 times the value of 20 minus the greater of the temperature or 7, as shown in the following equation:

Freshwater Chronic Criteria for Ammonia:

$$\text{Criteria} = 0.8876 \times [0.0278/(1+10^{7.688-pH}) + 1.1994/(1+10^{pH-7.688})] \times [2.126 \times 10^{0.028 \times (20-MAX(T,7))}]$$

Where MAX indicates the greater of the two values separated by a comma.

(c) The chronic criteria in Table 1703-4C represent a 30-day rolling average, but the highest 4-day average within any 30-day averaging period shall not exceed 2.5 times the chronic criteria.

(d) The equation described in (b), above, shall be used to calculate criteria at unlisted pH and temperature values.

(e) Table 1703-4C shall be as follows:

Table 1703-4C: Freshwater Chronic Aquatic Life Criteria For Ammonia in mg N/L													
pH	**Temperature, Degrees C**												
	0-7	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	4.9	4.6	4.1	3.6	3.1	2.8	2.4	2.1	1.9	1.6	1.5	1.3	1.1
6.6	4.8	4.5	4.0	3.5	3.1	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.1
6.7	4.8	4.5	3.9	3.5	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1
6.8	4.6	4.4	3.8	3.4	3.0	2.6	2.3	2.0	1.8	1.6	1.4	1.2	1.1
6.9	4.5	4.2	3.7	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0
7.0	4.4	4.1	3.6	3.2	2.8	2.4	2.2	1.9	1.7	1.5	1.3	1.1	0.99
7.1	4.2	3.9	3.5	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.95
7.2	4.0	3.7	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0	0.90
7.3	3.8	3.5	3.1	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.1	0.97	0.85
7.4	3.5	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0	0.90	0.79
7.5	3.2	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.95	0.83	0.73
7.6	2.9	2.8	2.4	2.1	1.9	1.6	1.4	1.3	1.1	0.98	0.86	0.76	0.67
7.7	2.6	2.4	2.2	1.9	1.7	1.5	1.3	1.1	1.0	0.88	0.78	0.68	0.60
7.8	2.3	2.2	1.9	1.7	1.5	1.3	1.2	1.0	0.89	0.79	0.69	0.61	0.53
7.9	2.1	1.9	1.7	1.5	1.3	1.2	1.0	0.89	0.79	0.69	0.61	0.53	0.47
8.0	1.8	1.7	1.5	1.3	1.1	1.0	0.88	0.78	0.68	0.60	0.53	0.44	0.41
8.1	1.5	1.5	1.3	1.1	0.99	0.87	0.76	0.67	0.59	0.52	0.46	0.40	0.35

Table 1703-4C: Freshwater Chronic Aquatic Life Criteria For Ammonia in mg N/L													
pH	**Temperature, Degrees C**												
	0-7	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.2	1.3	1.2	1.1	0.96	0.84	0.74	0.65	0.57	0.50	0.44	0.39	0.34	0.30
8.3	1.1	1.1	0.93	0.82	0.72	0.63	0.55	0.49	0.43	0.38	0.33	0.29	0.26
8.4	0.95	0.89	0.79	0.69	0.61	0.53	0.47	0.41	0.36	0.32	0.28	0.25	0.22
8.5	0.80	0.75	0.67	0.58	0.51	0.45	0.40	0.35	0.31	0.27	0.24	0.21	0.18
8.6	0.68	0.64	0.56	0.49	0.43	0.38	0.33	0.29	0.26	0.23	0.20	0.18	0.15
8.7	0.57	0.54	0.47	0.42	0.37	0.32	0.28	0.25	0.22	0.19	0.17	0.15	0.13
8.8	0.49	0.46	0.40	0.35	0.31	0.27	0.24	0.21	0.19	0.16	0.14	0.13	0.11
8.9	0.42	0.39	0.34	0.30	0.27	0.23	0.21	0.18	0.16	0.14	0.12	0.11	0.09
9.0	0.36	0.34	0.30	0.26	0.23	0.20	0.18	0.16	0.14	0.12	0.11	0.09	0.08

Env-Wq 1703.27 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 10 g/kg. The values shown in Table 1703-5 shall be used to determine saltwater acute aquatic life criteria for ammonia, in milligrams of NH_3 per liter (mg NH_3/L), for a salinity of 10 g/kg:

Table 1703-5: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/L; Salinity = 10 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	270	191	131	92	62	44	29	21
7.2	175	121	83	58	40	27	19	13
7.4	110	77	52	35	25	17	12	8.3
7.6	69	48	33	23	16	11	7.7	5.6
7.8	44	31	21	15	10	7.1	5.0	3.5
8.0	27	19	13	9.4	6.4	4.6	3.1	2.3
8.2	18	12	8.5	5.8	4.2	2.9	2.1	1.5
8.4	11	7.9	5.4	3.7	2.7	1.9	1.4	1.0
8.6	7.3	5.0	3.5	2.5	1.8	1.3	0.98	0.75
8.8	4.6	3.3	2.3	1.7	1.2	0.92	0.71	0.56
9.0	2.9	2.1	1.5	1.1	0.85	0.67	0.52	0.44

Env-Wq 1703.28 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 20 g/kg. The values shown in Table 1703-6 shall be used to determine saltwater acute aquatic life criteria for ammonia, in mg NH3 /L, for a salinity of 20 g/kg:

Table 1703-6: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/L; Salinity = 20 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	291	200	137	96	64	44	31	21
7.2	183	125	87	60	42	29	20	14
7.4	116	79	54	37	27	18	12	8.7
7.6	73	50	35	23	17	11	7.9	5.6
7.8	46	31	23	15	11	7.5	5.2	3.5
8.0	29	20	14	9.8	6.7	4.8	3.3	2.3
8.2	19	13	8.9	6.2	4.4	3.1	2.1	1.6
8.4	12	8.1	5.6	4.0	2.9	2.0	1.5	1.1
8.6	7.5	5.2	3.7	2.7	1.9	1.4	1.0	0.77
8.8	4.8	3.3	2.5	1.7	1.3	0.94	0.73	0.56
9.0	3.1	2.3	1.6	1.2	0.87	0.69	0.54	0.44

Env-Wq 1703.29 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 30 g/kg. The values shown in Table 1703-7 shall be used to determine saltwater acute aquatic life criteria for ammonia, in mg NH3 /L, for a salinity of 30 g/kg:

Table 1703-7: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/L; Salinity = 30 g/kg

pH	Temperature (°C)							
	0	5	10	15	20	25	30	35
7.0	312	208	148	102	71	48	33	23
7.2	196	135	94	64	44	31	21	15
7.4	125	85	58	40	27	19	13	9.4
7.6	79	54	37	25	21	12	8.5	6.0
7.8	50	33	23	16	11	7.9	5.4	3.7
8.0	31	21	15	10	7.3	5.0	3.5	2.5
8.2	20	14	9.6	6.7	4.6	3.3	2.3	1.7
8.4	12.7	8.7	6.0	4.2	2.9	2.1	1.6	1.1
8.6	8.1	5.6	4.0	2.7	2.0	1.4	1.1	0.81
8.8	5.2	3.5	2.5	1.8	1.3	1.0	0.75	0.58
9.0	3.3	2.3	1.7	1.2	0.94	0.71	0.56	0.46

Env-Wq 1703.30 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 10 g/kg. The values shown in Table 1703-8 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /L, for a salinity of 10 g/kg:

Table 1703-8: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH_3/L; Salinity = 10 g/kg

pH	Temperature (°C)							
	0	5	10	15	20	25	30	35
7.0	41	29	20	14	9.4	6.6	4.4	3.1
7.2	26	18	12	8.7	5.9	4.1	2.8	2.0
7.4	17	12	7.8	5.3	3.7	2.6	1.8	1.2
7.6	10	7.2	5.0	3.4	2.4	1.7	1.2	0.84
7.8	6.6	4.7	3.1	2.2	1.5	1.1	0.75	0.53
8.0	4.1	2.9	2.0	1.40	0.97	0.69	0.47	0.34
8.2	2.7	1.8	1.3	0.87	0.62	0.44	0.31	0.23
8.4	1.7	1.2	0.81	0.56	0.41	0.29	0.21	0.16
8.6	1.1	0.75	0.53	0.37	0.27	0.20	0.15	0.11
8.8	0.69	0.50	0.34	0.25	0.18	0.14	0.11	0.08
9.0	0.44	0.31	0.23	0.17	0.13	0.10	0.08	0.07

Env-Wq 1703.31 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 20 g/kg. The values shown in Table 1703-9 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /L, for a salinity of 20 g/kg:

Table 1703-9: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/L; Salinity = 20 g/kg

pH	Temperature (°C)							
	0	5	10	15	20	25	30	35
7.0	44	30	21	14	9.7	6.6	4.7	3.1
7.2	27	19	13	9.0	6.2	4.4	3.0	2.1
7.4	18	12	8.1	5.6	4.1	2.7	1.9	1.3
7.6	11	7.5	5.3	3.4	2.5	1.7	1.2	0.84
7.8	6.9	4.7	3.4	2.3	1.6	1.1	0.78	0.53
8.0	4.4	3.0	2.1	1.5	1.0	0.72	0.50	0.34
8.2	2.8	1.9	1.3	0.94	0.66	0.47	0.31	0.24
8.4	1.8	1.2	0.84	0.59	0.44	0.30	0.22	0.16
8.6	1.1	0.78	0.56	0.41	0.28	0.20	0.15	0.12

Table 1703-9: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/L; Salinity = 20 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
8.8	0.72	0.50	0.37	0.26	0.19	0.14	0.11	0.08
9.0	0.47	0.34	0.24	0.18	0.13	0.10	0.08	0.07

Env-Wq 1703.32 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 30g/kg. The values shown in table 1703-10 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /L, for a salinity of 30 g/kg:

Table 1703-10: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/L; Salinity = 30 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	47	31	22	15	11	7.2	5.0	3.4
7.2	29	20	14	9.7	6.6	4.7	3.1	2.2
7.4	19	13	8.7	5.9	4.1	2.9	2.0	1.4
7.6	12	8.1	5.6	3.7	3.1	1.8	1.3	0.90
7.8	7.5	5.0	3.4	2.4	1.7	1.2	0.81	0.56
8.0	4.7	3.1	2.2	1.6	1.1	0.75	0.53	0.37
8.2	3.0	2.1	1.4	1.0	0.69	0.50	0.34	0.25
8.4	1.9	1.3	0.90	0.62	0.44	0.31	0.23	0.17
8.6	1.2	0.84	0.59	0.41	0.30	0.22	0.16	0.12
8.8	0.78	0.53	0.37	0.27	0.20	0.15	0.11	0.09
9.0	0.50	0.34	0.26	0.19	0.14	0.11	0.08	0.07

Env-Wq 1703.33 Freshwater Aquatic Life Criteria for Pentachlorophenol.

(a) To calculate the freshwater aquatic life acute criteria, in µg/L, for pentachlorophenol, the exponent “e” shall be raised to the power “x” where “x” is equal to the parenthetical expression 1.005 multiplied by the pH and to which product the value of 4.869 shall be subtracted, as follows:

$$\text{Acute Criteria} = e^{x} \text{ where}$$
$$x = [\ 1.005\ (\text{pH}) - 4.869\ ]$$

(b) To calculate the freshwater aquatic life chronic criteria, in µg/L, for pentachlorophenol, the exponent “e” shall be raised to the power “x” where “x” is equal to the parenthetical expression 1.005 multiplied by the pH and to which product the value of 5.134 shall be subtracted, as follows:

$$\text{Chronic Criteria} = e^{x} \text{ where}$$
$$x = [\ 1.005\ (\text{pH}) - 5.134\ ]$$

Env-Wq 1703.34 Freshwater Aquatic Life Criteria for Selenium. Compliance with the freshwater aquatic life criteria for selenium shall be determined using egg-ovary fish tissue measurements, if available and applicable, or, in the alternative using, whole-body or muscle fish tissue measurements, if available, and if neither are available then using the water column values shown in Table 1703-11, below, for the freshwater aquatic life protection criteria:

Table 1703-11: Freshwater Selenium Ambient Chronic Water Quality Criteria for Protection of Aquatic Life

Media	Fish Tissue		Water Column	
Measurement	Egg/Ovary	Fish Whole Body or	Monthly Average Exposure	Intermittent Exposure

		Muscle		
Criteria	15.1 mg/kg dw	8.5 mg/kg dw whole body or 11.3 mg/kg dw muscle (skinless, boneless filet)	1.5 µg/L in lentic aquatic systems 3.1 µg/L in lotic aquatic systems	$Criteria_{int\ exp} = [Criteria_{monthly\ average} - C_{bkgrnd}(1-f_{int})] / f_{int}$

Env-Wq 1703.35 Notes for Table 1703-11.

(a) Fish tissue measures, egg-ovary and whole-body or muscle, shall be instantaneous measures expressed as steady-state and shall not be exceeded.

(b) Water column values shall be based on the total of the dissolved species of selenium in water. Water column values shall be the applicable criterion in the absence of fish tissue in a steady-state condition and shall not be exceeded more than once in 3-years.

(c) Intermittent exposure criteria ($Criteria_{int\ exp}$) shall be the $Criteria_{monthly}$ average from the monthly measurements, for either lentic or lotic waters, minus the C_{bkgrnd} which is the average background selenium concentration times one minus the f_{int} which is the fraction of any 30-day period during which elevated selenium concentrations occur, the difference of which is divided by the f_{int}.

PART Env-Wq 1704 ALTERNATIVE SITE-SPECIFIC CRITERIA

Env-Wq 1704.01 Purpose. The purpose of this part is to establish a procedure for determining alternative site-specific criteria in the following cases:

(a) For toxic substances not listed in Env-Wq 1703.21 through Env-Wq 1703.33;

(b) Where site-specific information is available and substantiates the use of different criteria; or

(c) Where new information that was not considered in the development of the criteria becomes available.

Env-Wq 1704.02 Procedures for Site-Specific Human Health Criteria. The procedure for determining alternative site-specific criteria for the protection of human health shall be as specified in EPA's "Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," EPA 822-B-00-004, dated October 2000, and the following accompanying technical support documents, all of which are available as noted in Appendix B:

(a) "Volume 1: Risk Assessment", EPA 822-B-00-005, dated October 2000;

(b) "Volume 2: Development of National Bioaccumulation Factors", EPA-822-R-03-030, dated December 2003; and

(c) "Volume 3: Development of Site-Specific Bioaccumulation Factors", EPA-822-R-09-008, dated September 2009.

Env-Wq 1704.03 Procedures for Site-Specific Nutrient Criteria.

(a) Subject to the criteria in Env-Wq 1703.14, Env-Wq 1703.25 through 1703.33, and the procedure in Env-Wq 1704.03(b), the following shall be acceptable procedures for determining alternative site-specific nutrient criteria:

(1) Adopting the nutrient target concentration or load from an EPA approved total maximum daily load (TMDL) study pursuant to 40 CFR 130.7;

(2) Adopting the nutrient target concentration or load from an advance restoration plan;

(3) Adopting one of the following federal requirements:

a. Criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

b. The ambient targets and commensurate flows applied in permits issued pursuant to 40 CFR 122;

(4) Approaches in the "Nutrient Criteria Technical Guidance Manual Rivers and Streams", EPA-822-B-00-002 dated July 2000, available as noted in Appendix B;

(5) Approaches in the "Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs", EPA-822-B00-001 dated April 2000, available as noted in Appendix B;

(6) Approaches in the "Nutrient Criteria Technical Guidance Manual Estuary and Coastal Marine Waters", EPA-822-B01-003 dated October 2001, available as noted in Appendix B;

(7) Approaches in the "Nutrient Criteria Technical Guidance Manual Wetlands", EPA-822-B-08-001 dated June 2008, available as noted in Appendix B; and

(8) Approaches in "Using Stressor-response Relationships to Derive Numeric Nutrient Criteria", EPA-820-S-10-001 dated November 2010, available as noted in Appendix B.

(b) Modeling conducted to determine alternative site-specific nutrient criteria shall be conducted as specified in EPA's "Guidance on the Development, Evaluation, and Application of Environmental Models", EPA-100-K-09-003 dated March 2009, available as noted in Appendix B.

Env-Wq 1704.04 Modifications to Surface Water Quality Standards. If the department determines, based on scientifically valid documentation, that alternative site-specific criteria will protect the existing and designated uses of the waterbody, the department shall revise these rules to incorporate those criteria.

PART Env-Wq 1705 PERMITTING RELATED STANDARDS

Env-Wq 1705.01 Assimilative Capacity.

(a) Subject to (b) and Env-Wq 1705.03, below, the department shall hold not less than 10 percent of the assimilative capacity of each surface water in reserve to provide for future needs.

(b) For purposes of combined sewer overflows, the department shall determine compliance based on 99 percent of the assimilative capacity of the receiving surface water.

Env-Wq 1705.02 Dilution and Conditions for Permitting.

(a) The ambient upstream flow used to calculate permit limits shall be as specified in (b) through (g), below.

(b) For tidal waters, the low flow condition shall be equivalent to the conditions that result in a dilution that is exceeded 99 percent of the time.

(c) For non-tidal rivers and streams, permit limits for all human health criteria for carcinogens shall be developed based on the long-term harmonic mean flow, which is the number of daily flow measurements divided by the sum of the reciprocals of the daily flows.

(d) Permit limits to meet nutrient criteria including, but not limited to, nitrogen and phosphorus species, shall be based on the following downstream ambient targets and flows:

(1) The ambient nutrient target used in the reasonable potential analysis conducted pursuant to 40 CFR 122.44(d) shall be based on one of the following methods provided that existing and designated uses are fully protected:

a. Site-specific criteria adopted pursuant to Env-Wq 1704;

b. An EPA approved total maximum daily load (TMDL) study pursuant to 40 CFR 130.7; or

c. One of the following federal requirements if deemed by the department to be protective of all existing and designated uses:

i. Criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

ii. Permits issued pursuant to 40 CFR 122; and

(2) The flows for nutrients used in the reasonable potential analysis shall be commensurate to, as applicable:

a. Site-specific nutrient criteria adopted pursuant to Env-Wq 1704;

b. Established conditions for the nutrient target in an EPA approved TMDL;

c. Nutrient target used in criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

d. Nutrient target used in permits issued pursuant to 40 CFR 122.

(e) For non-tidal rivers and streams, permit limits to prevent ammonia toxicity in aquatic life shall be based on a flow equal to the 7Q10 flow.

(f) Nutrient effluent permit limits shall be based on the 7Q10 flow if the nutrient limit is needed to achieve compliance with other water quality criteria that must have permit limits based on the 7Q10 flow in accordance with (g) below.

(g) For non-tidal rivers and streams, permit limits for all non-nutrient aquatic life criteria and human health criteria for non-carcinogens shall be based on the 7Q10 flow except as described in Env-Wq 1705.02(d)(2) through Env-Wq 1705.02(f), above.

(h) To the maximum extent practicable, data used for setting permit limits and calculating reasonable potential pursuant to 40 CFR 122.44(d)(1)(ii) shall be based upon:

(1) Data, modeling, or reasonable estimates of the ambient condition representative in space and time of the limiting conditions as defined in (a) through (g) above, for a particular criterion; and

(2) Data, modeling, or reasonable estimates of the ambient condition representative of the conditions on which a criterion is based.

Env-Wq 1705.03 Restoration Permitting.

(a) Temporary and infrequent impacts resulting from ecological restoration projects approved by the department shall be exempt from the assimilative capacity requirements of Env-Wq 1705.01 and dilution requirements of Env-Wq 1705.02.

(b) Any water quality or water quantity impacts from ecological restoration projects approved by the department shall be minimized to the extent practicable.

PART Env-Wq 1706 SAMPLING AND ANALYSIS

Env-Wq 1706.01 Procedures.

(a) Unless alternative procedures are specified in the surface water discharge permit, all procedures used for the purpose of collecting, preserving, and analyzing samples shall be as specified in 40 CFR Part 136 for wastewater and 40 CFR Part 141 for drinking water.

(b) All methods approved in 40 CFR 136 for bacteria testing, as well as analytical methods approved for use in national shellfish sanitation programs as specified pursuant to RSA 485-A:8, V, shall be approved methods for NPDES permit compliance.

PART Env-Wq 1707 MIXING ZONES

Env-Wq 1707.01 Designation of Mixing Zones.

(a) Because RSA 485-A:8, I prohibits the discharge of any sewage or other wastes into class A waters, mixing zones shall be prohibited in such waters.

(b) For class B waters, the department shall designate a limited area or volume of the surface water as a mixing zone if the applicant provides sufficient scientifically valid documentation to allow the department to independently determine that all criteria in Env-Wq 1707.02 have been met.

Env-Wq 1707.02 Criteria for Approval of Mixing Zones. The department shall not approve a mixing zone unless the proposed mixing zone:

(a) Meets the criteria in Env-Wq 1703.03(c)(1);

(b) Does not interfere with biological communities or populations of indigenous species;

(c) Does not result in the accumulation of pollutants in the sediments or biota;

(d) Allows a zone of passage for swimming and drifting organisms;

(e) Does not interfere with existing and designated uses of the surface water;

(f) Does not impinge upon spawning grounds or nursery areas, or both, of any indigenous aquatic species;

(g) Does not result in the mortality of any plants, animals, humans, or aquatic life within the mixing zone;

(h) Does not exceed the chronic toxicity value of 1.0 TUc at the mixing zone boundary; and

(i) Does not result in an overlap with another mixing zone.

Env-Wq 1707.03 Conditions for Mixing Zones. If the department approves a mixing zone, the department shall include such conditions as are needed to ensure that the criteria on which the approval is based are met.

Env-Wq 1707.04 Technical Standards. Mixing zones shall be established in accordance with "Technical Support Document for Water Quality-based Toxics Control", EPA/505/2-90-001, dated March 1991, available as noted in Appendix B.

PART Env-Wq 1708 ANTIDEGRADATION

Env-Wq 1708.01 Purpose. The purpose of these antidegradation rules is to ensure that the following requirements of 40 CFR 131.12 are met:

(a) Existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected;

(b) Where the quality of a surface water exceeds the level necessary to support recreation in and on the water and propagation of fish, shellfish, and wildlife, such quality shall be maintained and protected, subject to the following:

(1) The department shall not approve a proposed discharge or activity that would cause a significant change in water quality as specified in Env-Wq 1708.09 unless the department finds, after full satisfaction of the intergovernmental coordination and public participation requirements and the

analysis required by Env-Wq 1708.10, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the surface water is located; and

(2) The department shall not approve any proposed discharge or activity that might cause degradation or lower water quality, without such conditions as are necessary to ensure that:

a. Water quality will be adequate to fully protect existing uses;

b. The highest statutory and regulatory requirements will be achieved for all new and existing point sources; and

c. All cost effective and reasonable best management practices for nonpoint source control will be implemented;

(c) Where high quality waters constitute an outstanding resource waters (ORW), that water quality shall be maintained and protected; and

(d) In those cases where a potential water quality impairment is associated with a thermal discharge, the antidegradation rules shall ensure that the requirements of Section 316 of the Clean Water Act are met.

Env-Wq 1708.02 Applicability. Antidegradation shall apply to:

(a) Any proposed new or increased activity, including point source and nonpoint source discharges of pollutants, that would lower water quality or adversely affect existing or designated uses;

(b) Any proposed increase in loadings to a waterbody when the proposal is associated with existing activities;

(c) Any increase in flow alteration over an existing alteration; and

(d) Any hydrologic modifications, such as dam construction and water withdrawals.

Env-Wq 1708.03 Protection of Existing Uses.

(a) A proposed discharge or activity shall not eliminate any existing uses or the water quality needed to maintain and protect those uses.

(b) The department shall determine the existing uses for the waters in question using the information provided pursuant to Env-Wq 1708.07.

Env-Wq 1708.04 Protection of Water Quality in ORW.

(a) Surface waters of national forests and surface waters designated as natural under RSA 483:7-a, I, shall be considered outstanding resource waters (ORW).

(b) Subject to (c), below, water quality shall be maintained and protected in surface waters that constitute ORW.

(c) The department shall allow a limited activity, or point or nonpoint source discharge to an ORW only if:

(1) The discharge or activity will result in no more than temporary and short-term changes in water quality, wherein "temporary and short term" means that degradation is limited to the shortest possible time;

(2) The discharge or activity will not permanently degrade water quality or result at any time in water quality lower than that necessary to protect the existing and designated uses in the ORW; and

(3) All practical means of minimizing water quality degradation are implemented.

Env-Wq 1708.05 Protection of Class A Waters.

(a) As specified in RSA 485-A:8, I, discharges of sewage or waste to class A waters shall be prohibited.

(b) Proposed new or increased activities that the department determines do not involve the discharge of sewage or waste shall be reviewed in accordance with this part.

Env-Wq 1708.06 Protection of Water Quality in High Quality Waters.

(a) Subject to (b) through (d), below, high quality waters shall be maintained and protected.

(b) The department shall evaluate and authorize insignificant changes in water quality as specified in Env-Wq 1708.09.

(c) The department shall allow degradation of significant increments of water quality, as determined in accordance with Env-Wq 1708.09, in high quality waters only if the applicant can demonstrate to the department, in accordance with Env-Wq 1708.10, that allowing the water quality degradation is necessary to accommodate important economic or social development in the area in which the receiving waters are located.

(d) If the waterbody is class A water, the requirements of Env-Wq 1708.05 also shall apply.

Env-Wq 1708.07 Submittal of Data. The applicant shall provide all information necessary to:

(a) Identify all existing uses, including:

(1) Freshwater, estuarine, and marine aquatic life present in the affected surface waters;

(2) Other wildlife that use or otherwise are dependent on the affected surface waters;

(3) Presence of water quality and physical habitat that support, or would support, aquatic life or other animal or plant life;

(4) Presence of indigenous species and communities;

(5) Presence of a specialized use of the waterbody, such as a spawning area or as a habitat for a federally- or state-listed threatened or endangered species;

(6) Use of the surface waters for recreation in or on the water, such as fishing, swimming, and boating, or use of the surface waters for commercial activity; and

(7) Whether or not current conditions or uses of the surface waters conflict with achieving and maintaining goal uses of the CWA at Section 101(a)(2) and the primary CWA objective to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters;

(b) Determine the level of water quality necessary to maintain and protect all uses identified in (a), above;

(c) Evaluate the potential impacts on existing uses due to the proposed discharge or activity by itself, and in combination with other discharges or activities presently occurring;

(d) Ensure that existing uses and the level of water quality necessary to protect those uses will be maintained and protected;

(e) Evaluate the magnitude, duration, and upstream and downstream extent of any lowering of high quality water due to the proposed discharge or activity by itself, and in combination with other discharges or activities presently occurring;

(f) Evaluate other factors as necessary to determine whether the proposed activity would cause significant or insignificant degradation, in accordance with Env-Wq 1708.09;

(g) If the discharge or activity is determined by the department to be significant, in accordance with Env-Wq 1708.08 and Env-Wq 1708.09, determine if a proposed lowering of water quality is necessary to achieve important economic or social development in accordance with Env-Wq 1708.10; and

(h) Ensure that all water quality criteria applicable to the waterbody in question will not be violated.

Env-Wq 1708.08 Assessing Waterbodies.

(a) The applicant shall characterize the existing water quality and determine whether there is remaining assimilative capacity for each parameter in question.

(b) Existing water quality shall be calculated in accordance with Env-Wq 1705.02, based on point sources discharging at their allowed loadings and the highest loadings anticipated from nonpoint sources.

(c) Where flows will or might be altered, existing conditions shall be established based on the existing maximum allowed water withdrawals or impoundment, diversion, or fluctuation of stream flow, as applicable.

(d) Remaining assimilative capacity shall be evaluated by comparing existing water quality, as specified in (b) and (c), above, to the state's water quality criteria.

(e) If the type and frequency of the proposed discharge or activity will or might cause the waterbody to be impacted at flows other than those listed in Env-Wq 1705.02, the applicant shall evaluate the impact of the proposed discharge at those other flows.

(f) Subject to (h), below, if the department determines, based on the information submitted, that there is no remaining assimilative capacity for a specific parameter, no further degradation with regard to that parameter shall be allowed.

(g) Subject to (h), below, if the department determines, based on the information submitted, that there is some remaining assimilative capacity, then the department shall proceed in accord with Env-Wq 1708.09.

(h) Determinations made pursuant to (f) or (g), above, shall account for Env-Wq 1705.01, which requires the department to reserve no less than 10% of a surface water's assimilative capacity.

Env-Wq 1708.09 Significant or Insignificant Determination.

(a) Any discharge or activity that is projected to use 20% or more of the remaining assimilative capacity for a water quality criterion shall be considered a significant lowering of water quality.

(b) The department shall not approve a discharge or activity that will cause a significant lowering of water quality unless the applicant demonstrates, in accordance with Env-Wq 1708.10, that the proposed lowering of water quality is necessary to achieve important economic or social development in the area where the waterbody is located.

(c) Subject to (e), below, any applicant proposing an activity that will cause an insignificant lowering of water quality shall not be required to demonstrate that the activity is necessary to provide important economic or social development, provided the applicant implements best management practices to minimize degradation.

(d) Activities allowed under (c), above shall include, but not be limited to:

(1) Short term or intermittent discharges such as hydrostatic testing of pipelines, fire pump test water, and uncontaminated stormwater discharges or site clean-up activities;

(2) Permanent discharges such as uncontaminated noncontact cooling water, uncontaminated groundwater seepage, or unchlorinated or dechlorinated swimming pool water;

(3) Facilities whose nonpoint source runoff is controlled through the use of best management practices; and

(4) Any discharge or activity that is projected to use less than 20% of the remaining assimilative capacity for a water quality criterion.

(e) If the department determines based on the following factors that the effect of a discharge or activity results in a greater impact to the water quality than that normally found in insignificant discharges or activities, the department shall determine that the proposed activity or discharge is significant, regardless of the proposed consumption of the remaining assimilative capacity, and require the applicant to demonstrate, in accordance with Env-Wq 1708.10, that a lowering of water quality is necessary to achieve an important economic or social development:

(1) The magnitude, duration, and spatial extent of the proposed change in water quality;

(2) The cumulative lowering of water quality over time resulting from the proposed activity in combination with previously approved activities;

(3) The possible additive or synergistic effects of the activity in combination with existing activities;

(4) The magnitude of the mass load independent of the total assimilative capacity or change in receiving water pollutant concentration;

(5) The toxic or bioaccumulative characteristics of the pollutant(s) in question;

(6) The potential to stress sensitive biological resources such as indigenous species, rare species, and threatened or endangered species and their habitat;

(7) The potential to stress sensitive recreational uses or water supply uses; or

(8) The quality and value of the resource.

Env-Wq 1708.10 Alternatives Analysis; Determination of Net Economic or Social Benefits.

(a) For purposes of this section, the following definitions shall apply:

(1) "Activity" means any of the activities listed in Env-Wq 1708.02 as being subject to this part, including all associated construction;

(2) "Area in which the waterbody is located" means the directly affected municipality(ies) and, if necessary to quantify the net social and economic benefits of the activity, one or more of the municipalities that abut the directly affected municipality(ies), as determined by the applicant in consultation with the department;

(3) "Directly affected municipality(ies)" means the municipality or municipalities in which the waterbody that will be impacted by the activity is located; and

(4) "High value resource" means a natural or developed resource that is of particular value to the nation, region, state, or area in which the waterbody is located, including but not limited to state- or federally-listed threatened or endangered species, state or federal parks, public freshwater or saltwater beaches, and lands that are subject to conservation easements.

(b) For any activity that is determined to result in a significant impact to the existing water quality pursuant to Env-Wq 1708.09, the applicant shall provide documentation in accordance with (c) through (f), below, to demonstrate that:

(1) Lowering the water quality is necessary to accommodate the activity;

(2) The activity will provide net economic or social benefits in the area in which the waterbody is located; and

(3) The net social and economic benefits of constructing and operating or otherwise engaging in the activity outweigh the environmental impact that could be caused by the lower water quality.

(c) To determine whether the criteria specified in (b)(1)-(3), above, have been met, the applicant shall complete an alternatives analysis as described in (d), below, and submit the analysis and a request for approval of the preferred alternative to the department together with technically and scientifically valid supporting information.

(d) The alternatives analysis required by (c), above, shall describe the net social and economic benefits, as described in (e), below, and the water quality impacts, as described in (f), below, of constructing and operating or otherwise engaging in the activity and all practicable alternatives, including but not limited to the following:

(1) Alternative methods of production or operation;

(2) Improved process controls;

(3) Water conservation practices;

(4) Wastewater minimization technologies;

(5) Non-discharging alternatives;

(6) Improved wastewater facility operation;

(7) Alternative methods of treatment, including advanced treatment beyond applicable technology requirements of the Clean Water Act;

(8) Alternative sites, and associated water quality impacts at those sites; and

(9) For activities that involve alteration of terrain, alternative site design that incorporates low impact development elements, including but not limited to creating less impermeable area or infiltrating or reusing stormwater.

(e) To determine whether the activity will provide net social and economic benefits in the area in which the waterbody is located, the applicant shall submit information on, and the department shall evaluate, each of the following:

(1) Whether the activity is consistent with municipal and regional master plans and economic development strategies; and

(2) An explanation of the effect that constructing and operating or otherwise engaging in the activity will have, or an explanation of why there will be no effect, on the following factors:

a. Public and social services;

b. Public health and safety;

c. Employment;

d. Tourism and recreation; and

e. Other social or economic factors that are specific to the area in which the waterbody is located.

(f) To determine the environmental impacts of lower water quality, the applicant shall submit information on, and the department shall evaluate, each of the following:

(1) Relative to designated uses, the sensitivity of existing and designated uses to the effects of constructing and operating or otherwise engaging in of the activity;

(2) Relative to pollutants, whether any pollutants are expected to be discharged as a result of constructing and operating or otherwise engaging in the activity and, if so, the nature of the pollutants and the anticipated fate and transport of the pollutants in the waterbody;

(3) Relative to water quality, whether water quality is expected to change as a result of constructing and operating or otherwise engaging in activity, and if so, the estimated degree of change in water quality;

(4) Relative to high value resources, whether any high value resources are present that would be affected by constructing and operating or otherwise engaging in the activity, and if so, the degree to which such resources are expected to be affected;

(5) Relative to flow characteristics or hydrologic modifications, whether any alterations to existing flows or other hydrologic modifications are expected as a result of constructing and operating or otherwise engaging in the proposed activity, and if so, the impacts of such alterations or modifications;

(6) Relative to water treatment technology, whether the activity incorporates any such technology other than passive stormwater treatment best management practices and, if so, the reliability of the treatment technology proposed, and the risk management plan for non-standard situations such as accidents, upsets, or failures; and

(7) Relative to any other factors that are specific to the affected waterbody or the area in which the waterbody is located, a description of the factor and an explanation of the effect of constructing and operating or otherwise engaging in the proposed activity on that factor.

(g) After reviewing the information submitted pursuant to (c) through (f), above, the department shall make a preliminary determination to:

(1) Approve the request, if it determines that the criteria specified in (b)(1)-(3), above, have been met; or

(2) Deny the request, if it determines that the criteria specified in (b)(1)-(3), above, have not been met.

(h) If the department's preliminary determination is to approve the applicant's request, the department shall provide the opportunity for public comment on its preliminary decision in accordance with Env-Wq 1708.11.

Env-Wq 1708.11 Public Participation and Intergovernmental Coordination.

(a) The department shall provide the opportunity for public comment and an opportunity to request a public hearing on preliminary decisions to allow any significant lowering of water quality determined in accordance with Env-Wq 1708.09(b) or (e).

(b) The department shall issue a written notice to the public, the municipality in which the activity is located or proposed to be located, and all potentially affected municipalities of a preliminary decision to allow a significant lowering of water quality.

(c) The notice provided pursuant to (b), above, shall:

(1) Invite written comments to be submitted to the department;

(2) Be posted by the department on its website and in at least one public place in the municipality in which the proposed activity will occur;

(3) Contain the information specified in (d), below; and

(4) For activities related to state surface water discharge permits, be a part of the normal public participation procedures associated with the issuance of the permit.

(d) The notice provided pursuant to (b), above, shall include the following information:

(1) A description of the proposed activity;

(2) A description of each surface water that would be affected and its use classification;

(3) A summary of the antidegradation provisions in these rules;

(4) A determination that existing uses and the water quality necessary thereto will be maintained and protected;

(5) A summary of the expected impacts on high quality waters, if any;

(6) A determination that where a lowering of water quality is allowed, all applicable water quality criteria will be met, designated uses will be protected, and any higher water quality achievable by the most stringent applicable technology-based requirements will be maintained;

(7) A summary of any other information that is relevant to how the activity complies or does not comply with the requirements of these rules;

(8) The summary of the important economic or social development that will be achieved by allowing the proposed activity, if applicable;

(9) A summary of the alternatives analysis and a finding that the lowering of water quality is necessary to provide a net economic and social benefit;

(10) The deadlines for submitting a request for public hearing and submitting written comments; and

(11) The name, address, and telephone number of the department employee to whom all written comments or requests for public hearing can be sent.

(e) To fulfill intergovernmental coordination, the department shall send a copy of the public notice to the following agencies and request comments:

(1) NH department of natural and cultural resources;

(2) NH department of health and human services;

(3) NH fish and game department;

(4) NH department of energy;

(5) Local river management advisory committees, if applicable;

(6) US EPA Region I;

(7) US Army Corps of Engineers;

(8) US Fish and Wildlife Service;

(9) National Marine Fisheries Service;

(10) National Park Service; and

(11) Natural Resources Conservation Service.

(f) The department shall:

(1) Prepare a summary of all comments received as a result of public participation and intergovernmental coordination and provide responses; and

(2) Post the summary of comments and responses on its website.

(g) If the department receives a request to hold a public hearing, the department shall issue public notice and conduct a public hearing in accordance with the provisions of Env-C 200 that apply to non-adjudicative proceedings.

(h) Following this public participation process, the department shall consider all comments and other information submitted during the process and make a final decision to allow or deny the proposed impact on water quality.

(i) The department shall notify the applicant in writing of its decision. If the application is denied and the applicant wishes to pursue the project, the applicant shall:

(1) Revise the submittal to decrease or eliminate the projected impact to high quality waters and resubmit the application for consideration under the full review process; or

(2) Appeal the decision as a permitting decision pursuant to RSA 21-O:14.

Env-Wq 1708.12 Transfer of Water.

(a) In this section, "transfer" means the intentional conveyance of water from one surface water to another surface water for the purpose of increasing the volume of water available in the receiving surface water. The term does not include the transfer of stormwater, for the purpose of managing stormwater during construction, between basins created or otherwise lawfully used for stormwater detention or treatment, or both, and does not include the discharge of stormwater from a detention or treatment basin to a surface water.

(b) A transfer shall be subject to (c) and (d), below, if one or more of the following apply:

(1) The transfer was not in active operation, as determined pursuant to (f) through (i), below, prior to the effective date of the 2011 readoption of this section, August 23, 2011;

(2) The transfer is causing or contributing to a violation of surface water quality standards in the source water or receiving water; or

(3) A change that could impact any designated use of the source water or receiving water is made to the transfer on or after August 23, 2011 such that a water quality certification is required under RSA 485-A:12, III or IV.

(c) The transfer of water from one surface water to another shall be allowed only if all of the following conditions are met:

(1) The transferred water does not contain exotic aquatic species or other species of aquatic life that could result in a violation of Env-Wq 1703.19, relative to the integrity of the biological and aquatic community, in the receiving water;

(2) Existing and designated uses will be maintained and supported in the source water and in the receiving water;

(3) The withdrawal from the source water and transfer to the receiving water either:

a. Will not result in any degradation of water quality; or

b. Have both been reviewed under the process specified in Env-Wq 1708.10 and determined by the department to meet the criteria specified for approval in Env-Wq 1708.10(b)(1)-(3); and

(4) A water conservation plan that meets the water conservation requirements set forth in Env-Wq 2101 has been approved by the department and is being complied with.

(d) Transferred water may be treated to comply with the requirements of this section.

(e) The transfer of water shall not constitute a discharge under RSA 485-A:8, I, or RSA 485-A:13, I(a) if:

(1) The transfer is not subject to (c) and (d), above, pursuant to (b), above; or

(2) All of the conditions specified in (c), above, are met.

(f) A transfer shall be deemed to have been in active operation prior to August 23, 2011 if all of the following are true:

(1) The infrastructure necessary for the transfer is in place and in usable condition;

(2) Water has been transferred for at least one day in each of at least 3 years from 2000 through 2011; and

(3) At the time of its original initiation, the transfer complied with applicable legal requirements.

(g) If a transfer does not meet the conditions specified in (f), above, the person responsible for the transfer may request the department to make a determination that the transfer was in active operation by submitting the following information in writing:

(1) The reason(s) why the infrastructure necessary for the transfer is not in place or is not in usable condition, if applicable;

(2) The total time span, in years, over which the transfer has occurred from the first known transfer to the present;

(3) The most recent year during which the transfer occurred; and

(4) Why, based on the information provided in (1)-(3), above, the department should determine that the transfer qualifies as a transfer that was in active operation prior to August 23, 2011.

(h) If the department determines, based on information provided pursuant to (g), above, that the person responsible for the transfer makes a defendable case that the transfer qualifies as a transfer that was in active operation prior to August 23, 2011, then the department shall make that determination.

(i) The department shall notify the person who requested a determination pursuant to (g), above, in writing of its decision.

PART Env-Wq 1709 CHANGE IN DESIGNATED USES

Env-Wq 1709.01 Definition. For purposes of this part, "change in designated use" means the removal of a designated use that is not an existing use, or the establishment of subcategories of a designated use.

Env-Wq 1709.02 Use Attainability Analysis Required. Before determining whether to propose a change in designated use, the department shall conduct a use attainability analysis in accordance with 40 CFR § 131.10.

Env-Wq 1709.03 Process to Propose Change in Designated Use.

(a) Based on the information obtained as a result of the use attainability analysis performed pursuant to Env-Wq 1709.02, the department shall determine whether a change in a designated use should be proposed as specified in (b), below.

(b) The department shall make the determination required by (a), above, when attaining a designated use is not feasible based on 40 CFR 131.10(g), as reprinted in Appendix F.

(c) If the department determines that a change in designated use should be proposed, the department shall conduct a non-adjudicative public hearing in accordance with the provisions of Env-C 200 applicable to non-adjudicative hearings to receive public comment on the determination.

(d) If the department continues to believe after the public comment period that a change in designated use should be proposed, the department shall propose that the change in designated use be made.

APPENDIX A: STATE OR FEDERAL STATUTES OR REGULATIONS IMPLEMENTED

Rule Section(s)	State Statute or Federal Statute or Regulation Implemented
Env-Wq 1701 (also see specific section listed below)	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq.; 40 CFR § 131.3(o); 40 CFR § 131.14
Env-Wq 1701.03	RSA 485-A:13, I(a); 33 U.S.C. 1251 et seq.; 40 CFR § 122.2; 40 CFR § 122.22; 40 CFR § 122.47
Env-Wq 1701.04	RSA 485-A:13, I(a); 40 CFR § 131.14
Env-Wq 1702	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq.
Env-Wq 1703	RSA 485-A:4, V; RSA 485-A:8, I, II, & III; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq; 40 CFR §131.10
Env-Wq 1704	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq; 40 CFR § 122; 40 CFR § 130.7
Env-Wq 1705	RSA 485-A:4, V; RSA 485-A:6, VII; RSA 485-A:8, VI; RSA 485-A:13, I(a); 33 U.S.C. 1251 et seq.; 33 U.S.C. 1314(a)(1); 40 CFR § 122.44(d); 40 CFR § 122.44(d)(1)(ii); 40 CFR § 130.7
Env-Wq 1706	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq; 40 CFR § 136; 40 CFR § 141
Env-Wq 1707	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq
Env-Wq 1708	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq; 40 CFR § 131.12
Env-Wq 1709	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 et seq; 40 CFR § 131.10; 40 CFR § 131.10(g)

APPENDIX B: INCORPORATED REFERENCES

Rule (Env-Wq)	Reference	Obtain At:
1703.05(c)	"EPA Combined Sewer Overflow (CSO) Control Policy", EPA 830-B-94-001, dated April, 1994	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at https://nepis.epa.gov/Exe/ZyNET.exe/2000407X.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000011%5C2000407X.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

Rule (Env-Wq)	Reference	Obtain At:
1703.22(d) intro	"Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003QI5.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\91thru94\Txt\00000011\20003QI5.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(d) (1)	"Streamlined Water-Effect Ratio procedure for Discharges of Copper", EPA-822-R-01-005, dated March 2001	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/901Q0I00.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C00thru05%5CTxt%5C00000012%5C901Q0I00.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

Rule (Env-Wq)	Reference	Obtain At:
1703.22(d) (2)	"Aquatic Life Ambient Freshwater Quality Criteria - Copper", EPA-822-R-07-001, dated February 2007	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1000PXC.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\06thru10\Txt\00000002\P1000PXC.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(s)(1)	"Final Aquatic Life Ambient Water Quality Criteria For Aluminum", EPA-822-R-18-001, dated December 2018	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P100VWXJ.txt?ZyActionD=ZyDocument&Client=EPA&Index=2016%20Thru%202020&Docs=&Query=Final%20Aquatic%20Life%20Ambient%20Water%20Quality%20Criteria%20Aluminum%20EPA-822-R-18-001&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C16THRU20%5CTXT%5C00000010%5CP100VWXJ.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=#
1703.22(s)(1)a.	The "Aluminum Criteria Calculator V2.0 (Excel)(xlsm)", dated December 2018	Available at no charge from EPA at https://www.epa.gov/wqc/2018-final-aquatic-life-criteria-aluminum-freshwater

Rule (Env-Wq)	Reference	Obtain At:
1703.22(s)(2)b.	The "Aluminum Criteria Calculator R Code and Data V2.0", dated November 15, 2019	Available at no charge from EPA at https://www.epa.gov/wqc/2018-final-aquatic-life-criteria-aluminum-freshwater
1704.02 intro	"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," EPA 822-B-00-004, dated October 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003D2R.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000001\20003D2R.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(a)	"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000), Technical Support Document, Volume 1: Risk Assessment", EPA 822-B-00-005, dated October 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003D81.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000001\20003D81.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

Rule (Env-Wq)	Reference	Obtain At:
1704.02(b)	"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) Technical Support Document Volume 2: Development of National Bioaccumulation Factors", EPA-822-R-03-030, dated December 2003	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1005EZQ.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000022\P1005EZQ.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(c)	"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) Technical Support Document Volume 3: Development of Site-Specific Bioaccumulation Factors", EPA-822-R-09-008, dated September 2009	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1005CAF.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=Methodology%20Deriving%20Ambient%20Water%20Quality%20Criteria%20Protection%20Human%20Health%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\ZYFILES\INDEX%20DATA\06THRU10\TXT\00000011\P1005CAF.txt&User=ANONYMOUS&Password=anonymous&SortMethod=f%3Atitle&MaximumDocuments=15&FuzzyDegree=-1&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionE&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(4)	"Nutrient Criteria Technical Guidance Manual Rivers and Streams", EPA-822-B-00-002 dated July 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003CVP.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=EPA822B00002%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000001%5C20003CVP.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(5)	"Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs", EPA-822-B00-001 dated April 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003COV.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=Nutrient%20Criteria%20Technical%20Guidance%20Manual%20Lakes%20Reservoirs%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000001%5C20003COV.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(6)	"Nutrient Criteria Technical Guidance Manual Estuary and Coastal Marine Waters", EPA-822-B01-003 dated October 2001	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003FDF.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=EPA822B01003%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000004%5C20003FDF.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=xv
1704.03(a)(7)	"Nutrient Criteria Technical Guidance Manual Wetlands", EPA-822-B-08-001 dated June 2008	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P1002DY6.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005&Docs=&Query=EPA822B08001%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000005%5CP1002DY6.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(8)	"Using Stressor-response Relationships to Derive Numeric Nutrient Criteria", EPA-820-S-10-001 dated November 2010	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P100IK1N.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005&Docs=&Query=EPA822B08001%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000034%5CP100IK1N.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(b)	"Guidance on the Development, Evaluation, and Application of Environmental Models", EPA-100-K-09-003 dated March 2009	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P1003E4R.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=Guidance%20Development%20Evaluation%20Application%20Environmental%20Models%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000007%5CP1003E4R.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1707.04	"Technical Support Document for Water Quality-based Toxics Control", EPA/505/2-90-001, dated March 1991	Available at no charge from: https://www3.epa.gov/npdes/pubs/owm0264.pdf

APPENDIX C: STATUTORY DEFINITIONS

RSA 485-A:2:

VI. "Industrial waste" means any liquid, gaseous or solid waste substance resulting from any process of industry, manufacturing trade or business or from development of any natural resources.

VIII. "Other wastes" means garbage, municipal refuse, decayed wood, sawdust, shavings, bark, lime, ashes, offal, oil, tar, chemicals and other substances other than sewage or industrial wastes, and any other substance harmful to human, animal, fish or aquatic life.

X. "Sewage" means the water-carried waste products from buildings, public or private, together with such groundwater infiltration and surface water as may be present.

XIV. "Surface waters of the state" means perennial and seasonal streams, lakes, ponds, and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, water courses, and other bodies of water, natural or artificial.

XVI. "Waste" means industrial waste and other wastes.

XIX. "Wastewater facilities" means the structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes, and dispose of the effluent and sludge.

XXIV. "7Q10" means the lowest average flow that occurs for 7 consecutive days on an annual basis with a recurrence interval of once in 10 years on average, expressed in terms of volume per time period.

RSA 482-A:2:

X. "Wetlands" means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

APPENDIX D: FEDERAL DEFINITIONS

40 CFR 122.2:

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 *et seq.*)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. It does not mean:

(a) Sewage from vessels; or

(b) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well [that is] used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

NOTE: Radioactive materials covered by the Atomic Energy Act are those encompassed in its definition of source, byproduct, or special nuclear materials. Examples of materials not covered include radium and accelerator-produced isotopes. See *Train v. Colorado Public Interest Research Group, Inc.*, 426 U.S. 1 (1976).

APPENDIX E: SUMMARY OF BACTERIA STANDARDS FROM RSA 485-A:8

Type of Waters	Standard
Class A other than designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli (E. coli) per 100 milliliters, unless naturally occurring; or (2) 153 E. coli per 100 milliliters in any one sample, unless naturally occurring.

Type of Waters	Standard
Class B other than designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 126 E. coli per 100 milliliters, unless naturally occurring; or (2) 406 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Class A or Class B at designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 47 E. coli per 100 milliliters, unless naturally occurring; or (2) 88 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Tidal waters used for swimming	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 35 enterococci per 100 milliliters, unless naturally occurring; or (2) 104 enterococci per 100 milliliters in any one sample, unless naturally occurring.
Tidal waters used for growing or taking of shellfish for human consumption	Same as for tidal waters used for swimming, PLUS must not exceed a geometric mean most probable number (MPN) of 14 organisms per 100 ml for fecal coliform, nor shall more than 10 percent of the samples exceed an MPN of 28 per 100 ml for fecal coliform, or other values of equivalent protection based on sampling and analytical methods used by the department of environmental services shellfish program and approved in the latest revision of the National Shellfish Sanitation Program, Guide For The Control of Molluscan Shellfish.

APPENDIX F: CRITERIA FOR DETERMINATION OF CHANGE IN DESIGNATED USE

40 CFR §131.10 Designation of uses.

(g) States may remove a designated use which is not an existing use, as defined in § 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

Exhibit 5

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Post Public Hearing Comments to the Draft 2024 – 303(d) List

Ken Edwardson
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November 21, 2024

Dear Mr. Edwardson,

These are additional comments to the 303(d) listing to coincide with the Public Hearing held Friday, November 15, 2024, at the NHDES office building in room 208C. I provided verbal testimony and this is the follow-up written comments. These comments only address the Aluminum Criteria Implementation in the NPDES Permitting Draft.

Draft Aluminum Criteria Implementation

The NHDES document details the criterion for using EPA's Aluminum Calculator Ver. 2.0 in conjunction with flow. The EPA's document is referenced at the end of the NHDES document as the fourth listed reference. The document is extensive and I could not find anywhere within that document where the EPA ties the results of the aluminum calculator to the receiving waterbody flow.

A link to a Peer Review Report (External Letter Peer Review for Aluminum Criteria Model) is one of the links in the EPA's Aluminum Criteria Document (Peer Review Summary Report: External Peer Review of EPA's Letter Peer Review Draft Report "Nanomaterial Case Study: A Comparison of Multiwalled Carbon Nanotube and Decabromodiphenyl Ether Flame-Retardant Coatings Applied to Upholstery Textiles"). Page xii indicates that "All of the toxicity test data used in the model were subjected to independent external expert peer review." Page 1 indicates, "The document describes scientifically defensible water quality criteria values pursuant to CWA section 304(a), derived utilizing best available data in a manner consistent with the 1986 guidelines."

In short, the EPA is stating that this version of the Aluminum Calculator has the best data and scientifically defensible water criteria values. My question is, has the NHDES method of using the relationship between river flow and the ICVs in developing reasonable potential analysis been subjected to any type of peer review?

The Peer Review Document on pages 86 to 161 lists over 700 references. Appendix J (pages J1 through J 52) lists over 500 references that were reviewed but not cited as these didn't meet the acceptance criteria due to the quality of data, sufficient data or relevant data. This document is well received in the scientific community and highly praised by the peer reviewers.

The very fact that that NHDES states, "In instances where there is a significant relationship ($p< 0.05$) and the lower 95th prediction interval at 7Q10 is greater than the 50th percentile of the ICVs then the 50th percentile will be used.

The points on the graph are proof that there is no significant relationship between the flow and CCC. The graph on page 9 shows a point at 9 cfsm at 340 ug/l. There is a 340 ug/l CCC at 1.1 cfsm. Page 10 has the same condition at 4.7 cfsm of flow about 290 ug/l. Then at 1.2 cfsm and 1.7 cfsm about 320 ug/l for a CCC. The page 11 graph is even worse the 14 cfsm flow has a CCC of 240 ug/l and the 1.5 and 2.1 cfsm flows have CCC of 240 and 230 ug/l. There is no literature or research out in the general public that demonstrates a consistent relationship between flow and CCC. The Aluminum Calculator has three factors in the modeling of their regression curves being pH DOC and hardness. The NHDES is trying to add a fourth factor that was never meant to be a part of the CCC equation.

I have worked with the Aluminum Calculator (both versions 1.0 and 2.0) and I find it hard to believe there is any correlation between flow and the CCC value. Below is data from this summer's, Town of Merrimack, sampling.

Tot Al	**Sitename**	**DOC (mg/L)**	**Total Hardness (mg/L as $CaCO_3$)**	**pH**		**FAV**	**CMC**	**CCC**	**River Q cfs**
79	Upstream 5/28/24	3.9	19	7.19	7542.874	2,625	**1,300**	**530**	3,740
73	Upstream 5/29/24	3.7	19	6.89	7542.874	1,853	**930**	**390**	5,210
85	Upstream 5/30/24	3.7	17	6.94	7542.874	1,888	**940**	**400**	4,825
69	Upstream 5/31/24	3.8	16	7	7542.874	2,007	**1,000**	**430**	4,050
69	Upstream 6/11/24	3.9	19	7.08	7542.874	2,341	**1,200**	**480**	3,259
65	Upstream 6/12/24	4.0	18	7.08	7542.874	2,329	**1,200**	**480**	2,520
52	Upstream 6/13/24	3.9	18	7.11	7542.874	2,378	**1,200**	**490**	5,100
52	Upstream 6/14/24	3.5	19	7.12	7542.874	2,329	**1,200**	**480**	3,200
27	Upstream 7/16/24	3.5	20	7.29	7542.874	2,815	**1,400**	**580**	3,080
27	Upstream 7/18/24	3.5	19	7.11	7542.874	2,305	**1,200**	**480**	1,570
100	Upstream 8/21/24	5.6	18	7.15	7542.874	2,888	**1,400**	**560**	2,400
							5% percentile	***395***	***1985***

50% percentile	***480***	***3200***
10% percentile	***400***	***1985***

As you can see the percentile calculations follow your curves to a tee. There is very little difference between the 5th percentile and the 10th percentile. As you can see the lowest CCC of 390 ug/l was at the highest flow of 5,210 cfs. This happens as a result of the interaction of pH, DOC, and hardness and is not influenced whatsoever by flow. None of your data demonstrated this aspect of flow to CCC values.

As I am still confused about what would constitute a significant relationship and what would not constitute a significant relationship when comparing flows from the values I've sampled this summer. As I state above the highest flow has the lowest CCC which turns the NHDES theory upside down.

In the recently released Medium General Permit, Table 4, demonstrates facilities in Lincoln, Penacook, Hooksett, and Allenstown have hardness values below 12 and in Lincoln's case 7.1. Go to the lookup tables in Appendix K and see how low aluminum values can be. I ran a hypothetical value from the Hooksett hardness of 11.3 mg/l and a DOC of 1.5 mg/l. I used the minimum value of 6.0 for a pH, but Hooksett did have one value of 5.39 for pH this summer. This was on 9/11/24. The flow that day was 1,210 cfs. The model run is below.

Sitename	DOC (mg/L)	Total Hardness (mg/L as CaCO3)	pH		FAV	**CMC**	**CCC**
Example Run	1.5	11.3	6	#	195	**98**	**66**

We speculated the low pH could be from the Bow plant cooling water, possibly the bottom river bed decayed matter that was devoid of O_2 and had been stirred up from the continuing dam maintenance below and above the Hooksett outfall, or some other phenomena. Model runs below a 6.0 pH do not calculate due to being outside of model inputs.

As you can see the CCC is 66 ug/l (62.3% of the current value of 106 ug/l for acid soluble comparison at 0.74% of 118 ug/l – see Fact Sheet for Allenstown) of the current allowable limit in that segment of the Merrimack River.

Also included as Attachment 1, are four graphs. Note graph B for Wild River near Gilead, Maine. This is similar in many respects to many small streams and rivers in NH where smaller plants discharge. I drew a line from the CCC value of 50 ug/l across the bottom of the graph. Note that many of the samples are below the 50 ug/l for the CCC value. Look closely and note that many are below 20 ug/l. In taking these lower values and figuring a RP analysis against the plant's 95th percentile discharge you would have an instream WQ value of the CCC. As the MDL for aluminum for many labs is 20 ug/l, the affected plants would need to meet ND in their effluent discharge for reasonable analysis potential. Highly unlikely that any plant can reach this value with chemical, physical, or filtration for process control.

Why is 106 ug/l (acid soluble converted to total recoverable) value valid today yet with the CCC and inclusion of the flow curves now become <20 ug/l? There are unintended consequences with the NHDES proposal of using flow and the very low percentile values out of 24 samples that have not been considered with the development of this method.

As the NHDES uses the upstream median value for calculation for reasonable potential analysis wouldn't the selection of the median value or the 50th percentile of all the data run in the calculation be the same? It's quite obvious that it would be. Using the 10th or 5th percentile of the CCC values would be the same as using the 10th or 5th percentiles of the upstream measured values when running RP analysis presently. Using the 50th percentile or median value already coincides with the current accepted practice for calculating RP.

Is the 10% assimilative capacity safety factor going to apply to the 50th, 10th, and 5th percentile values if this method is adopted?

Is the value calculated from the first run of 24 data points going to be the five-year permit concentration? Is there going to be yearly aluminum calculator runs to adjust the value of the aluminum CCC value or does it remain the same for the entire permit period? Is the first calculated 5th percentile value cast in stone due to the anti-backsliding rules? Will future NPDES permit renewals be allowed to go to higher CCC values if the calculator values change upwards? These are all questions that need review and answering.

Another observation is the way the ICVs are being compared to flows. It seems likely that the 5th percentile will always be the value chosen with the current vague approach of the meaning of significant relationship. There are no expressed parameters as to the upper and lower bounds of significant relationship expressed in the document. It appears it will be a subjective observation by the person doing the calculating. I believe the chosen CCC value will be the 5th percentile value in a vast majority of the calculations. The condition of $P < 0.05$ is actually a result of the interaction of pH, DOC, and hardness in the calculator being clustered like a bell shaped curve rather than any impact from the flow.

Also, there are endangered species in every permit. Look at the Medium Draft Permits Section 5.2. Endangered Species Act. It states that there are two species in the vicinity of all 21 plants' outfalls. The long-eared bat and the tricolored bat. This in and of itself would negate the use of the 10th percentile and reduce it to the 5th percentile. Page 18 of the Peer Review describes in 2.5 that the Aluminum Criteria are designed to be protective of the vast majority of aquatic animal taxa in an aquatic community. On page 82 (Protection of Endangered Species it further states the calculator is protective of rainbow trout, Rio Grande Silvery minnow, and Atlantic Salmon. The latest science and the best available information to date. It is hard to dispute, delete from, or add to the soundness of the aluminum criteria CMC and CCC calculated values in regards to impact on endangered species.

Method 2, as mentioned above states, *"Generate protective criteria values from the lowest 10th percentile of the distribution of individual Criteria Calculator outputs, based upon spatially and temporally representative data from a site. Although the 10th percentile of outputs should be sufficiently protective in most cases, certain circumstances may warrant use of a different output (e.g., consideration of threatened or endangered species). Sufficient data to characterize the appropriate distribution of outputs are necessary to derive a protective percentile so that the site is protected under conditions where aluminum is most available."*

Method 2 describes the NHDES approach to applying the Aluminum Calculator. It goes on to state that, Method 2 is particularly useful when values of acute and chronic criteria need to be protective of particular site conditions, such as for NPDES permitting actions (as discussed in Section 5 on NPDES Permitting). **Whichever method is selected, states and authorized tribes should consider developing written implementation methods and make these documents available to the public to maximize transparency, defensibility, and regulatory certainty.** It also states the regulatory authority should designate the geographic extent of each site. This would mean a different WQ aluminum CCC for each segment of the receiving waters from one plant extending to the next plant and so on.

There is no scientific defensibility or regulatory certainty with this approach. In looking at the current aluminum criteria of 87 ug/l (or 106 ug/l when compared to acid soluble values) it would be reasonable to have these values as minimum values if the CCC goes below that value. Also, the 50th percentile seems more than reasonable as it mimics the median of >10 upstream values. As the old saying goes, “If it ain’t broke, don’t fix it.”

END OF COMMENTS

Attachment 1

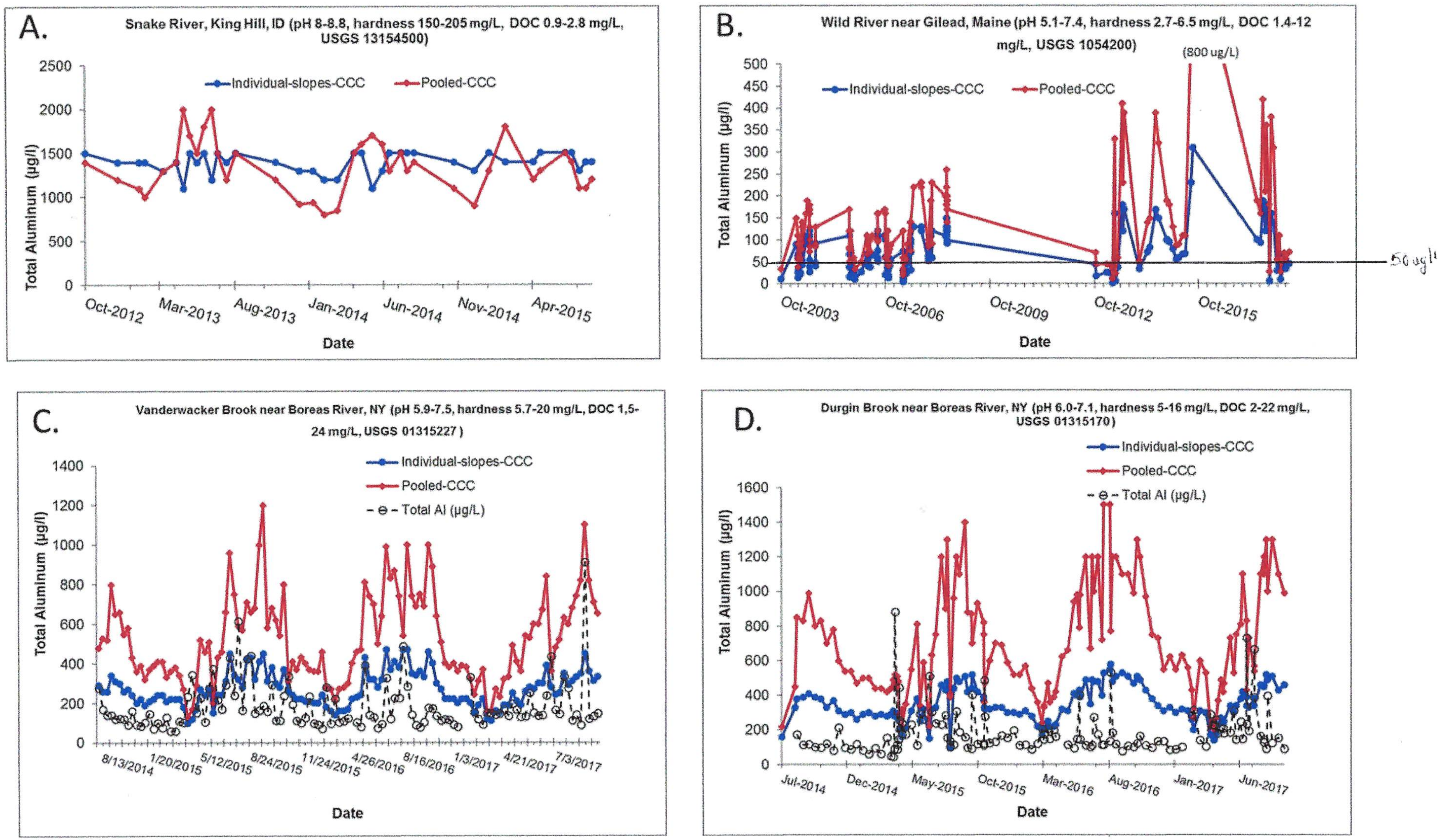

Figure 4. Comparisons of criteria in natural waters. In a river with moderately high pH and low DOC, the two MLR CCC versions were mostly similar; in the low pH waters in which aluminum toxicity is actually a real concern, the non-pooled MLR version tended to be lower.

November 22, 2024

Via Email (Kenneth.Edwardson@des.nh.gov)
Attn: Kenneth Edwardson
Watershed Management Bureau
Water Division, New Hampshire Department of Environmental Services
29 Hazen Dr., P.O Box 95
Concord, NH 03302-0095

Re: Comments on DES proposal to readopt with amendment Env-Wq 1700

Dear Mr. Edwardson,

The undersigned organizations appreciate the opportunity to comment on the proposed amendments to New Hampshire's Surface Water Quality Regulations, Env-Wq 1700.

Conservation Law Foundation ("CLF") is a member-supported, nonprofit environmental advocacy organization that works in New Hampshire and across New England to protect the environment for the benefit of all people. CLF has a long history of advocacy to protect water resources in New Hampshire and has been engaged for several years in advocacy addressing toxic "forever chemicals," or "PFAS" (per- and polyfluoroalkyl substances).[1]

The Connecticut River Watershed Council, Inc. ("CRWC"), doing business as the Connecticut River Conservancy ("CRC"), is a nonprofit organization established in 1952 to advocate for the protection, restoration, and sustainable use of the Connecticut River and its watershed. CRC is keenly interested in ensuring that water quality is protected and enhanced in New Hampshire. PFAS contamination and environmental health effects continue to be of concern to our members and our organization.

Manchester NAACP is the Manchester New Hampshire branch of the National Association for the Advancement of Colored People. Our Mission is to secure the political, education, social and economic equality of rights in order to eliminate race-based discrimination and ensure the health and well-being of all persons. Our vision is to ensure a society in which all individuals have equal rights without discrimination based on race.

Merrimack Citizens for Clean Water, based in Merrimack, New Hampshire, is an advocacy and information group founded by citizens who saw a need to develop a path to assist our residents, health professionals, community leaders and elected officials in comprehensively addressing the needs of our PFAS impacted community.

Merrimack River Watershed Council is a local non-profit that focuses on making the Merrimack River cleaner, healthier, and more accessible.

New Hampshire Healthy Climate is a nonprofit organization consisting of students, trainees, early, mid and late-career professionals, and retirees, from a wide variety of healthcare settings, both clinical and nonclinical. We work in independent practices, community hospitals, academic centers, laboratories, professional associations, nonprofits, local and state government, schools, long-term care facilities, and home care. As healthcare workers are uniquely positioned to increase public awareness of the links between human health and climate change, we seek to

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[1] The following abbreviations for PFAS chemicals are used throughout these comments: perfluorooctanoic acid (PFOA), perflurooctane sulfanate (PFOS), hexafluoropropylene oxide dimer acid and ammonium salt (GenX), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), perfluorohexanoic acid (PFHxA), perfluorobutanoic acid (PFBA), perfluorodecanoic acid (PFDA), 2H-perfluoro-2-decenoic acid (8:2 FTUCA), and 2H,2H,3H,3Hpefluorodecanoic acid (7:3 FTCA).

provide NH healthcare workers the tools to educate and mobilize the public in support of climate solutions to improve health for all.

The New Hampshire Rivers Council is committed to the conservation and ecologically sound management of New Hampshire's rivers, watersheds, and related natural resources. Since its incorporation as a non-profit organization in 1993, the New Hampshire Rivers Council has worked to educate the public about the value of the state's rivers, designate rivers in the state's protection program, and advocate for strong public policies and wise management of New Hampshire river resources.

New Hampshire Safe Water Alliance is an advocacy group focused on protecting the environment, drinking water, and public health in New Hampshire.

The Society for the Protection of New Hampshire Forests is a non-profit land trust and forestry organization whose mission is to perpetuate the forests of New Hampshire through their wise use and their complete reservation in places of special scenic beauty.

Testing for Pease is a community action group whose mission is to be a reliable resource for education and communication while advocating for a long term health plan on behalf of those impacted by PFAS water contamination at the former Pease Air Force Base in Portsmouth, New Hampshire.

* * *

PFAS chemicals create serious risks for people and the environment. We commend DES for including PFAS criteria in its proposed surface water quality regulation at Env-Wq 1703. But the proposed rule ignores relevant regulatory and scientific developments for PFAS. To advance environmental justice, protect human health and aquatic life, and ensure compliance with the Clean Water Act, we urge DES to strengthen Env-Wq 1703.21 with respect to PFAS.[2]

I. <u>Legal Background</u>

The Clean Water Act seeks to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. §1251(a). To comply with the Clean Water Act, states must adopt water quality standards and review them at least every three years. 33 U.S.C. § 1313(a)–(b), (c)(1). Water quality standards consist of multiple components, including (1)

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[2] While our comments focus on improving Env-Wq 1703.21 provisions for PFAS chemicals, the limited scope does not imply support for all other proposed Env-Wq 1700 rules or amendments.

designated uses, and (2) water quality criteria that help achieve designated uses and measure compliance.[3]

Every surface water in New Hampshire must meet several designated uses for protecting human health.[4] Specifically, all New Hampshire waters must support fish consumption, potential drinking water supply, and recreation.[5] All New Hampshire waters must also meet a designated use for protecting aquatic life.[6] Ensuring that waters are clean enough for fish consumption and drinking water supply is also essential for advancing environmental justice.

Water quality criteria must be stringent enough to protect "the most sensitive" designated use of each waterbody. 40 C.F.R. § 131.11(a)(1). Criteria must "accurately reflect[] the latest scientific knowledge," 33 U.S.C. § 1314(a)(1), and state development of criteria must rely on "sound scientific rationale," 40 C.F.R. § 131.11(a)(1). The criteria must cover as many pollutants as necessary to meet the designated use. *Id.* Importantly, when developing numeric water quality criteria for protecting designated uses, DES cannot "consider the cost of implementation" under the Clean Water Act or state law.[7]

II. <u>Factual Background</u>

A. DES chose the proposed PFAS criteria based on an outdated 2019 analysis that considered development and assessment costs, without accounting for up-to-date science or recent federal action.

Five years ago, in 2019, DES published a Plan to Generate PFAS Surface Water Quality Standards ("2019 Plan" or "Plan"). The 2019 Plan recognized that PFAS chemicals persist for long time periods, move easily through different environmental media, jeopardize human health, and bioaccumulate in people and animals.[8] The Plan labeled PFAS as "problematic" pollutants[9] and highlighted that they may cause cancer, immunotoxicity, developmental impacts, fertility and reproductive issues, high cholesterol, and other health harms.[10] It recognized that even low

[3] ENV'T PROT. AGENCY, WATER QUALITY STANDARDS HANDBOOK, CHAPTER 3: WATER QUALITY CRITERIA, at 1 (2023), *accessible at* https://www.epa.gov/sites/default/files/2014-10/documents/handbook-chapter3.pdf [hereinafter WQS Handbook].
[4] *See* RSA 485-A:8; N.H. CODE ADMIN. ENV-WQ 1703.01; *see also* Dep't Env't Servs., Plan to Generate PFAS Surface Water Quality Standards, at 14 (2019), *accessible at* https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/r-wd-19-30.pdf [hereinafter 2019 Plan].
[5] 2019 Plan at 14.
[6] *Id.*
[7] 2019 Plan at 13.
[8] *Id.* at 10–11.
[9] *Id.* at 10.
[10] *Id.* at 11.

levels of human exposure to PFAS—through diet, drinking water, or environmental sources—may "result in higher concentrations" in people because they can bioaccumulate and persist in the human body.[11]

DES's 2019 Plan evaluated seven different approaches for establishing surface water quality criteria for PFAS. Six approaches focused on protecting human health, and one focused on protecting aquatic life. Under the first human health approach (approach 5.3), DES would establish criteria by applying "an approved MCL" to surface waters within twenty miles upstream of a drinking water source.[12] Under the fifth human health approach (approach 5.7), DES would develop water concentration values that would protect both the drinking water and fish consumption uses.[13]

While the 2019 Plan acknowledged that DES cannot consider the cost of implementation when developing water quality criteria,[14] it nonetheless computed and evaluated the costs of developing criteria and assessing compliance for each approach.[15] DES ultimately chose the MCL-only approach, which had the lowest associated costs, and which is now reflected in the proposed rule.

Thus, the proposed rule adopts New Hampshire's state MCLs as water and fish ingestion criteria for surface waters within 20 miles upstream of a drinking water source.[16] It does not incorporate more recent science or federal drinking water standards or EPA recommendations for aquatic life criteria and benchmarks.

B. PFAS pollution is an environmental justice issue.

PFAS-related health risks are often higher for communities of color and low-income communities already overburdened by cumulative impacts of pollution. As the National Academies of Sciences, Engineering, and Medicine has recognized:

> [P]lace-based factors that may put individuals at greater risk of exposure (siting of chemical companies, refineries, and industrial sites), coupled with insufficient access to environmental screening,

[11] *Id.* at 11.
[12] *Id.* at 41.
[13] *Id.* at 74.
[14] *Id.* at 8, 13, 100.
[15] *Id.* at 36.
[16] *See* DEP'T ENV'T SERVS., CHAPTER ENV-WQ 1700 INITIAL PROPOSAL (2024), at Env-Wq 1703.21(b), Tbl. 1703.01, Tbl. 1703-2A, *accessible at* https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/env-wq-1700-ip.pdf.

> information, and adequate health care, have disproportionate impacts on Black, Hispanic, and Indigenous communities, as well as low-income populations.[17]

Some communities are often disproportionately exposed to PFAS through drinking water and fish consumption—which are also two designated uses that the final criteria must protect.

With respect to drinking water, one study considering data from 18 states—including New Hampshire—found that community water systems serving communities of color "had significantly increased odds" of containing PFAS.[18] The study concluded that "environmental justice concerns should be a component of risk mitigation planning for areas affected by drinking water PFAS contamination."[19]

With respect to fish consumption, residents of some communities often eat more locally caught fish for cultural and/or subsistence reasons, which increases PFAS exposure.[20] Of particular note and concern, eating just one serving of freshwater fish with 8.41 parts per billion (ppb) PFOS—the median level of PFOS found in freshwater fish in one EPA sampling program—*has the same health impacts as drinking water with 48 parts per trillion PFOS (2,400 times higher than EPA's interim health advisory level for PFOS) for an entire month.*[21]

The 2019 Plan failed to mention environmental justice, indicating that DES did not consider environmental justice when developing the PFAS criteria. When finalizing the proposed rule, DES should consider the disproportionate impacts caused by PFAS chemicals and should strengthen its PFAS criteria to ensure that the rules protect the health of residents in communities that are exposed to cumulative impacts of environmental pollution.

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[17] NAT'L ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE, GUIDANCE ON PFAS EXPOSURE, TESTING, AND CLINICAL FOLLOW-UP (2022), *accessible at* 22 https://www.ncbi.nlm.nih.gov/books/NBK584707/ [hereinafter National Academies Guidance].

[18] Jahred M. Liddie et al, *Sociodemographic Factors are Associated with the Abundance of PFAS Sources and Detection in U.S. Community Water Systems*, 57 ENV'T SCI. & TECH. 7902, 7902 (2023), *accessible at* https://pubs.acs.org/doi/10.1021/acs.est.2c07255.

[19] *Id.*

[20] National Academies Guidance at 24 ("Food insecurity, for example, even if only temporary, increases subsistence fishing (Quimby et al., 2020), which may cause people to fish for food in contaminated lakes or rivers."); Nadia Barbo et al., *Locally caught freshwater fish across the United States are likely a significant source of exposure to PFOS and other perfluorinated compounds*, 220 ENV'T RSCH. 1, 8 (2023), *accessible at* https://www.sciencedirect.com/science/article/pii/S0013935122024926?via%3Dihub.

[21] Barbo et al., *supra* note 20 at 6, Tbl. 2.

III. The Proposed Rules Pertaining to PFAS Should be Amended to Ensure Compliance with the Clean Water Act, Protect Important Designated Uses, and Advance Environmental Justice

Env-Wq 1703.21, as currently proposed, does not comply with the Clean Water Act's mandate for states to establish criteria that protect the most sensitive designated use, based on sound scientific rationale. To ensure compliance with the Clean Water Act—and to protect human health and aquatic life and advance environmental justice—DES should revise Env-Wq 1703.21 as detailed below.

A. DES should not rely on outdated, less protective state MCLs; it should revise the proposed PFAS criteria to incorporate federal MCLGs.

The proposed rule for PFAS incorporates state MCLs as "water and fish ingestion" criteria.[22] DES established the state MCL values five years ago, in 2019.[23] Those state MCLs are: 12 ng/L for PFOA, 15 ng/L for PFOS, 11 ng/L for PFNA, and 18 ng/L for PFHxS.[24]

The proposed criteria do not incorporate significantly more recent federal maximum contaminant level goals ("MCLGs") or MCLs, which EPA finalized in 2024.[25] EPA's drinking water limits and goals "represent[] data-driven drinking water standards that are based on the best available science[.]"[26] EPA's health-based MCLGs are: zero for PFOA and PFOS, 10 ng/L for PFHxS, PFNA, and GenX, and a Hazard Index of 1 for mixtures of two or more of PFHxS, PFNA, GenX, and PFBS.[27]

The state's MCLs, incorporated by the proposed rule, were established five years ago and contain higher values and cover fewer pollutants than the more recent federal MCLGs and MCLs, which EPA described as "data-driven."[28] Thus, the proposed criteria do not reflect the latest scientific knowledge or sound scientific rationale for protecting potential drinking water

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[22] *See* DEP'T ENV'T SERVS., CHAPTER ENV-WQ 1700 INITIAL PROPOSAL (2024), at Env-Wq 1703.21(l), Tbl. 1703-2A, *accessible at* https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/env-wq-1700-ip.pdf.
[23] N.H. DEP'T ENV'T SERVS., TECHNICAL BACKGROUND REPORT FOR THE JUNE 2019 PROPOSED MAXIMUM CONTAMINANT LEVELS (MCLS) AND AMBIENT GROUNDWATER QUALITY STANDARDS (AGQSS) FOR PERFLUOROOCTANE SULFONIC ACID (PFOS), PERFLUOROOCTANOIC ACID (PFOA), PERFLUORONONANOIC ACID (PFNA), AND PERFLUOROHEXANE SULFONIC ACID (PFHXS) (2019) at 1, https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/r-wd-19-29.pdf.
[24] *See* RSA 485:16-e.
[25] *See* 89 Fed. Reg. 32532 (April 26, 2024).
[26] *Id.* at 32532.
[27] *Id.*
[28] *Id.*

supplies, as is required under the Clean Water Act. *See* 33 U.S.C. § 1314(a)(1); 40 C.F.R. § 131.11(a)(1).

Moreover, and very importantly, EPA guidance directly advises *against* states incorporating MCLs as surface water quality standards when "*consideration of available treatment technology, costs, or availability of analytical methodologies has resulted in an MCL that is less protective than an MCLG*."[29] The state MCLs are inarguably "less protective" than the federal MCLGs: the federal MCLGs contain more stringent concentrations, cover two additional PFAS compounds, and address mixtures of PFAS chemicals. Notably, the federal MCLG values for PFOA and PFOS are zero, indicating that there is no safe level for those chemicals in drinking water.

Because the federal MCLGs are supported by the latest science, *see* 33 U.S.C. § 1314(a)(1), and are more health-protective, DES should incorporate the federal MCLG values (for all covered PFAS compounds) into Env-Wq 1703.21 as water quality criteria.

In the alternative, DES should, using the process outlined in section 5.7 of the 2019 Plan, calculate water concentration limits for PFAS to protect both fish consumption and drinking water uses based on available data. In doing so, DES should consider recent peer-reviewed data on PFAS bioaccumulation in New Hampshire[30] and the health impacts associated with consuming PFAS-contaminated fish,[31] as well as data that DES has gathered on PFAS in fish after 2019.[32]

B. DES should adopt EPA's recommended final aquatic life criteria and benchmarks.

The proposed rule for PFAS does not include criteria for aquatic life protection. In the 2019 Plan, DES described EPA's aquatic life recommendations as "well vetted by the scientific and regulated community" and acknowledged that "States can adopt [EPA-recommended] criteria as is" or adopt more protective criteria.[33] However, in 2019, when the Plan was published, EPA had not published criteria recommendations or guidance for PFAS chemicals. Thus, the Plan stated

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[29] https://www.epa.gov/sites/default/files/2014-10/documents/handbook-chapter3.pdf (emphasis added)
[30] *See* Heidi M. Pickard et al., *PFAS and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories*, 56 ENV'T SCI. & TECH. 15573 (2022), *accessible at* https://pubs.acs.org/doi/10.1021/acs.est.2c03734 (calculating bioaccumulation factors for various PFAS in fish at freshwater sampling sites in New Hampshire; concluding that regulatory efforts "do not consider the full range of highly bioaccumulative terminal [perfluoroalkyl acids] and precursors[.]")
[31] *See generally* Barbo et al., *supra* note 20.
[32] *See generally* DEP'T ENV'T SERVS., PFAS BASELINE STUDY LAKE FISH SPECIMEN, SURFACE WATER, AND SEDIMENT, MULTIPLE LAKES, NEW HAMPSHIRE (2021), *accessible at* https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/r-wd-21-12.pdf.
[33] 2019 Plan at 13.

that DES should "*wait[] for national efforts* to buildout the full data gaps before calculating aquatic life use support criteria."[34]

The status of EPA's aquatic life recommendations for PFAS has changed significantly since the 2019 Plan. On October 7, 2024, EPA finalized 304(a) criteria for PFOA and PFOS in freshwater.[35] It also established acute saltwater aquatic life benchmarks for PFOA and PFOS, as well as acute freshwater aquatic life benchmarks for eight other PFAS compounds (PFBA, PFHxA, PFNA, PFDA, PFBS, PFHxS, 8:2 FTUCA, and 7:3 FTCA).[36]

To ensure that the Env-Wq 1703 criteria protect the aquatic life designated use, we urge DES to directly incorporate EPA's PFAS aquatic life criteria and benchmarks into the state rule. Importantly, EPA's aquatic life final criteria and benchmarks would apply to all surface waters, not only surface waters within 20 miles upstream of a drinking water source. DES should incorporate these aquatic life criteria and benchmarks *in addition to*, not in place of, human health criteria to ensure that the criteria protect most sensitive use of each surface water. *See* 40 C.F.R. § 131.11(a)(1).

IV. Conclusion

To ensure compliance with the Clean Water Act's goals and requirements, to protect human health and aquatic life, and advance environmental justice, it is essential that DES strengthen the PFAS provisions of the proposed rule. Specifically, DES should incorporate federal MCLGs for PFAS instead of state MCLs, and/or develop water concentration limits for PFAS to protect both fish consumption and drinking water uses. In addition to strengthening its human health criteria, DES should adopt EPA's final recommendations for aquatic life criteria and benchmarks for PFAS.

Respectfully submitted,

/s/ Jillian Aicher
Jillian Aicher, Equal Justice Works Fellow
Conservation Law Foundation

Tom Irwin, Vice President, New Hampshire
Conservation Law Foundation

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[34] *Id.* at 98.
[35] 89 Fed. Reg. 81077 (Oct. 7, 2024).
[36] *Id.* at 81077.

Dr. Kate Buckman, River Steward, New Hampshire
Connecticut River Conservancy

James McKim, President
Manchester NAACP

Laurene Allen, Co-Founder
Merrimack Citizens for Clean Water

John Macone, Policy and Education Director
Merrimack River Watershed Council

Dr. Paul Friedrichs, Chair, Board of Directors
New Hampshire Healthy Climate

Michele L. Tremblay, President, Board of Directors
New Hampshire Rivers Council

Mindi Messmer, Co-Founder
New Hampshire Safe Water Alliance

Matt Leahy, Public Policy Director
Society for the Protection of New Hampshire Forests

Andrea Amico, Co-Founder
Testing for Pease

Edwardson, Ken

From: Daniel Hooberman <Daniel.Hooberman@messages.clf.org>
Sent: Monday, November 18, 2024 1:36 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.
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Dear Kenneth Edwardson,
These chemicals are poisoning our children.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Daniel Hooberman

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Elyza Agosta <Elyza.Agosta@messages.clf.org>
Sent:	Thursday, November 21, 2024 8:48 AM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

____

Dear Kenneth Edwardson,
I am a Manchester resident. I've learned more about the amount of PFAS being burned at our waste water facility and going down the Merrimack river and its devastating effects on cancer rates in our community. This needs urgent action and any rules that can be put in place to limit PFAS will save lives and communities.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

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Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

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Thank you,

Elyza Agosta

Edwardson, Ken

From:	Janet Ward <Janet.Ward@messages.clf.org>
Sent:	Tuesday, November 19, 2024 9:38 AM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

____

Dear Kenneth Edwardson,
The use of UPDATED, CURRENT information in protecting NH surface water quality is essential.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Janet Ward

Edwardson, Ken

From: Jean Lewandowski <Jean.Lewandowski@messages.clf.org>
Sent: Thursday, November 21, 2024 11:30 AM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

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Dear Kenneth Edwardson,
I live in Nashua, NH, which is part of the Merrimack River Valley and the Merrimack and Nashua River watersheds. Tens of thousands of people who depend on these rivers and streams are affected every day by the quality of the water they carry.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

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Thank you,

Jean Lewandowski

Edwardson, Ken

From: James McConnell <James.McConnell@messages.clf.org>
Sent: Monday, November 18, 2024 3:48 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.
____

Dear Kenneth Edwardson,
When I was a member of the NH House of Representatives we studied PFAS extensively. It is a serious risk which has not been adequately addressed.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Jim McConnell

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Joe Mazzone <Joe.Mazzone@messages.clf.org>
Sent:	Monday, November 18, 2024 2:36 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

____

Dear Kenneth Edwardson,
Mr Edwardson,
My name is Joe Mazzone and I live in Ashland NH. I am totally for enforci g the most stringent laws possible to keep our water clean and free of pollutants. This is no easy task as the East Coast is the tailpipe of the USA. While we cannot control other States West of us, we can control New Hampshire. Please use your influence to pursue the course of prevention and sustainability in regards to clean water Thank you!
Sincerely
Joe Mazzone
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

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Thank you,

Joe Mazzone

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	John Donovan <John.Donovan@messages.clf.org>
Sent:	Tuesday, November 19, 2024 6:28 AM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

____

Dear Kenneth Edwardson,
please contact me about forest degradation action As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

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Thank you,

John Donovan

Edwardson, Ken

From: Julia Hawkins <Julia.Hawkins@messages.clf.org>
Sent: Tuesday, November 19, 2024 11:00 AM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.
____

Dear Kenneth Edwardson,
I grew up on Swains Lake in Barrington, NH. The ecological network of our state's bodies of water have always been part of what makes this place feel like home to me. I want those bodies of water to be clean and useable for NH residients and wildlife long after I'm gone.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

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Thank you,

Julia Hawkins

Edwardson, Ken

From: Katrie Hillman <Katrie.Hillman@messages.clf.org>
Sent: Tuesday, November 19, 2024 1:44 PM
To: Edwardson, Ken

Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

____

Dear Kenneth Edwardson,
Thank you for taking the time to consider my thoughts regarding PFAS-related decisions. I feel that we must do more to protect our land, water and fellow residents from PFAS contamination. Any action, therefore, that might decrease the threats from PFAS must be taken. People care about how these thousands of contaminants affect their health and the world around them. I serve on my city's Safe Water Advisory board and often receive questions from residents and friends about what NH is doing to better protect them.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

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To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Katrie Hillman

Edwardson, Ken

From:	Lois Cote <Lois.Cote@messages.clf.org>
Sent:	Monday, November 18, 2024 5:34 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Dear Kenneth Edwardson,
Many decades ago New Hampshire began the work that successfully brought the Merrimack River back from being one of the most polluted in the country to a Class B waterway, and we thought we had saved this precious natural resource. Sadly, it appears that history is repeating itself with a new, more virulent generation of pollutants entering our beautiful Merrimack.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

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To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Lois Cote

Edwardson, Ken

From: Richard de Seve <Richard.deSeve@messages.clf.org>
Sent: Monday, November 18, 2024 3:32 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Dear Kenneth Edwardson,
Come on, Ken, we can do better than the Fed standards!
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

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Thank you,

Richard de Seve

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Robin Kaiser <Robin.Kaiser@messages.clf.org>
Sent: Thursday, November 21, 2024 10:34 AM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Dear Kenneth Edwardson,
I fully support the message written here. Clean water is essential to human health and the health of all living things. All of us, particularly those who have the responsibility to safeguard our water quality, have a duty to protect our water quality using the latest scientific research as our guideline.
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Robin Kaiser

Edwardson, Ken

From:	Alan Brown <Alan.Brown@messages.clf.org>
Sent:	Monday, November 18, 2024 2:42 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

Under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. But DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called "Maximum Contaminant Level Goals"). I also urge DES to directly adopt EPA's recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Alan Brown

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Ann Podlipny <Ann.Podlipny@messages.clf.org>
Sent: Monday, November 18, 2024 1:44 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

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Thank you,

Ann Podlipny

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Ann Podlipny <Ann.Podlipny@messages.clf.org>
Sent:	Tuesday, November 19, 2024 2:58 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

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Thank you,

Ann Podlipny

Edwardson, Ken

From: Barbara Widger <Barbara.Widger@messages.clf.org>
Sent: Tuesday, November 19, 2024 12:56 PM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Dear Kenneth Edwardson,
Do all that can be to prevent the long-term effects!
As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

PFAS chemicals create serious risks for people and the environment. Communities of color and low-income communities are often disproportionately exposed to PFAS through drinking water and fish consumption – which are also two designated uses that the final PFAS criteria must protect.

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Thank you,

Barbara Widger

Edwardson, Ken

From:	Barry Draper <Barry.Draper@messages.clf.org>
Sent:	Monday, November 18, 2024 4:18 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

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Thank you,

Barry Draper

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Carol Breault <Carol.Breault@messages.clf.org>
Sent:	Monday, November 18, 2024 3:16 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

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Thank you,

Carol Breault

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Carl Prellwitz <Carl.Prellwitz@messages.clf.org>
Sent:	Monday, November 18, 2024 3:04 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

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Thank you,

Carl Prellwitz

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Carl Prellwitz <Carl.Prellwitz@messages.clf.org>
Sent:	Monday, November 18, 2024 3:06 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Dear Kenneth Edwardson,

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Thank you,

Carl Prellwitz

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Charles Arnold <Charles.Arnold@messages.clf.org>
Sent: Tuesday, November 19, 2024 8:40 AM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

___

Dear Kenneth Edwardson,

As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

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Thank you,

Charles Arnold

Edwardson, Ken

From: Cynthia Glenn <Cynthia.Glenn@messages.clf.org>
Sent: Monday, November 18, 2024 1:38 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Cynthia Glenn

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: d carr <d.carr@messages.clf.org>
Sent: Monday, November 18, 2024 1:34 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

Dear Kenneth Edwardson,

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Thank you,

d carr

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Diane Chatigny <Diane.Chatigny@messages.clf.org>
Sent: Monday, November 18, 2024 1:44 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Dear Kenneth Edwardson,

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Thank you,

Diane Chatigny

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Ellen Jahos <Ellen.Jahos@messages.clf.org>
Sent: Monday, November 18, 2024 1:36 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Ellen Jahos

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Erik Bisson <Erik.Bisson@messages.clf.org>
Sent:	Tuesday, November 19, 2024 6:52 AM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Erik Bisson

Edwardson, Ken

From: Erline Towner <Erline.Towner@messages.clf.org>
Sent: Monday, November 18, 2024 1:40 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Erline Towner

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Francis Coleman <Francis.Coleman@messages.clf.org>
Sent:	Monday, November 18, 2024 3:54 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Francis Coleman

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Jane Davidson <Jane.Davidson@messages.clf.org>
Sent: Monday, November 18, 2024 2:50 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Jane Davidson

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Janet Fotos <Janet.Fotos@messages.clf.org>
Sent:	Monday, November 18, 2024 1:42 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Janet Fotos

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Jennifer Allen <Jennifer.Allen@messages.clf.org>
Sent: Wednesday, November 20, 2024 1:06 AM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Jennifer Allen

Edwardson, Ken

From:	Julia Di Stefano <Julia.DiStefano@messages.clf.org>
Sent:	Monday, November 18, 2024 4:04 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Julia Di Stefano

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Kellie Smith <Kellie.Smith@messages.clf.org>
Sent:	Monday, November 18, 2024 6:16 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Kellie Smith

Edwardson, Ken

From: Kelly Turney <Kelly.Turney@messages.clf.org>
Sent: Thursday, November 21, 2024 10:58 PM
To: Edwardson, Ken
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

Dear Kenneth Edwardson,

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Thank you,

Kelly Turney

Edwardson, Ken

From:	Larry Johnson <Larry.Johnson@messages.clf.org>
Sent:	Monday, November 18, 2024 1:52 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Larry Johnson

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Lawrence Rush <Lawrence.Rush@messages.clf.org>
Sent:	Monday, November 18, 2024 2:00 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Lawrence Rush

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Linda Ferland <Linda.Ferland@messages.clf.org>
Sent:	Wednesday, November 20, 2024 4:50 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Linda Ferland

Edwardsson, Ken

From:	Lisa Heard <Lisa.Heard@messages.clf.org>
Sent:	Monday, November 18, 2024 2:46 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Lisa Heard

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Lisa Magazu <Lisa.Magazu@messages.clf.org>
Sent:	Monday, November 18, 2024 1:38 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Lisa Magazu

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Mara Sabinson <Mara.Sabinson@messages.clf.org>
Sent:	Monday, November 18, 2024 4:58 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Mara Sabinson

Edwardson, Ken

From: Mary Casey <Mary.Casey@messages.clf.org>
Sent: Monday, November 18, 2024 1:48 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Mary Casey

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Meg Gilman <Meg.Gilman@messages.clf.org>
Sent:	Monday, November 18, 2024 3:46 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Meg Gilman

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Melanie Dieringer <Melanie.Dieringer@messages.clf.org>
Sent:	Monday, November 18, 2024 2:02 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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To strengthen the rule, I urge DES not to rely on outdated, less protective state drinking water standards. Instead, it should revise the proposed PFAS criteria to incorporate the most protective, health-based federal standards for PFAS (called “Maximum Contaminant Level Goals”). I also urge DES to directly adopt EPA’s recommended aquatic life criteria and benchmarks for PFAS as an additional part of the rule.

Thank you,

Melanie Dieringer

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Michael Belanger <Michael.Belanger@messages.clf.org>
Sent:	Tuesday, November 19, 2024 10:18 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

Dear Kenneth Edwardson,

As a New Hampshire resident, I am writing to comment on the Department of Environmental Services ("DES") proposed rule amending the New Hampshire surface water quality standards.

I support DES including criteria for forever chemicals, or PFAS, in its proposed rule. But I am concerned that the proposed rule does not go far enough to protect human health, the environment, and environmental justice.

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Thank you,

Michael Belanger

Edwardson, Ken

From:	Michael Semprebon <Michael.Semprebon@messages.clf.org>
Sent:	Monday, November 18, 2024 3:06 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Michael Semprebon

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Nick Jenkins <Nick.Jenkins@messages.clf.org>
Sent:	Monday, November 18, 2024 3:42 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Nick Jenkins

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Niki Tulk <Niki.Tulk@messages.clf.org>
Sent: Monday, November 18, 2024 2:06 PM
To: Edwardson, Ken
Cc: EUT@legislature.maine.gov
Subject: Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Niki Tulk

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Richard Lombard <Richard.Lombard@messages.clf.org>
Sent:	Monday, November 18, 2024 1:52 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Richard Lombard

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From:	Robyn Dibble <Robyn.Dibble@messages.clf.org>
Sent:	Monday, November 18, 2024 6:50 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Robyn Dibble

Edwardson, Ken

From:	Sara Olson <Sara.Olson@messages.clf.org>
Sent:	Tuesday, November 19, 2024 4:54 PM
To:	Edwardson, Ken
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Sara Olson

Edwardson, Ken

From:	Tim Pendergast <Tim.Pendergast@messages.clf.org>
Sent:	Monday, November 18, 2024 3:12 PM
To:	Edwardson, Ken
Cc:	EUT@legislature.maine.gov
Subject:	Strengthen PFAS Criteria in Env-Wq 1703.21

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Thank you,

Tim Pendergast

cc: Committee Clerk Michael Gagne

Edwardson, Ken

From: Andrea LaMoreaux <alamoreaux@nhlakes.org>
Sent: Wednesday, November 20, 2024 11:11 AM
To: Edwardson, Ken
Subject: Public Comment on DES proposed amendments to Env-Wq 1700

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Attn: Kenneth Edwardson
Watershed Management Bureau
Water Division, New Hampshire Department of Environmental Services
29 Hazen Dr., P.O Box 95
Concord, NH 03302-0095

November 20, 2024

Dear Mr. Edwardson,

NH LAKES appreciates the opportunity to comment on the proposed amendments to New Hampshire's Surface Water Quality Regulations, Env-Wq 1700. NH LAKES is a statewide, publicly-supported nonprofit organization with a mission of restoring and preserving the health of New Hampshire's lakes.

We have all been learning that PFAS chemicals can create serious risks for people and the environment, including the lake environment in New Hampshire. We appreciate that the New Hampshire Department of Environmental Services (NHDES) has included criteria for these chemicals in its proposed surface water quality regulation at Env-Wq 1703. To be even more protective of human and ecological health, we recommend that NHDES strengthen its PFAS criteria.

Specifically, we suggest that the proposed PFAS criteria incorporate the more recent federal maximum contaminant level goals, which the US Environmental Protection Agency finalized in 2024. We also suggest that NHDES incorporate the PFAS aquatic life criteria and benchmarks finalized by the EPA in 2024.

As we continue to learn about the impact of PFAS on human and ecological health, we support implementing EPA's more protective criteria in New Hampshire.

Respectfully,
Andrea LaMoreaux

Andrea LaMoreaux
President & Policy Advocate, NH LAKES
p: 603.226.0299 | 17 Chenell Drive, Suite One | Concord, NH 03301
nhlakes.org
Working together for the lakes we all love.

NH LAKES

Want to give your lake a voice at the State House? Sign up for *Advocacy Alerts* here!

City of Rochester, New Hampshire

31 Wakefield Street • Rochester, NH 03867

(603) 335-7506

www.RochesterNH.net

November 22, 2024

VIA ELECTRONIC MAIL

Ken Edwardson, Senior Scientist
Office of Watershed Management
Department of Environmental Services
29 Hazen Drive
P.O. Box 95
Concord, NH 03302-0095
Email: Kenneth.j.edwardson@des.nh.gov

Re: Surface Water Quality Regulations – Env-Wq 1700
Rulemaking Notice 2024-219
City of Rochester Public Comments

Dear Mr. Edwardson,

The City of Rochester ("City") hereby submits its written comments to the New Hampshire Department of Environmental Services ("NHDES") for proposed changes to Env-Wq 1700: Surface Water Quality Regulations pursuant to the above-referenced Rulemaking Notice published on October 29, 2024. The City appreciates the opportunity to provide written comments and asked the NHDES considered these comments as part of the Administrative Record.

The City is deeply committed to protecting the water quality of the Cocheco River and the Great Bay watershed. As you know, the City is currently implementing and planning significant upgrades to our Wastewater Treatment Facility (WWTF) to improve the efficiency of the facility and to reduce nitrogen and phosphorus discharges from the WWTF effluent. We are an active member of the Municipal Alliance for Adaptive Management (MAAM) and are funding studies to better understand the interplay of nitrogen and other factors that may impact the health of eelgrass in the Great Bay estuary.

Our enclosed comments offer greater detail of the technical concerns that we have with the proposed changes to Env-Wq 1700 rules. These comments have been prepared in consultation with Clifton Bell, our environmental consultant with Brown and Caldwell.

Comment No. 1:

Procedures for Site-Specific Nutrient Criteria: The City supports the incorporation of procedures for determining alternative site-specific criteria (Env-Wq 1704.03), and we appreciate the Department's efforts in crafting the associated language. For permitting purposes, the City also supports the use of flows that are commensurate with the technical basis of site-specific criteria or a TMDL (Env-Wq 1705.01(d)(2)). These procedures provide a pathway for improving the scientific linkage between nutrient loads, water body responses, and designated uses.

Env-Wq 1704.03(a) lists a number of approaches that could be used to determine site-specific nutrient criteria, including the EPA's nutrient criteria technical guidance manuals that were developed around the year 2000, and the 2010 EPA guidance on using stressor-response relationships. As NHDES is aware, the EPA technical guidance documents are not highly prescriptive regarding how nutrient criteria are derived. Rather, they discuss broad categories of technical approaches (reference conditions, empirical approaches, modeling, etc.) and provide examples. In the City's view, this guidance should be interpreted broadly to allow for any defensible empirical or modeling-based methods or technologies, regardless of whether they are explicitly mentioned in the manuals. Most of these documents are about quarter-century old and could not anticipate all the specific methods that might be employed or available in the future. For example, the manuals' lack of discussion of remote sensing techniques and machine learning methods should not preclude the application of such methods, if agencies agreed that they were relevant and applicable.

In the past, the City recommended that the procedures listed Env-Wq 1704.03(a) include "Other modeling or empirical-based methods accepted by the department" or similar language. The purpose would be to ensure that a narrow interpretation of old guidance manuals (e.g., by an external agency or third party) would not preclude the flexibility to apply defensible methods. The City retains this recommendation and comment and suggests adding the following language to the proposed Env-Wq 1704.03(a):

> ***(9) Other modeling or empirical-based methods accepted by the Department.***

Barring the inclusion of such language, it would be help if NHDES could clarify in writing that the Department intends to interpret the EPA guidance manual broadly, to allow the use a broad range of scientific methods that link nutrient loads or concentrations to water body responses and designated uses.

Comment No. 2:

Implementation Procedures for New Aluminum Criteria: In the past, NHDES demonstrated that, in many settings, aluminum can be less toxic with the critical flow critical conditions used for permitting; e.g., due to higher hardness. To our knowledge, the EPA aluminum criteria document and calculation methods mention the proposed language of Env-Wq 1703.22(s) but do not explicitly include (or rule out) the consideration of such a relationship between flow and the background concentrations of constituents that affect aluminum toxicity. Therefore, the City requests NHDES provide clarification regarding if and how the Department plans to consider this relation, where it exists.

Thank you for your attention to this matter. We hope you give our concerns serious consideration, and we look forward to continued discussions.

Very truly yours,

Peter Nourse

Digitally signed by Peter Nourse
DN: DC=local, DC=Rochester, OU=ROCH-Staff, OU=DPW, CN=Peter Nourse, E=peter.nourse@rochesternh.gov
Reason: I am the author of this document
Location:
Date: 2024.11.21 16:03:54-05'00'
Foxit PDF Editor Version: 12.0.0

Peter Nourse
Director of City Services

cc: Katie Ambrose, City of Rochester, City Manager
Terence O'Rourke, Esq., City of Rochester, City Attorney
Gretchen Young, City of Rochester, Deputy Director of City Services
David Green, City of Rochester, Chief Operator, WWTF
Clifton Bell, P.E., P.G., Managing Environmental Scientist, Brown and Caldwell
Sherilyn Burnett Young, Esq., Rath, Young & Pignatelli, P.C.
James Steinkrauss, Esq., Rath, Young & Pignatelli, P.C.

REGION 1
BOSTON, MA 02109

November 22, 2024

Ken Edwardson, Senior Scientist
Watershed Management Bureau
Water Division, NH Department of Environmental Services
29 Hazen Dr., P.O. Box 95
Concord, NH 03302-0095

Dear Mr. Edwardson:

Thank you for the opportunity to comment on the New Hampshire Department of Environmental Services (NHDES) Rulemaking for Env-Wq 1700: Surface Water Quality Regulations, i.e., NHDES's proposed amendments to the New Hampshire Water Quality Standards (WQS). The U.S. Environmental Protection Agency (EPA) Region 1 and Office of Water have been coordinating closely with NHDES staff on the development of this rule and have provided comments and suggestions on previous drafts. This letter represents EPA's comments on the proposed NH WQS.

Comments:

Env-Wq 1703.03(c) and **Env-Wq 1703.04(a)** – Water Quality Criteria Approval
NHDES has removed the following language in (c) and (d) "unless otherwise specifically allowed by a statute, rule, order, or permit." In past triennial reviews, EPA could not approve the language that is being struck because it did not demonstrate how water quality standards would be achieved given those allowances. As such, EPA is supportive of the removal of this language.

Env-Wq 1703.17 – Cyanotoxins
NHDES is proposing new criteria for cyanotoxins. EPA is supportive of this effort and notes that the proposed magnitude values align with EPA's 2019 Recreational Water Quality Criteria or Swimming Advisories for Cyanotoxins.[1] However, in Env-Wq 1703.17(a) the duration of the criteria are expressed as a 12-month rolling period. While EPA's recommended cyanotoxin criteria are also expressed as an annual duration, the assumption is that the annual period encompasses a single recreational period or swimming season. In contrast, in Env-Wq 1703.17(b), NHDES does not discuss the criteria as a rolling period but instead expresses the criteria as "not to be exceeded more than once in five years." EPA seeks clarification on how the 12-month rolling periods will be implemented (if that was the intention) when assessing whether chronic concentrations are exceeded more than once in five years.

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[1] Available at: https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods#rec3.

EPA also notes that while changes in notation of micrograms per liter were made in other parts of Env-Wq 1700, they were not made in this section. NHDES should consider including consistent lettering, i.e., "µg/L".

Env-Wq 1703.20 – Target Risk for Human Health Criteria
This section includes updates to the language used for describing how human health criteria are derived. EPA does not have any comments or issues on the change in terminology from "risk factor" to "target risk."

EPA also notes in this section how human health criteria are being defined in relation to their values for discharges. In general, EPA does not support this framing as criteria are supposed to express the desired condition of a waterbody rather than the regulatory requirements of a discharge into that waterbody. In this section, NHDES's use of "criteria" appears to be more similar to descriptions of how water quality-based effluent limitations should be calculated. If the provisions in this section are intended to address how human health criteria will be derived, EPA recommends removing reference to discharges.

Table 1703-01 and Note (c) and Technical Support Document – Arsenic
NHDES is proposing changes to the arsenic human health criteria. NHDES is changing multiple input variables used to calculate the criteria that will result in the final criteria increasing in value. The water and fish ingestion criteria would increase from 0.018 µg/L to 0.19 µg/L (freshwater) or 0.18 µg/L (marine waters) and the fish consumption only criteria would increase from 0.140 µg/L to 4.1 µg/L (freshwater) or 2.2 µg/L (marine waters). NHDES is proposing to change the following input variables:

1) Target risk is decreasing (i.e., becoming less stringent) from 1 in 1,000,000 to 1 in 100,000.
2) Body weight is increasing from 70 to 80 kg.
3) Cancer potency factor is decreasing from 1.75 to 1.5 [per (mg/kg)/day].
4) Drinking water intake is increasing from 2.0 to 2.7 L/day
5) Fish consumption rate is increasing from 0.0065 to 0.092 kg/day.
6) A 10% inorganic fraction is being incorporated into the criteria equation.
7) The bioconcentration factor is decreasing from 44 to 14 L/kg for freshwater and to 26 for marine waters.

Together these inputs will increase the criteria (i.e., make less stringent). EPA is supportive of the updates that are changing due to EPA guidance (e.g., the assumptions for average body weight, cancer potency risk factor, and average drinking water intake). However, the significant change being made to the state's target risk (see item 1 above) lacks sufficient justification. EPA provided informal comments on NHDES's arsenic revisions ahead of the public comment period and encourages NHDES to revisit those. An overview of the central issue is discussed below.

As NHDES has highlighted, EPA believes that both 10^{-6} and 10^{-5} may be acceptable cancer risk levels ("target risks") for the general population and that highly exposed populations should not exceed a cancer risk level of 10^{-4}. However, EPA's main concern is that the new cancer risk level for arsenic (10^{-5}) is inconsistent with the state's cancer risk level used to develop other human health criteria (10^{-6}). NHDES has provided minimal justification for why a deviation from their standard risk framework is warranted for arsenic. The argument primarily rests on the discrepancy between the maximum contaminant level (MCL) for arsenic in state regulations and the current water quality criteria. While the MCL for arsenic is higher than the proposed water quality criteria, the MCL goal (MCLG) is zero, i.e., even more stringent than the current water quality criteria. The MCLG is the level of a contaminant in drinking water below which there is no known or expected risk to health. An MCL by contrast takes into account economic considerations surrounding cost of treatment. Under the Clean Water Act, water quality criteria are not based on those same economic considerations and thus a comparison between the water quality criteria and MCLG is more appropriate.

Another factor brought up in justifying the change to arsenic criteria is the high ambient concentrations of arsenic in New Hampshire waters. As described by NHDES, this has posed a challenge for wastewater treatment facilities to meet arsenic permit limits. EPA recommends that NHDES refocus its analysis away from one centered solely on cost of treatment to an analysis that includes a discussion of the health risk and the potential economic cost-to-human health cost trade-offs. This issue also comes up via the following claim made by NHDES, "If NHDES were to maintain the existing HHC and conduct broader arsenic sampling, there is a possibility that NHDES would recommend reduced fish and shellfish consumption which would be detrimental to public health at the population level due to the loss of health benefits from the consumption of fish and shellfish. From a risk management perspective, there are a lack of risk assessment models and tools to quantitatively balance the benefits and risks for arsenic in seafood. Thus, NHDES made a qualitative determination to adjust the target risks from 10^{-6} to 10^{-5} in an effort to strike a balance between public health protection and excessive risk conservatism. Therefore, New Hampshire is revising the arsenic criteria based on a target risk of 10^{-5}." See Draft R-WD-24-18 at 5. NHDES's recognition of uncertainty in the risk vs benefits of eating seafood exposed to higher arsenic concentration does not on its own justify an increase in the potential risk of arsenic exposure. EPA recommends providing further justification for its "qualitative determination."

EPA does not believe the concerns laid out in this comment would prohibit the adoption of the proposed criteria in WQS. However, EPA is concerned that NHDES's analysis focuses narrowly on the economic impacts of water treatment without sufficient consideration of the human health risks of changing the target risk. EPA would like to see further justification on the change to the target risk value that is not solely based on economic considerations and takes into account the human health implications of the change. In addition, to develop the arsenic criteria, NHDES used new values of fish consumption rate and drinking water intake that are inconsistent with the values used to derive their other human health criteria. NHDES should address how the other human health criteria in Env-Wq 1700 will be updated (if at all) to account for the new values for these parameters. Lastly, the arsenic criteria for the protection of water and fish ingestion are being specified for both freshwater and marine waters. NHDES should clarify the appropriateness of a water consumption-related criteria for marine waters.

Table 1703-01 – Diazinon
EPA notes that the water quality criteria for Diazinon have not been approved by EPA and are currently not in effect for Clean Water Act purposes.

Table 1703-01 and Note (l) – Methyl tertiary-butyl ether (MtBE)
NHDES proposes adding MtBE human health criteria based on state drinking water maximum contaminant levels (MCLs). EPA does not have any recommended human health criteria or MCLs for

MtBE. EPA requests that in its eventual submittal of proposed changes to Env-Wq 1700, NHDES include a justification for how these criteria are based on sound scientific rationale and protective of the applicable designated use(s), pursuant to 40 CFR § 131.11. Doing so will facilitate EPA's CWA Section 303(c) review.

Table 1703-01 and Note (l) – PFAS
NHDES proposes adding human health criteria for four PFAS compounds based on state drinking water maximum contaminant levels (MCLs). EPA MCLs and MCLGs for these four PFAS compounds are more stringent than the concentrations proposed by NHDES.[2] The proposed criteria are also stipulated for the protection of human health from water and fish ingestion. While MCLs and MCLGs under the Safe Drinking Water Act may address drinking water ingestion, they are not derived to protect human health with respect to fish ingestion. Lastly, EPA is in the process of proposing human health criteria for at least two PFAS that may be more stringent than EPA's MCLs referenced above as well as NHDES's. Given these facts, EPA requests that in its eventual submittal of proposed changes to Env-Wq 1700, NHDES include a justification for how these criteria are based on sound scientific rationale and protective of the applicable designated use(s), pursuant to 40 CFR § 131.11. Doing so will facilitate EPA's CWA Section 303(c) review.

Table 1703-01 – Toluene
EPA notes that the water quality criteria for Toluene have not been approved by EPA and are currently not in effect for Clean Water Act purposes.

Note (l) and Table 1703-2A – Methyl Chloride
NHDES proposes adding a Methyl Chloride human health criterion based on the state drinking water maximum contaminant level (MCL). EPA does not have any recommended human health criteria or MCLs for Methyl Chloride. EPA requests that in its eventual submittal of proposed changes to Env-Wq 1700, NHDES include a justification for how these criteria are based on sound scientific rationale and protective of the applicable designated use(s), pursuant to 40 CFR § 131.11. Doing so will facilitate EPA's CWA Section 303(c) review.

Env-Wq 1703.22(o) and Env-Wq 1703.34 – Selenium
NHDES is adopting EPA's 2016 Clean Water Act 304(a) aquatic life criteria for Selenium in freshwater. EPA is supportive of the change. EPA notes that the notes in 1703.35 differ from those recommended by EPA in its 304(a) recommendation document, as amended in 2021.[3] As written 1703.35(b) is not clear when water column values take precedence. EPA recommends that NHDES add language to the effect that "When selenium inputs are increasing, water column values are the applicable criterion element in the absence of steady-state condition fish tissue data."

Env-Wq 1703.22(s) – Aluminum
NHDES is adopting EPA's 2018 Clean Water Act 304(a) aquatic life criteria for Aluminum in freshwater. NHDES has also published a draft aluminum criteria implementation guidance for NPDES permitting. The guidance will dictate how the criteria will be used in practice to protect NH waterbodies and, as such, necessitates further review from EPA. EPA has comments on this guidance; however, since this

[2] See https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas.
[3] See https://www.epa.gov/wqc/aquatic-life-criterion-selenium.

guidance is separate from the triennial review and not referenced in the WQS, EPA will submit those comments separately.

The aluminum criteria are expressed as acid soluble aluminum; however, EPA's 2018 aluminum criteria are expressed as total recoverable aluminum. It is not clear in Env-Wq 1700 if acid soluble criteria are only applicable when the 2018 criteria are not used, or if all criteria are meant to be expressed as acid soluble aluminum. NHDES should clarify which approach they are taking, e.g., by changing footnote (s) to "Unless subject to (1) and (2)…" If all criteria are meant to be expressed as acid soluble aluminum, NHDES should provide further justification for how their modified criteria are as protective as EPA's 304(a) criteria and how data conversion between the two types of measurements will be conducted.

Env-Wq 1704.03 – Procedures for Site-Specific Nutrient Criteria
NHDES is proposing to clarify the procedures for developing nutrient criteria. EPA notes that these are not criteria in and of themselves as they do not describe a quality of water that would support a particular designated use, rather they outline the procedures to develop those criteria. As such, EPA does not plan to act on these procedures. Any nutrient criteria developed through the procedures proposed in Env-Wq 1704.03 must go through the same approval process as any other water quality standard submission as required by 40 CFR § 131.21.

Env-Wq 1705.02 – Dilution and Conditions for Permitting
NHDES is proposing to revise the permitting related requirements in Env-Wq 1700. Some of these conditions are not clearly water quality standards that need EPA's approval. Further, these changes do not appear to provide further clarity to NH WQS and EPA is unclear of what benefit the changes provide. In practice, it is unclear how these requirements should be interpreted. A few related comments are provided below to elaborate on these concerns.

NHDES's first proposed change is to specify what ambient targets can be used to set permit limits. However, the discussion in 1705.02(d)(1) and (2) goes on to discuss reasonable potential analyses. Is 1705.02(d) implying that permit limits shall be based on the same targets as those used in reasonable potential analyses (RPA) or is this section meant to clarify what targets should be used in those analyses? Regarding the RPA nutrient targets, it is unclear how these targets shall be considered in RPA. For example, how would an EPA-approved TMDL be used to set an ambient nutrient target? Is NHDES implying that the wasteload allocation should be used or just that the general assumptions written into the TMDL be used? If there is a wasteload allocation in the TMDL for the given facility, then reasonable potential has already been established and this direction appears redundant. Similarly, for the federal requirements clause, how would a permit be used to set an ambient target? It is our understanding that the underlying basis for the permit limit (i.e. the ambient target) would be used. Please clarify if this understanding is incorrect. If this understanding is correct, the regulations should be reworded to reflect this. It is also not clear how these requirements relate to the Clean Water Act requirement that NPDES permits must contain any requirements in addition to Technology Based Effluent Limits (TBELs) that are necessary to achieve water quality standards established under § 303 of the CWA. See CWA § 301(b)(1)(C), 33 U.S.C. § 1311(b)(1)(C), and 40 CFR § 122.44(d)(1). There also appears to be an incorrect citation to 40 CFR 122.43(d) which doesn't exist.

Similar confusion exists over interpretation of the flow regulation in 1705.02(d)(2). What flow in a TMDL is the reference pointing to? Which method takes precedence when deciding on a flow? What if the nutrient target does not discuss the flow condition to be used in an RPA or permit context? Env-Wq 1705.02(f) provides further guidance on what flow should be used for setting permit limits, this time explicitly describing when the 7Q10 flow can be used. It is unclear when the 7Q10 flow should be used and whether it is meant to take precedence over the requirements of 1705.02(d)(2). When is it inappropriate to rely on one of the applicable bases of flows in 1705.02(d)(2) and use the 7Q10 flow instead?

At this time, EPA has not made a final determination on what sections of 1705.02 constitute water quality standards requiring EPA action/approval. Some of these conditions appear to relate to how criteria will be used in practice and therefore warrant review by EPA. Other conditions appear to be guidance for permitting authorities. Before final submission of these regulations to EPA, EPA recommends clarifying these requirements and addressing the questions raised above.

Env-Wq 1705.03 – Restoration Permitting
NHDES is proposing to add a new section related to restoration activities. EPA requests further clarification on the basis for this change. Will the proposed change impact the state's approach to antidegradation reviews? After the temporary and infrequent impacts from ecological restoration projects end, will the assimilative capacity of the waterbody be restored to where it was? What defines an ecological restoration project?

If you have any questions on EPA's comments, please reach out to Dan Arsenault of my staff at Arsenault.Dan@epa.gov or (617) 918-1562 or Nathan Chien at chien.nathan@epa.gov or (617) 918-1649.

Sincerely,

Katie Lamoureux
Chief, Water Quality and Wetlands Protection Section
US Environmental Protection Agency

cc: Dan Arsenault (EPA), Nathan Chien (EPA), Maria Letourneau (EPA), Saranna Soroka (EPA), Mike Knapp (EPA)

Edwardson, Ken

From:	Johnson, Aron
Sent:	Monday, December 2, 2024 12:17 PM
To:	Edwardson, Ken
Cc:	Joyal, Thane
Subject:	FW: 2024-219 (Env-Wq 1700) OLS comments on IP
Attachments:	2024-219 IP Text Env-Wq 1700 FINAL.pdf

Hi Ken,

We've received comments back from OLS for Wq 1700. There are a few unclear/leg intent comments that will need to be addressed. When are you hoping to file the final proposal on this ruleset?

Happy to meet and chat this week if you'd like. I know you also received public comments on this.

Aron

Aron Johnson
Legal Coordinator
NH Department of Environmental Services
29 Hazen Drive
Concord, NH 03301-0095
office: (603) 271-2464

From: Rebecca Ricard <rebecca.ricard@leg.state.nh.us>
Sent: Monday, December 2, 2024 11:15 AM
To: Johnson, Aron <Aron.B.Johnson@des.nh.gov>
Cc: Joyal, Thane <THANE.JOYAL@DES.NH.GOV>
Subject: 2024-219 (Env-Wq 1700) OLS comments on IP

Good afternoon Aron,

Please see the attached. If you have any questions on the comments, please do not hesitate to contact me.

Best,

Rebecca D. Ricard
Committee Attorney
N.H. Office of Legislative Services
Administrative Rules
25 Capitol Street, Room 219
Concord, NH 03301
(603) 271-3680
rebecca.ricard@leg.state.nh.us

Legis. Intent/Note to JLCAR: As stated in the notice, these rules were last readopted and effective December 1, 2016, but the Clean Water Act (CWA) requires that state to review and update their water quality standards every 3 years. There are many substantive changes in this proposal, with a number of them stemming from changes made to standards, statutes, and federal regulations in 2017 through 2021. The Committee may have questions on why these rules have not been updated for almost 8 years and if there were any internal reviews done that identified the need for these substantive changes earlier.

Readopt with amendment Env-Wq 1700, eff. 12-1-16 (Document #12042), to read as follows:

CHAPTER Env-Wq 1700 SURFACE WATER QUALITY REGULATIONS

Edit: comma

Statutory Authority: RSA 485-A:6, I, ~~&~~ XI-c***, XIV & XV*** and RSA 485-A:8, VI

PART Env-Wq 1701 PURPOSE; APPLICABILITY; COMPLIANCE SCHEDULES***; VARIANCES***

Env-Wq 1701.01 Purpose. The purpose of these rules is to establish water quality standards for the state's surface water uses as set forth in RSA 485-A:8, I, ***II-a***, II, III and V. These standards are intended to protect public health and welfare, enhance the quality of water and serve the purposes of the federal Clean Water Act, 33 U.S.C. 1251 et seq., and RSA 485-A. These standards provide for the protection and propagation of fish, shellfish, and wildlife, and provide for such uses as recreational activities in and on the surface waters, public water supplies, agricultural and industrial uses, and navigation in accord with RSA 485-A:8, I and II.

Env-Wq 1701.02 Applicability. These rules shall apply to:

(a) All surface waters ***except:*** ~~; and~~

(1) Artificial bodies of water for management of stormwater provided they are legally designed and constructed in accordance with all applicable permits and other legal requirements;

(2) Bodies of water that are exempt from permitting pursuant to RSA 482-A:3, IV(b); and

(3) Wastewater facilities designed and constructed to convey or treat sewage or waste, as defined in RSA 485-A:2, X and RSA 485-A:2, XVI respectively, and permitted in accordance with RSA 485-A:13.

Edit: "; and"

(b) Any person who:

(1) Causes any point or nonpoint source discharge ~~of any pollutant~~ to surface waters;

(2) Undertakes hydrologic modifications, such as dam construction or water withdrawals; or

(3) Undertakes any other activity that affects the beneficial uses or the water quality of surface waters.

Edit: lowercase

Edit: change font size so it is consistent with the rest of the text.

Env-Wq 1701.03 Compliance Schedules in NPDES Permits.

(a) A National Pollutant Discharge Elimination System (NPDES) permit issued or renewed for a discharge to New Hampshire surface waters, as defined herein, shall not specify a schedule leading to compliance with New Hampshire or federal surface water quality standards, or both, unless:

(1) The permittee cannot comply with the permit limits or other requirements immediately upon issuance of the permit; and

(2) The compliance schedule is provided to afford the permittee adequate time to comply with one or more permit requirements or limitations that are***:*** ~~based on~~

a. new~~,~~***;***

Edit: capitalize

b. newly interpreted~~,~~***;*** or

c. revised water quality standards that became effective after issuance of the original discharge permit and after July 1, 1977.

(b) A compliance schedule established to meet any surface water quality standard that applies to the New Hampshire waters receiving the discharge shall:

Edit/Legis. Intent: need to format as required by the *Mnaual*. Change to: "7Q10" means "7Q10" as defined in RSA 485-A:2, XXIV, namely " the lowest average flow that occurs for 7 consecutive days on an annual basis with a recurrence interval of once in 10 years on average, expressed in terms of volume per time period."

(1) Include dates for specified tasks or activities leading to compliance;

Unclear: This is the procedure for adopting rules. Is this the right citation? Doesn't seem to make sense here.

(2) Include interim effluent limits; and

(3) Require compliance at the earliest practicable time.

Env-Wq 1701.04 Water Quality Standards Variances. Water quality standards variances as defined in 40 CFR 131.3(o) shall be issued in accordance with 40 CFR § 131.14 and RSA 541-A:3.

PART Env-Wq 1702 DEFINITIONS

Env-Wq 1702.01 "7Q10" means the lowest average flow that occurs for 7 consecutive days on an annual basis with a recurrence interval of once in 10 years on average, expressed in terms of volume per time period.

~~Env-Wq 1702.02 "Acute toxicity" means an adverse effect such as mortality or debilitation caused by an exposure of 96 hours or less to a toxic substance.~~

Env-Wq 1702.~~03~~***02*** "Antidegradation" means a provision of the water quality standards that maintains and protects existing water quality and uses.

Env-Wq 1702.~~04~~***03*** "Assimilative capacity" means the ***chemical, physical, biological, and radiological alterations that can occur*** ~~amount of a pollutant or combination of pollutants that can safely be released to a waterbody~~ without causing violations of applicable water quality criteria or ~~negatively impacting~~ ***impairing any existing or designated*** uses.

Env-Wq 1702.~~05~~***04*** "Benthic community" mean the community of plants and animals that live on, over, or in the substrate of the surface water.

Env-Wq 1702.~~06~~***05*** "Benthic deposit" means any sludge, sediment, or other organic or inorganic accumulations on the bottom of the surface water.

Env-Wq 1702.~~07~~***06*** "Best management practices" means those practices that are determined, after problem assessment and examination of all alternative practices and technological, economic, and institutional considerations, to be the most effective practicable means of preventing or reducing the amount of pollution***, including hydrologic modification,*** generated by point or nonpoint sources to a level compatible with water quality goals.

Env-Wq 1702.~~08~~***07*** "Biological integrity" means the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

Env-Wq 1702.~~09~~***08*** "Biota" means species of plants or animals occurring in surface waters.

Env-Wq 1702.~~10~~***09*** "Chronic toxicity" means an adverse effect, such as reduced reproductive success or growth or poor survival of sensitive life stages, that occurs as a result of prolonged exposure to a toxic substance.

Env-Wq 1702.~~11~~***10*** "Class A and B waters" means those surface waters that are legislatively classified as Class A or B waters pursuant to RSA 485-A:8, I, II and III.

Edit: comma

Env-Wq 1702.~~12~~***11*** "Clean Water Act (CWA)" means the federal Clean Water Act, Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117, Pub. L. 100-4, 33 U.S.C. 1251 et seq.

Env-Wq 1702.~~13~~***12*** "Community" means one or more populations co-occurring in surface waters.

Env-Wq 1702.~~14~~***13*** "Criterion" means:

(a) A designated concentration of a pollutant;

(b) A narrative statement concerning that pollutant that when not exceeded, will protect an organism, a population, a community, or a prescribed water use; or

(c) A numeric value or narrative statement related to other characteristics of the surface waters, such as flow and biological community integrity.

Edit: Here and subsequently, need to put the defined term in quotation marks

Env-Wq 1702.~~15~~***14*** "Cultural eutrophication" means the human-induced addition of wastes that contain nutrients to surface waters, resulting in excessive plant growth or a decrease in dissolved oxygen, or both.

Env-Wq 1702.~~16~~***15*** "Department" means the department of environmental services.

Env-Wq 1702.~~17~~***16*** "Designated uses" means those uses specified in water quality standards for each waterbody or segment whether or not such uses are presently occurring. The term includes the following:

(a) Swimming and other recreation in and on the water, meaning the surface water is suitable for swimming, wading, boating of all types, fishing, surfing, and similar activities;

(b) Fish consumption, meaning the surface water can support a population of fish free from toxicants and pathogens that could pose a human health risk to consumers;

(c) Shellfish consumption, meaning the tidal surface water can support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers;

(d) Aquatic life integrity, meaning the surface water can support aquatic life, including a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region;

(e) Wildlife, meaning the surface water can provide habitat capable of supporting any life stage or activity of undomesticated fauna on a regular or periodic basis; and

(f) Potential drinking water supply, meaning the surface water could be suitable for human intake and meet state and federal drinking water requirements after adequate treatment.

Env-Wq 1702.~~18~~***17*** "Discharge" means:

Edit: comma

(a) ***Additions, introductions, leakage, spillage, emissions, or flow*** ~~The addition, introduction, leaking, spilling, or emitting of a pollutant~~ to surface waters, either directly***,*** or indirectly through the groundwater, whether done intentionally, unintentionally, negligently or otherwise; or

(b) The placing of a pollutant in a location where the pollutant is likely to enter surface waters.

Env-Wq 1702.~~19~~***18*** "Dissolved oxygen" means the oxygen dissolved as a gas in sewage, water or other liquid expressed in milligrams per liter (mg/~~l~~***L***), parts per million (ppm), or percent saturation.

Env-Wq 1702.~~20~~***19*** "Effluent limitation(s)" means any restriction(s) imposed by the department pursuant to RSA 485-A on quantities, discharge rates, characteristics, or concentrations of pollutants, or any combination thereof, that are allowed to be discharged to surface waters.

Env-Wq 1702.~~21~~***20*** "Epilimnion" means the upper, well-circulated warm layer of a thermally stratified lake, pond, impoundment or reservoir.

Env-Wq 1702.~~22~~***21*** "Existing uses" means those uses, other than assimilation or waste transport, that actually occurred in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards.

Env-Wq 1702.~~23~~***22*** "High quality waters" means any surface water whose water quality is better than required by any aquatic life and/or human health water quality criteria contained in these rules or other criteria

Edit: "or"

assigned to the surface water, or whose qualities and characteristics make the surface water critical to the propagation or survival of important living natural resources.

Env-Wq 1702.~~24~~***23*** "Industrial waste" means "industrial waste" as defined in RSA 485-A:2, VI, as reprinted in Appendix C.

Env-Wq 1702.~~25~~***24*** "Maintain and protect" means to preserve the existing and designated uses of surface waters.

Env-Wq 1702.~~26~~***25*** "Mixing zone" means a defined area or volume of the surface water surrounding or adjacent to a ~~wastewater~~ discharge where the surface water, as a result of the discharge, might not meet all applicable water quality standards.

Env-Wq 1702.~~27~~***26*** "Most sensitive use" means the use that is most susceptible to degradation by a specific pollutant, combination of pollutants, or activity, such as drinking, swimming, boating, fish and aquatic life propagation, fish consumption by higher level consumers including man, or irrigation.

Env-Wq 1702.~~28~~***27*** "Naturally-occurring conditions" means conditions that exist in the absence of human influences.

Env-Wq 1702.~~29~~***28*** "Nephelometric turbidity unit (NTU)" means a standard used to measure the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through water, as measured by a nephelometer.

Env-Wq 1702.~~30~~***29*** "Noncontact cooling water" means water used for cooling that does not come into direct contact with any raw material, intermediate product, waste product or finished product and to which no pollutants, other than heat, have been added.

Edit: comma

Env-Wq 1702.~~31~~***30*** "Nonpoint source" means any source other than a point source.

Env-Wq 1702.~~32~~***31*** "No observed effect concentration (NOEC)" means the highest measured continuous concentration, in percent, of an effluent at which no adverse effects are observed on the aquatic test organisms.

Env-Wq 1702.~~33~~***32*** "Nuisance species" means any species of flora or fauna living in or near the water whose noxious characteristics or presence in sufficient number or mass prevent or interfere with a designated use of those surface waters.

Env-Wq 1702.~~34~~***33*** "Other wastes" means "other wastes" as defined in RSA 485-A:2, VIII, as reprinted in Appendix C.

Env-Wq 1702.~~35~~***34*** "Outstanding resource water (ORW)" means surface waters of exceptional recreational or ecological significance.

Env-Wq 1702.~~36~~***35*** "pH" means a measure of the hydrogen ion concentration in a solution, expressed as the logarithm to the base 10, of the reciprocal of the hydrogen ion concentration in gram moles per liter.

Env-Wq 1702.~~37~~***36*** "Point source" means a discernible, confined, and discrete conveyance from which pollutants are or might be discharged, excluding return flows from irrigated agriculture or agricultural stormwater runoff. The term includes, but is not limited to, a pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft.

Env-Wq 1702.~~38~~***37*** "Pollutant" means "pollutant" as defined in 40 CFR 122.2, as reprinted in Appendix D.

Env-Wq 1702.~~39~~***38*** "Pollution" means the man-made or man-induced alteration of the chemical, physical, biological, or radiological integrity of water.

Env-Wq 1702.~~40~~***39*** "Population" means a group of individuals of one biological species co-occurring in time and space.

~~Env-Wq 1702.41 "Publicly owned treatment works (POTW)" means any device or system used in the treatment of municipal sewage and/or industrial wastewater that is owned by the state or a political subdivision of the state.~~

Edit: comma

Env-Wq 1702.~~42~~***40*** "Radionuclide" means a radioactive atomic nucleus specified by its atomic number, atomic mass and energy state.

Env-Wq 1702.~~43~~***41*** "Sewage" means "sewage" as defined in RSA 485-A:2, X, as reprinted in Appendix C.

Env-Wq 1702.~~44~~***42*** "Surface waters" means "surface waters of the state" as defined in RSA 485-A:2, XIV, as reprinted in Appendix C, and waters of the United States as defined in 40 CFR 122.2.

Env-Wq 1702.~~45~~***43*** "Tainting substance" means any material that can impart objectionable taste, odor, or color to the flesh of fish or other edible aquatic organisms.

Env-Wq 1702.~~46~~***44*** "Tidal waters" means those portions of the Atlantic Ocean within the jurisdiction of the state, and all other surface waters subject to the rise and fall of the tide.

~~Env-Wq 1702.47 "Toxicity test" means a test to determine the toxicity of a chemical or an effluent that involves exposing test organisms in a laboratory setting to one or more concentrations of the chemical or dilutions of the effluent in accordance with standard laboratory procedures.~~

Env-Wq 1702.~~48~~***45*** "Toxic unit chronic (TU_c)" means the reciprocal of the effluent dilution that causes no unacceptable effect to the test organisms by the end of the chronic exposure period, which can be calculated by dividing 100 by the chronic NOEC value.

Edit: quotation marks

Env-Wq 1702.~~49~~***46*** "Waste" means "waste" as defined in RSA 485-A:2, XVI, as reprinted in Appendix C.

Env-Wq 1702.47 "Wastewater facilities" means "wastewater facilities" as defined in RSA 485-A:2, XIX, as reprinted in Appendix C, namely the structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes, and dispose of the effluent and sludge.

Env-Wq 1702.~~50~~***48*** "Water quality standards" means the combination of designated uses of surface waters, and the water quality criteria for such surface waters based upon such uses ***and antidegradation requirements***.

Edit: delete **Edit:** comma

Env-Wq 1702.~~51~~***49*** "Wetland***s***" means "wetland***s***" as defined in RSA 482-A:2, X, as reprinted in Appendix C. Wetlands include, but are not limited to, swamps, marshes, bogs and similar areas as delineated in accordance with Env-Wt 100 et seq.

Env-Wq 1702.~~52~~***50*** "Zone of passage" means an area bordering a mixing zone that is free from pollutants and allows for unobstructed movement of aquatic organisms.

PART Env-Wq 1703 WATER QUALITY STANDARDS

Env-Wq 1703.01 Water Use Classifications; Designated Uses.

(a) All surface waters shall be classified as provided in RSA 485-A:8, based on the standards established therein for class A and class B waters. Each classification shall identify the most sensitive use it is intended to protect.

(b) All surface waters shall be restored to meet the water quality criteria for their designated classification including existing and designated uses, and to maintain the chemical, physical, and biological integrity of surface waters.

Edit: comma

(c) All surface waters shall provide, wherever attainable, for the protection and propagation of fish, shellfish and wildlife, and for recreation in and on the surface waters.

Edit: comma

(d) Unless ***alterations in water quantity, including but not limited to flow rate, volume, area or depth*** ~~high or low flows~~ are caused by naturally-occurring conditions, surface water quantity shall be maintained at levels that protect existing uses and designated uses.

Env-Wq 1703.02 Wetlands Criteria.

(a) Subject to (b), below, wetlands shall be subject to the criteria listed in this part.

(b) Wherever the naturally-occurring conditions of the wetlands are different from the criteria listed in these rules, the naturally-occurring conditions shall be the applicable water quality criteria.

Env-Wq 1703.03 General Water Quality Criteria.

(a) The presence of pollutants in the surface waters shall not justify further introduction of pollutants from point or nonpoint sources, alone or in any combination.

(b) Once classified, state surface waters shall retain their legislated classification until such time as they are reclassified in accordance with RSA 485-A:10, even if they fail to meet any or all of the general, class-specific, or toxic criteria contained in this part.

(c) ~~Unless otherwise specifically allowed by a statute, rule, order, or permit, t~~***T***he following physical, chemical, and biological criteria shall apply to all surface waters:

(1) All surface waters shall be free from substances in kind or quantity that:

a. Settle to form harmful benthic deposits; **Edit:** comma

b. Float as foam, debris, scum or other visible substances;

c. Produce odor, color, taste or turbidity that is not naturally occurring and would render the surface water unsuitable for its designated uses;

d. Result in the dominance of nuisance species; or

e. Interfere with recreational activities;

(2) The level of radioactive materials in all surface waters shall not be in concentrations or combinations that would: **Edit:** comma

a. Be harmful to human, animal or aquatic life or the most sensitive designated use;

b. Result in radionuclides in aquatic life exceeding the recommended limits for consumption by humans; or

c. Exceed limits specified in EPA's national drinking water regulations or subtitle Env-Dw, whichever are more stringent; and

(3) Tainting substances shall not be present in concentrations that individually or in combination are detectable by taste and odor tests performed on the edible portions of aquatic organisms.

Env-Wq 1703.04 Class-Specific Criteria.

Legis. Intent/Note to JLCAR: As stated in the notice, this proposal Env-Wq 1703.06 [Bacteria] was revised to align with revisions to RSA 485-A:2, V, pursuant to Chapter 208, Laws of 2021 (effective October 9, 2021). The Committee may have questions on why it took over 3 years to make these changes, when there was nothing in the chapter law that allowed for delayed implementation of the statute.

(a) In addition to the general water quality criteria specified in Env-Wq 1703.03, the class-specific criteria specified in Env-Wq 1703.05 through Env-Wq 1703.33 shall apply to all surface waters ~~unless otherwise specifically allowed by a statute, rule, order, or permit~~.

(b) The surface waters in each classification shall satisfy all criteria applicable to the lower classification(s).

Env-Wq 1703.05 Combined Sewer Overflows.

Edit: insert a space

(a) An applicant for a surface water discharge permit under RSA 485-A:13 who asserts that class B criteria cannot reasonably be met at all times in the receiving water due to combined sewer overflows shall conduct a use attainability analysis (UAA) in accordance with 40 CFR §131.10 and submit the UAA to the department.

(b) If, after public notice and comment, the department determines, based on the UAA and any public comments received, that the UAA supports the establishment of less stringent criteria, the department shall recommend a change in the classification of the waterbody to the legislature.

(c) Exceedances of class B criteria and uses due to combined sewer overflows shall be limited to those identified in the long-term combined sewer overflow plan developed in accordance with “EPA Combined Sewer Overflow (CSO) Control Policy”, EPA 830-B-94-001, dated April, 1994, available as noted in Appendix B, after full implementation of the control measures.

Env-Wq 1703.06 Bacteria.

See the Legis. Intent comment on Appendix E. The summary includes requirements that are not in the statute.

(a) Uses and criteria associated with bacteria shall be as set forth in RSA 485-A:8, I, II, and V, as summarized in Appendix E.

(b) Subject to (~~c~~***d***), below, the bacteria criteria shall be applied at the end of a wastewater ~~treatment~~ facility’s discharge pipe.

Edit: "shall"

(c) Tidal waters must meet the national shellfish sanitation program, guide for the control of molluscan shellfish within the shellfish beds as specified in RSA 485-A:8, V.

(~~c~~***d***) For any combined sewer overflow that discharges into non-tidal surface waters, a bacteria criteria of 1,000 Escherichia coli per 100 milliliters shall apply at the end of the combined sewer overflow’s discharge pipe.

Env-Wq 1703.07 Dissolved Oxygen.

Legis. Intent: The statute RSA 485-A:8, I does not seem to ahve requirements for dissolved oxygen content for class A waters. Is this a federal requirement?

(a) Class A waters shall have a dissolved oxygen content of at least 75% saturation, based on a daily average, and an instantaneous minimum of at least 6 mg/~~l~~***L*** at any place or time except as naturally occurs.

(b) Except as naturally occurs and subject to (c) ~~and~~ ***through*** (e), below, class B waters shall have a dissolved oxygen content of:

(1) At least 75% of saturation~~, as specified in RSA 485-A:8, II~~, based on a daily average; and

(2) An instantaneous minimum dissolved oxygen concentration of at least 5 mg/~~l~~***L***.

(c) In areas identified by the New Hampshire fish and game department (NHF&G) as cold water fish spawning areas of species whose early life stages are buried in the gravel on the bed of the surface water, the 7 day mean dissolved oxygen concentration shall be at least 9.5 mg/~~l~~***L*** and the instantaneous minimum dissolved oxygen concentration shall be at least 8 mg/~~l~~***L*** for the period from October 1 of one year to May 14 of the next year, provided that the time period shall be extended to June 30 for a specific discharge to a specific waterbody if modeling done in consultation with the NHF&G determines the extended period is necessary to protect spring spawners or late hatches of fall spawners, or both.

(d) Unless naturally occurring or subject to (a), above, surface waters within the top 25 percent of depth of thermally unstratified lakes, ponds, impoundments, and reservoirs or within the epilimnion shall contain a dissolved oxygen content of at least 75 percent saturation, based on a daily average and an instantaneous

Legis. Intent/Note to JLCAR: As stated in the notice, this proposal Env-Wq 1703.07(b)(1) was revised to align with revisions to RSA 485-A:8, II pursuant to Chapter 211, Laws of 2017 (effective September 8, 2017). The Committee may have questions on why it took over 7 years to make these changes, when there was nothing in the chapter law that allowed for delayed implementation of the statute.

minimum dissolved oxygen content of at least 5 mg/~~l~~***L***. Unless naturally occurring, the dissolved oxygen content below those depths shall be consistent with that necessary to maintain and protect existing and designated uses.

(e) As specified in RSA 485-A:8, III, waters in a temporary partial use area established under RSA 485-A:8, II as a surface water that is receiving a combined sewer overflow discharge shall contain not less than 5 parts per million of dissolved oxygen for the duration of the discharge and up to 3 days following cessation of the discharge.

Legis. Intent/Authority: There does not seem to be any requirements in RSA 845-A, or authority to set requirements through rules, for benthic deposits in RSA 485-A. Is this a federal requirement? If so, what is the specific citation for that federal requirement?

Env-Wq 1703.08 Benthic Deposits.

(a) Class A waters shall contain no benthic deposits, unless naturally occurring.

Edit: "(b)"

Edit: fix indentation

(a) Class B waters shall contain no benthic deposits that have a detrimental impact on the benthic community, unless naturally occurring.

Env-Wq 1703.09 Oil and Grease.

(a) Class A waters shall contain no oil or grease, unless naturally occurring.

(b) Class B waters shall contain no oil or grease in such concentrations that would impair any existing or designated uses.

Legis. Intent/Authority: There does not seem to be any requirements in RSA 845-A, or authority to set requirements through rules, for water color in RSA 485-A. Is this a federal requirement? If so, what is the specific citation for that federal requirement?

Env-Wq 1703.10 Color.

(a) Class A waters shall contain no color, unless naturally occurring.

(b) Class B waters shall contain no color in such concentrations that would impair any existing or designated uses, unless naturally occurring.

Env-Wq 1703.11 Turbidity.

(a) Class A waters shall contain no turbidity, unless naturally occurring.

(b) Class B waters shall not exceed naturally occurring conditions by more than 10 NTUs.

(c) Turbidity in waters identified in RSA 485-A:8, III shall comply with the applicable long-term combined sewer overflow plan prepared in accordance with Env-Wq 1703.05(c).

(d) For purposes of state enforcement actions, if a discharge causes or contributes to an increase in turbidity of 10 NTUs or more above the turbidity of the receiving water upstream of the discharge or otherwise outside of the visible discharge, a violation of the turbidity standard shall be deemed to have occurred.

Env-Wq 1703.12 Slicks, Odors, and Surface Floating Solids.

(a) Class A waters shall contain no slicks, odors, or surface floating solids unless naturally occurring.

(b) Class B waters shall contain no slicks, odors, or surface floating solids that would impair any existing or designated use, unless naturally occurring.

(c) Slicks, odors, and surface floating solids in waters in temporary partial use areas shall comply with the applicable long-term combined sewer overflow plan prepared in accordance with Env-Wq 1703.05(c).

Env-Wq 1703.13 Temperature.

(a) There shall be no change in temperature in class A waters, unless naturally occurring.

(b) Temperature in class B waters shall be as specified in RSA 485-A:8, II and VIII.

Env-Wq 1703.14 Nutrients.

(a) Class A waters shall contain no phosphorus or nitrogen unless naturally occurring.

(b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.

(c) Existing discharges containing phosphorus or nitrogen, or both, which encourage cultural eutrophication shall be treated to remove the nutrient(s) to ensure attainment and maintenance of water quality standards.

(d) There shall be no new or increased discharge of phosphorus into lakes or ponds.

(e) There shall be no new or increased discharge containing phosphorus or nitrogen to tributaries of lakes or ponds that would contribute to cultural eutrophication or growth of weeds or algae in such lakes and ponds.

Env-Wq 1703.15 ~~Gross Beta Radioactivity~~***Radionuclide Contaminants***. ~~Class A and B waters shall not contain gross beta radioactivity in excess of 1,000 picocuries per liter.~~***Waters within 20 miles upstream of any active surface water intake for a public water system as defined in RSA 485:1-a, XV shall not exceed the drinking water maximum contaminant level (MCL) for radionuclides contaminants, as specified in Env-Dw 703.01.***

Env-Wq 1703.16 ~~Strontium-90~~ ***Beta Particle and Photon Radioactivity from Man-Made Sources***. ~~Class A and B waters shall not contain strontium-90 in excess of 10 picocuries per liter.~~ ***Waters within 20 miles upstream of any active surface water intake for a public water system as defined in RSA 485:1-a, XV shall not exceed the annual dose equivalent for beta particle and photon radioactivity, as specified in Env-Dw 703.03.***

Env-Wq 1703.17 ~~Radium-226~~ ***Cyanotoxins***. ~~Class A and B waters shall contain no radium-226 in excess of 3 picocuries per liter.~~

Edit: "3"

(a) The recreational human health criteria to protect swimming and other recreation in and on the water from excessive microcystin and cylindrospermopsin toxins shall be as follows:

> ***(1) Microcystin shall not exceed 8 ug/L in three or more 10-day periods during a 12-month rolling period; or***
>
> ***(2) Cylindrospermopsin shall not exceed 15 ug/L in three or more 10-day periods during a 12-month rolling period.***

Edit: "5"

(b) The values in (a)(1) and (2) are chronic concentrations not to be exceeded more than once in five years.

Edit: "shall be"

(c) Other cyanotoxins will be evaluated based on known health risks and potential for cyanotoxin production and accumulation.

Env-Wq 1703.18 pH.

(a) The pH of class A waters shall be as naturally occurs.

(b) As specified in RSA 485-A:8, II, the pH of class B waters shall be 6.5 to 8.0 unless due to natural causes.

(c) As specified in RSA 485-A:8, III, the pH of waters in temporary partial use areas shall be 6.0 to 9.0 unless due to natural causes.

Env-Wq 1703.19 Biological and Aquatic Community Integrity.

(a) All surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

(b) Differences from naturally-occurring conditions shall be limited to non-detrimental differences in community structure and function.

Env-Wq 1703.20 ***Target*** Risk ~~Factors~~ for Human Health Criteria.

(a) ***Except as provided in (d) below***, t~~T~~he department shall use a target risk ~~factor~~ of one in 1,000,000 when determining human health criteria for all new discharges.

(b) ***Except as provided in (d) below, t***~~T~~he department shall use a one in 1,000,000 ***target*** risk ~~factor~~ when determining human health criteria for any modification to a permit for an existing discharge unless the applicant for a water discharge permit can demonstrate that the criteria obtained using the one in 1,000,000 ***target*** risk ~~factor~~ cannot be achieved because it is either technologically impossible or economically unfeasible.

(c) When establishing an alternative ***target*** risk ~~factor~~ under (b), above, the department shall not allow ~~a~~***more*** risk ***than allowed by*** ~~factor~~ ~~greater than~~ one in 100,000.

(d) The department shall use a target risk of one in 100,000 when determining human health criteria for all existing and new discharges that contain arsenic.

Edit: comma

Env-Wq 1703.21 Water Quality Criteria for Toxic Substances.

(a) Unless naturally occurring or allowed under Env-Wq 1707, all surface waters shall be free from toxic substances or chemical constituents in concentrations or combinations that:

(1) Injure or are inimical to plants, animals, humans or aquatic life; or

(2) Persist in the environment or accumulate in aquatic organisms to levels that result in harmful concentrations in: **Edit:** insert "or" **Edit:** semicolon

a. Edible portions of fish, shellfish, other aquatic life, or

b. Wildlife that might consume aquatic life.

(b) Unless allowed under Env-Wq 1707 or naturally occurring, concentrations of toxic substances in all surface waters shall not exceed the recommended safe exposure levels of the most sensitive surface water use shown in Table 1703-1, subject to the notes in Env-Wq 1703.22, as follows:

Table 1703-01: Water Quality Criteria for Toxic Substances

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
83-32-9	Acenaphthene	1,700	520	970	710	20 µg [j]	20 µg [j]
107-02-8	Acrolein	3	3	55	--	~~6~~ ***3*** µg	400 µg

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
107-13-1	Acrylonitrile	7,550	2,600	--	--	0.061 µg [c]	7 µg [c]
15972-60-8	***Alachlor (Lasso)***	***--***	***--***	***--***	***--***	***Note l***	***--***
116-06-3	***Aldicarb (Temik)***	***--***	***--***	***--***	***--***	***Note l***	***--***
1646-87-3	***Aldicarb sulfoxide***	***--***	***--***	***--***	***--***	***Note l***	***--***
1646-88-4	***Aldicarb sulfone(aldoxycarb)***	***--***	***--***	***--***	***--***	***Note l***	***--***
309-00-2	Aldrin	3.0 [k]	--	1.3 [k]	--	~~0.049~~ ***0.0007*** ng [c]	~~0.05~~ ***0.0007*** ng [c]
N/A	Alkalinity	--	20,000 [u]	--	--	--	--
7429-90-5	Aluminum	750 [s]	87 [s]	--	--	--	--
7664-41-7	Ammonia [a]	Note a	Note a	Note a	Note a	--	--
62-53-3	Aniline	28	14	77	37	--	--
120-12-7	Anthracene	(see Polynuclear Aromatic Hydrocarbons)				~~8,300~~ ***300*** µg	~~40,000~~ ***400*** µg
7440-36-0	Antimony	9,000	1,600	--	--	5.6 µg	640 µg
7440-38-2	Arsenic	340 [d, i]	150 [d, i]	69 [d, i]	36 [d, i]	~~18 ng~~ ***0.19/0.18 ug*** [b, c, w]	~~140 ng~~ ***4.1/2.2 ug*** [b, c, w]
1332-21-4	Asbestos	--	--	--	--	7,000,000 fibres [c]	--
1912-24-9	***Atrazine (Atranex, Crisazine)***	***--***	***--***	***--***	***--***	***Note l***	***--***
7440-39-3	Barium	--	--	--	--	1.0 mg	--
71-43-2	Benzene	5,300	--	5,100	700	~~2.2~~ ***2.1*** µg [c]	58 µg [c]
92-87-5	Benzidine	2,500	--	--	--	0.14 ng [c]	11 ng [c]
56-55-3	Benzo(a) Anthracene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.0012*** µg [c]	~~0.018~~ ***0.0013*** µg [c]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
50-32-8	Benzo(a) Pyrene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.00012*** µg [c]	~~0.018~~ ***0.00013*** µg [c]
205-99-2	Benzo(b) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.0012*** µg [c]	~~0.018~~ ***0.0013*** µg [c]
192-97-2	Benzo(e) Pyrene	(see Polynuclear Aromatic Hydrocarbons)				--	--
191-24-2	Benzo(g,h,i) Perylene	(see Polynuclear Aromatic Hydrocarbons)				--	--
205-82-3	Benzo(j) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				--	--
207-08-9	Benzo(k) Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				0.012 µg [c]	~~0.018~~ ***0.013*** µg [c]
7440-41-7	Beryllium	130	5.3	--	--	Note ***l***	--
~~N/A~~ ***608-73-1***	BHC (Hexachloro-cyclohexane)	100 [c***k***]	--	0.34 [c***k***]	--	(see individual compounds)	
319-84-6	alpha-BHC	(see BHC ***(Hexachloro-cyclohexane)***)				~~2.6~~ ***0.36*** ng [c]	~~4.9~~ ***0.39*** ng [c]
319-85-7	beta-BHC	(see BHC ***(Hexachloro-cyclohexane)***)				~~9.1~~ ***8*** ng [c]	~~17~~ ***14*** ng [c]
319-86-8	delta-BHC	(see BHC ***(Hexachloro-cyclohexane)***)				0.0123 µg	0.0414 µg
58-89-9	gamma-BHC (Lindane)	0.95	0.08 [***k***]	0.16 [k]	--	4.2 µg [*l*]	4.4 µg
608-73-1	technical-BHC	(see Hexachlorocyclo-hexane-(Technical))				(see Hexachlorocyclo-hexane-(Technical))	
111-91-1	Bis (2-Chloroethoxy) methane	(see Chloroalkyl ethers)				--	--
111-44-4	Bis (2-Chloroethyl) Ether	(see Chloroalkyl ethers)				0.03 µg [c]	2.2 µg [c]
108-60-1	Bis (2-Chloroiso-propyl) ether	(see Chloroalkyl ethers)				~~1,400~~ ***200*** µg	~~65,000~~ ***4,000*** µg
117-81-7	Bis (2-Ethylhexy***l***)Phthalate	(see Phthalate esters)				~~1.2~~ ***0.32*** µg [c]	~~2.2~~ ***0.37*** µg [c]
75-25-2	Bromoform	(see Halomethanes)				7 µg [c]	~~140~~ ***120*** µg [c]
101-55-3	4-Bromophenyl phenyl ether	(see Haloethers)				--	--
85-68-7	Butyl benzyl phthalate	(see Phthalate esters)				~~1,500~~ ***0.1*** µg[*c*]	~~1,900~~ ***0.1*** µg[*c*]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
7440-43-9	Cadmium [i]	0.39 [f, d]	0.21 [f, d]	33 [d]	7.9 [d]	Note *1*	--
63-25-2	Carbaryl	2.1	2.1	1.6	--	--	--
1563-66-2	***Carbofuran (Furadon, 4F)***	***--***	***--***	***--***	***--***	***Note l***	--
56-23-5	Carbon Tetrachloride	35,200	--	50,000	--	0.4 µg [c]	5 µg [c]
57-74-9	Chlordane	2.4 [k]	0.0043 [k]	0.09 [k]	0.004 [k]	~~0.8~~ ***0.31*** ng [c]	~~0.81~~ ***0.32*** ng [c]
N/A	Chlorinated benzenes	250 [e]	50 [e]	160 [e]	129 [e]	(see individual compounds)	
108-90-7	Chlorobenzene	(See Chlorinated benzenes)				20 µg [j]	20 µg [j]
16887-00-6	Chlorides	860,000	230,000	--	--	--	--
70776-03-3	Chlorinated nap***h***thalenes	1,600[e]	--	7.5[e]	--	(see individual compounds)	
7782-50-5	Chlorine	19	11	13	7.5	Note *1*	--
10049-04-4	***Chlorine Dioxide, as*** ClO_2	***--***	***--***	***--***	***--***	***Note l***	***--***
N/A	Chloroalkyl ethers	238,000[e]	--	--	--	(see individual compounds)	
10599-90-3	***Chloramines, as*** Cl_2	***--***	***--***	***--***	***--***	***Note l***	***--***
111-44-4	Chloroethyl ether (Bis-2)	***(***see Bis (2-Chloroethyl) Ether***)***				***(***see Bis (2-Chloroethyl) Ether***)***	
110-75-8	Chloroethyl vinyl ether-2	(see Chloroalkyl ethers)				--	--
124-48-1	Chlorodibromomethane	(see Halomethanes)				0.8 µg [c]	21 µg [c]
111-91-1	Chloroethoxy methane (Bis-2)	(see Bis (2-Chloroethoxy) methane)				(see Bis (2-Chloroethoxy) methane)	
67-66-3	Chloroform	28,900	1,240	(see Halomethanes)		60 µg [c]	2,000 µg [c]
108-60-1	Chloroisopropyl ether (Bis-2)	(see Bis (2-Chloroisopropyl) ether)				(see Bis (2-Chloroisopropyl) ether)	
59-50-7	p-Chloro-m-cresol	(see 3-Methyl-4-chlorophenol)				(see 3-Methyl-4-chlorophenol)	
542-88-1	Chloromethyl ether (Bis)	(see Chloroalkyl ethers)				0.15 ng [c]	~~0.17~~ ***17*** ng [c]

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		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
91-58-7	Chloronaphthalene 2	(see Chlorinated naphthalenes)				~~1,000~~ ***800*** µg	~~1,600~~ ***1,000*** µg
95-57-8	Chlorophenol 2	4,380	2,000	--	--	0.1 µg [j]	0.1 µg [j]
108-43-0	Chlorophenol 3	--	--	--	--	0.1 µg [j]	0.1 µg [j]
106-48-9	Chlorophenol 4	--	--	29,700	--	0.1 µg [j]	0.1 µg [j]
93-72-1	Chlorophenoxy herbicides (2,4,5-TP)	--	--	--	--	100 µg [l]	--***400 ug***
94-75-7	Chlorophenoxy herbicides (2,4-D)	--	--	--	--	1,300 µg [l]	-- ***12,000 ug***
7005-72-3	Chlorophenyl phenyl ether 4	(see Haloethers)				--	--
2921-88-2	Chlorpyrifos	0.083	0.041	0.011	0.0056	--	--
59-50-7	Chloro-4 Methyl-3 Phenol	(see 3-Methyl-4-chlorophenol)				(see 3-Methyl-4-chlorophenol)	
18540-29-9	Chromium+6	16 [d, i]	11 [d, i]	1,100 [d, i]	50 [d, i]	~~note 1~~ **Note *l***	--
16065-83-1	Chromium+3	152 [f, d, i]	19.8 [f, d ,i]	10300	--	~~note 1~~ **Note *l***	--
218-01-9	Chrysene	(see Polynuclear Aromatic Hydrocarbons)				0.12 µg [c]	0.13 µg [c]
7440-50-8	Copper [i]	2.9 [f, d]	2.3 [f, d]	4.8 [d]	3.1 [d]	1,000 µg [j]	1,000 µg [j]
57-12-5	Cyanide	22[m]	5.2[m]	1.0[m]	1.0[m]	~~140~~ ***4*** µg [q]	~~140~~ ***400*** µg [q]
72-55-9	DDE(4,4')	1050	--	14	--	~~0.22~~ ***0.018*** ng [c]	~~0.22~~ ***0.018*** ng [c]
72-54-8	DDD(4,4')	0.6	--	3.6	--	~~0.31~~ ***0.12*** ng [c]	~~0.31~~ ***0.12*** ng [c]
50-29-3	DDT(4,4')	1.1[k, t]	0.001[k, t]	0.13[k, t]	0.001[k, t]	~~0.22~~ ***0.03*** ng [c]	~~0.22~~ ***0.03*** ng [c]
75-99-0	***Dalapon***	***--***	***--***	***--***	***--***	***Note l***	***--***
8065-48-3	Demeton	--	0.1	--	0.1	--	--
333-41-5	Diazinon	0.17	0.17	0.82	0.82	--	--
53-70-3	Dibenzo(a,h)Anthracene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038 µg~~ ***0.12 ng*** [c]	~~0.018 µg~~ ***0.13 ng***[c]

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		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
96-12-8	***Dibromochloropropane (DBCP)***	***--***	***--***	***--***	***--***	***Note l***	***--***
84-74-2	Dibutyl Phthalate	(see Di-n-butyl Phthalate)				(see Di-n-butyl Phthalate)	
N/A	Dichlorobenzenes	1,120[e]	763[e]	1,970[e]	--	(see individual compounds)	
95-50-1	Dichlorobenzene(1,2)	(see Dichlorobenzenes)				1,000 µg [l]	3,000 µg
541-73-1	Dichlorobenzene(1,3)	(see Dichlorobenzenes)				~~320~~ ***7*** µg	~~960~~ ***10*** µg
106-46-7	Dichlorobenzene(1,4)	(see Dichlorobenzenes)				300 µg [l]	900 µg
91-94-1	Dichlorobenzidine(3,3')	--	--	--	--	0.049 µg [c]	0.15 µg [c]
75-27-4	Dichlorobromomethane	(see Halomethanes)				0.95 µg [c]	27 µg [c]
75-71-8	Dichlorodifluoromethane	(see Halomethanes)				6.9 mg [c]	570 mg [c]
107-06-2	Dichloroethane(1,2)	118,000	20,000	113,000	--	9.9 µg [c, ***l***]	650 µg [c]
25323-30-2	Dichloroethylenes	11,600 [e]	--	224,000 [e]	--	(see individual compounds)	
75-35-4	Dichloroethylene(1,1)	(see Dichloroethylenes)				~~330~~ ***300*** µg [l]	20,000 µg
156-59-2	***Dichloroethylene (1,2-cis)***	***-- -- -- --(see Dichloroethylenes)***				***Note l***	***--***
156-60-5	Dichloroethylene (1,2-Trans)	(see Dichloroethylenes)				~~140~~ ***100*** µg [l]	~~10,000~~ ***4,000*** µg
576-24-9	Dichlorophenol(2,3)	--	--	--	--	0.04 µg [j]	0.04 µg [j]
120-83-2	Dichlorophenol(2,4)	2020	365	--	--	0.3 µg [j]	0.3 µg [j]
583-78-8	Dichlorophenol(2,5)	--	--	--	--	0.5 µg [j]	0.5 µg [j]
87-65-0	Dichlorophenol(2,6)	--	--	--	--	0.2 µg [j]	0.2 µg [j]
95-77-2	Dichlorophenol(3,4)	--	--	--	--	0.3 µg [j]	0.3 µg [j]
26638-19-7	Dichloropropanes	23,000 [e]	5,700 [e]	10,300 [e]	3,040 [e]	(see individual compounds)	
78-87-5	Dichloropropane(1,2)	(see Dichloropropanes)				0.9 µg [c]	31 µg [c]

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		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
26952-23-8	Dichloropropenes	6,060 [e]	244 [e]	790 [e]	--	(see individual compounds)	
542-75-6	Dichloropropene(1,3)	(see Dichloropropenes)				~~0.34~~ ***0.27*** µg [c]	~~21~~ ***12*** µg [c]
60-57-1	Dieldrin	0.24	0.056[k]	0.71[k]	0.0019[k]	~~0.052~~ ***0.0012*** ng [c]	~~0.054~~ ***0.0012*** ng [c]
84-66-2	Diethyl Phthalate	--	--	--	--	~~17 mg~~ ***600 ug***	~~44 mg~~ ***600 ug***
105-67-9	Dimethyl Phenol(2,4)	1,300	530	270	110	~~380~~ ***100*** µg	400 µg [j]
131-11-3	Dimethyl Phthalate	(see Phthalate esters)				~~270 mg~~ ***2,000 ug***	~~1.1 g~~ ***2,000 ug***
84-74-2	Di-n-butyl Phthalate	(see Phthalate esters)				~~2 mg~~ ***20 ug***	~~4.5 mg~~ ***30 ug***
N/A	Dinitrotoluenes	330 [e]	230 [e]	590 [e]	370 [e]	(see individual compounds)	
121-14-2	Dinitrotoluene(2,4)	(see Dinitrotoluenes)				~~0.11~~ ***0.049*** µg [c]	~~3.4~~ ***1.7*** µg [c]
606-20-2	Dinitrotoluene(2,6)	(see Dinitrotoluenes)				--	--
~~N/A~~	~~Dinitro-o-cresol (2,4)~~	~~(see Nitrophenols)~~				~~13.4 µg~~	~~765 µg~~
534-52-1	Dinitro-o-cresol (4,6)	(see 2 Methyl-4,6-Dinitrophenol)				(see 2 Methyl-4,6-Dinitrophenol)	
25550-58-7	Dinitrophenols	(see Nitrophenols)				~~69~~ ***10*** µg	~~5,300~~ ***1,000*** µg
51-28-5	Dinitrophenol(2,4)	(see Nitrophenols)				~~69~~ ***10*** µg	~~5,300~~ ***300*** µg
117-84-0	Di-n-octyl phthalate	(see Phthalate esters)				--	--
88-85-7	***Dinoseb***	***--***	***--***	***--***	***--***	***Note l***	***--***
85-00-7	***Diquat***	***--***	***--***	***--***	***--***	***Note l***	***--***
1746-01-6	2,3,7,8-TCDD (Dioxin)	--	--	--	--	0.000005 ng [c]	0.0000051 ng [c]
122-66-7	Diphenylhydrazine(1,2)	270	--	--	--	~~0.036~~ ***0.03*** µg [c]	0.2 µg [c]
103-23-1	***Di(2-ethylhexyl)adipate***	***--***	***--***	***--***	***--***	***Note l***	***--***
117-81-7	Di-2-ethylhexyl phthalate	(see Bis (2-Ethylhexy)Phthalate***)***				(see Bis (2-Ethylhexy)Phthalate***)***	

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~*L*)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
115-29-7	***Endosulfan***	***0.22 [k, r]***	***0.056 [k, r]***	***0.034 [k, r]***	***0.0087 [k, r]***	***(see individual compounds)***	
~~959-98-8~~	~~alpha-Endosulfan~~	~~0.22 [k, r]~~	~~0.056 [k, r]~~	~~0.034 [k, r]~~	~~0.0087 [k, r]~~	~~62 µg~~	~~89 µg~~
959-98-8	***alpha-Endosulfan***	***(see Endosulfan)***				***20 ug***	***30 ug***
~~33213-65-9~~	~~beta-Endosulfan~~	~~0.22 [k, r]~~	~~0.056 [k, r]~~	~~0.034 [k, r]~~	~~0.0087 [k, r]~~	~~62 µg~~	~~89 µg~~
33213-65-9	***beta-Endosulfan***	***(see Endosulfan)***				***20 ug***	***40 ug***
1031-07-8	Endosulfan Sulfate	--	--	--	--	~~62~~ ***20*** µg	~~89~~ ***40*** µg
145-73-3	***Endothall***	***--***	***--***	***--***	***--***	***Note l***	***--***
72-20-8	Endrin	0.086	0.036	0.037 [k]	0.0023 [k]	~~0.059~~ ***0.03*** µg	~~0.06~~ ***0.03*** µg
7421-93-4	Endrin Aldehyde	--	--	--	--	1 µg	1 µg
100-41-4	Ethylbenzene	32000	--	430	--	~~530~~ ***68*** µg	~~2,100~~ ***130*** µg
106-93-4	***Ethylene Dibromide (EDB)***	***--***	***--***	***--***	***--***	***Note l***	***--***
206-44-0	Fluoranthene	(see Polynuclear Aromatic Hydrocarbons)				~~130~~ ***20*** µg	~~140~~ ***20*** µg
86-73-7	Fluorene	(see Polynuclear Aromatic Hydrocarbons)				~~1,100~~ ***50*** µg	~~5,300~~ ***70*** µg
16984-48-8	***Flouride***	***--***	***--***	***--***	***--***	***Note l***	***--***
1071-83-6	***Glyphosate***	***--***	***--***	***--***	***--***	***Note l***	***--***
86-50-0	Guthion	--	0.01	--	0.01	--	--
N/A	Haloethers	360 [e]	122 [e]	--	--	(see individual compounds)	
N/A	Halomethanes	11,000 [e]	--	12,000 [e]	6,400 [e]	(see individual compounds)	
76-44-8	Heptachlor	0.52 [k]	0.0038 [k]	0.053 [k]	0.0036 [k]	~~0.079~~ ***0.0059*** ng [c]	~~0.079~~ ***0.0059*** ng [c]
1024-57-3	Heptachlor Epoxide	0.52 [k]	0.0038 [k]	0.053 [k]	0.0036 [k]	~~0.039~~ ***0.032*** ng [c]	~~0.039~~ ***0.032*** ng [c]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
67-72-1	Hexachloroethane	980	540	940	--	~~1.4~~ ***0.1*** µg[c]	~~3.3~~ ***0.1*** µg[c]
118-74-1	Hexachlorobenzene	(see Chlorinated benzenes)				~~0.28~~ ***0.079*** ng[c]	~~0.29~~ ***0.079*** ng[c]
87-68-3	Hexachlorobutadiene	90	9.3	32	--	~~0.44~~ ***0.01*** µg[c]	~~18~~ ***0.01*** µg[c]
608-73-1	Hexachlorocyclo-hexane-(Technical)	(see BHC ***(Hexachloro-cyclohexane)***)				~~0.0123~~ ***0.0066*** µg	~~0.0414~~ ***0.01*** µg
77-47-4	Hexachlorocyclopentadiene	7	5.2	7	--	1.0[j]	1.0[j]
193-39-5	I***n***deno(1,2,3-cd)Pyrene	(see Polynuclear Aromatic Hydrocarbons)				~~0.0038~~ ***0.0012*** µg[c]	~~0.018~~ ***0.0013*** µg[c]
7439-89-6	Iron	--	1000	--	--	0.3 mg[j]	--
78-59-1	Isophorone	117,000	--	12,900	--	~~35~~ ***34*** µg[c]	1,800 µg[c]
7439-92-1	Lead[i]	10.5[f, d]	0.41[f, d]	210[d]	8.1[d]	--	--
121-75-5	Malathion	--	0.1	--	0.1	--	--
7439-96-5	Manganese	--	--	--	--	50 µg[j]	100 µg
7439-97-6	Mercury	1.4[d, i]	0.77[d, i]	1.8[d, i]	0.94[d, i]	0.05 µg	0.051 µg
72-43-5	Methoxychlor	--	0.03	--	0.03	~~100~~ ***0.02*** µg	***-- 0.02 µg***
74-83-9	Methyl Bromide	(see Halomethanes)				100 µg	10,000 µg
74-87-3	Methyl Chloride	(see Halomethanes)				--	--
1634-04-4	***Methyl tertiary-butyl ether (MtBE)***	***--***	***--***	***--***	***--***	***Note l***	***--***
75-09-2	Methylene Chloride	(see Halomethanes)				20 µg[c]	1,000 µg[c]
22967-92-6	Methylmercury	(see Mercury ***)***				--	0.3 mg/kg[g]
534-52-1	2 Methyl-4,6-Dinitrophenol	(see Nitrophenols)				~~13~~ ***2*** µg	~~280~~ ***30*** µg
1570-64-5	2-Methyl-4-chlorophenol	--	--	--	--	1,800 µg[j]	1,800 µg[j]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
59-50-7	3-Methyl-4-chlorophenol	30	--	--	--	~~3,000~~ ***500*** µg [j]	~~3,000~~ ***2,000*** µg [j]
615-74-7	3-Methyl-6-chlorophenol	--	--	--	--	20 µg [j]	20 µg [j]
2385-85-5	Mirex	--	0.001	--	0.001	--	--
91-20-3	Naphthalene	2,300	620	2,350	--	--	--
7440-02-0	Nickel [i]	120.0 [f, d]	13.3 [f, d]	74 [d]	8.2 [d]	610 µg	4,600 µg
14797-65-0	***Nitrite-N***	***--***	***--***	***--***	***--***	***Note l***	***--***
14797-55-8	Nitrate~~s~~***-N***	--	--	--	--	10 mg[l]	--
14797-55-8 + 14797-65-0	***Nitrate-N + Nitrite-N***	***--***	***--***	***--***	***--***	***Note l***	***--***
98-95-3	Nitrobenzene	27000	--	6680	--	~~17~~ ***10*** µg	30 µg[j]
25154-55-6	Nitrophenols	230 [e]	150 [e]	4,850 [e]	--	(see individual compounds)	
88-75-5	Nitrophenol 2	(see Nitrophenols)				--	--
100-02-7	Nitrophenol 4	(see Nitrophenols)				--	--
N/A	Nitrosamines	5,850 [e]	--	3,300,000 [e]	--	0.8 ng	1.24 µg
924-16-3	Nitrosodibutylamine N	(see Nitrosamines)				6.3 ng [c]	220 ng [c]
55-18-5	Nitrosodiethylamine N	(see Nitrosamines)				0.8 ng [c]	1,240 ng [c]
62-75-9	Nitrosodimethylamine N	(see Nitrosamines)				0.69 ng [c]	3 µg [c]
621-64-7	Nitrosodi-n-propylamine N	(see Nitrosamines)				0.005 µg [c]	0.51 µg [c]
86-30-6	Nitrosodiphenylamine N	(see Nitrosamines)				3.3 µg [c]	6 µg [c]
930-55-2	Nitrosopyrrolidine N	(see Nitrosamines)				16 ng [c]	34,000 ng [c]
84852-15-3	Nonylphenol	28	6.6	7	1.7	--	--
56-38-2	Parathion	0.065	0.013	--	--	--	--
1336-36-3	PCB	2.0 [e, n]	0.014 [e, n]	10.0 [e, n]	0.03 [e, n]	0.064 ng [c, n]	0.064 ng [c, n]

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~L)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
N/A	PCB-1242	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1254	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1221	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1248	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1260	(see PCB)				(see PCB)	(see PCB)
N/A	PCB-1016	(see PCB)				(see PCB)	(see PCB)
76-01-7	Pentachloroethane	7240	1100	390	281	--	--
608-93-5	Pentachlorobenzene	(see Chlorinated benzenes)				~~1.4~~ ***0.1*** µg	~~1.5~~ ***0.1*** µg
87-86-5	Pentachlorophenol	5.28 [h]	4.05 [h]	13	7.9	~~0.27~~ ***0.03*** µg [c]	~~3~~ ***0.04*** µg [c]
85-01-8	Phenanthrene	(see Polynuclear Aromatic Hydrocarbons)				--	--
108-95-2	Phenol	10,200	2,560	5,800	--	300 µg [j]	300 µg [j]
N/A	Phthalate Esters	940 [e]	3 [e]	2,944 [e]	3.4 [e]	--	--
1336-36-3	Polychlorinated Biphenyls	(see PCBs)				(see PCB)	(see PCB)
N/A	Polynuclear Aromatic Hydrocarbons	--	--	300 [e]	--	(see individual compounds)	
23135-22-0	***Oxamyl (Vydate)***	***--***	***--***	***--***	***--***	***Note l***	***--***
355-46-4	***Perfluorohexane sulfonic acid (PFHxS)***	***--***	***--***	***--***	***--***	***Note l***	***--***
375-95-1	***Perfluorononanoic acid (PFNA)***	***--***	***--***	***--***	***--***	***Note l***	***--***
1763-23-1	***Perfluorooctane sulfonic acid (PFOS)***	***--***	***--***	***--***	***--***	***Note l***	***--***
335-67-1	***Perfluorooctanoic Acid (PFOA)***	***--***	***--***	***--***	***--***	***Note l***	***--***
1918-02-1	***Picloram***	***--***	***--***	***--***	***--***	***Note l***	***--***
129-00-0	Pyrene	(see Polynuclear Aromatic Hydrocarbons)				~~830~~ ***20*** µg	~~4,000~~ ***30*** µg
7782-49-2	Selenium	-- ***Note o***	~~5~~ ***Note o***	290[d,i]	71[d,i]	170 µg [l]	4,200 µg

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water & Fish Ingestion	Fish Consumption Only
7440-22-4	Silver	0.20[d,f, i, ***k***]	--	1.9[d,i,k]	--	105 µg [p]	65 mg [p]
122-34-9	***Simazine***	***--***	***--***	***--***	***--***	***Note l***	***--***
100-42-5	***Styrene***	***--***	***--***	***--***	***--***	***Note l***	***--***
7783-06-4	Sulfide-Hydrogen Sulfide	--	2	--	2	--	--
95-94-3	Tetrachlorobenzene 1,2,4,5	(see Chlorinated benzenes)				~~0.97~~ ***0.03*** µg	~~1.1~~ ***0.03*** µg
79-34-5	Tetrachloroethane 1,1,2,2	(see Tetrachlor-oethanes)	2400	9020	--	0.2 µg [c]	4 ***3*** µg [c]
25322-20-7	Tetrachloroethanes	9,320 [e]	--	--	--	(see individual compounds)	
127-18-4	Tetrachloroethylene	5,280	840	10,200	450	10 µg [c]	29 µg [c]
935-95-5	Tetrachlorophenol 2,3,5,6	--	--	440	--	--	--
58-90-2	Tetrachlorophenol 2,3,4,6	--	--	--	--	1.0 µg [j]	1.0 µg [j]
7440-28-0	Thallium	1,400	40	2,130	--	0.24 µg	0.47 µg
108-88-3	Toluene	17,500	--	6,300	5,000	~~1.3 mg [l]~~ ***57 ug***	~~15 mg~~ ***520 ug***
8001-35-2	Toxaphene	0.73	0.0002	0.21	0.0002	0.70 ng [c]	0.71 ng [c]
N/A	Tributyltin (TBT)	0.46	0.072	0.42	0.0074	--	--
N/A	Trichlorinated Ethanes	18,000 [e]	--	--	--	(see individual compounds)	
120-82-1	Trichlor***o***benzene 1,2,4	(see Chlorinated benzenes)				~~35~~ ***0.071*** µg ***[c]***	~~70~~ ***0.076*** µg ***[c]***
71-55-6	Trichloroethane 1,1,1	--	--	31,200	--	~~Note 1~~ ***10 mg [l]***	--***200 mg***
79-00-5	Trichloroethane 1,1,2	--	9,400	--	--	~~0.59~~ ***0.55*** µg [c]	~~16~~ ***8.9*** µg [c]
79-01-6	Trichloroethylene	45,000	21,900	2,000	--	~~2.5~~ ***0.6*** µg [c]	~~30~~ 7 µg [c]
75-69-4	Trichlorofluoromethane	(see Halomethanes)				10 mg	860 mg

CAS Number	Chemical Name	Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~***L***)[v]				Protection of Human Health Units per Liter	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
95-95-4	Trichlorophenol 2,4,5	--	--	--	--	1.0 µg [j]	1.0 µg [j]
88-06-2	Trichlorophenol 2,4,6	--	970	--	--	1.5 µg [c]	2.0 µg [c, j]
75-01-4	Vinyl Chloride	--	--	--	--	~~0.025~~ ***0.022*** µg [c]	~~2.4~~ ***1.6*** µg [c]
1330-20-7	***Xylene, Total***	***--***	***--***	***--***	***--***	***Note l***	***--***
7440-66-6	Zinc [i]	30.0 [f, d]	30.0 [f, d]	90[d]	81[d]	5,000 µg [j]	5,000 µg [j]

Env-Wq 1703.22 Notes For Table 1703-1. The following shall apply to Table 1703-1:

(a) The letter "a" shall indicate that the freshwater and saltwater aquatic life criteria for ammonia are shown in Env-Wq 1703.25 through Env-Wq 1703.32. **Edit:** semicolon

(b) The letter "b" shall indicate that the criteria refer to the inorganic form only.

(c) The letter "c" shall indicate that these criteria for the protection of human health are based on carcinogenicity using a ***target*** risk ~~factor~~ of one in 1,000,000, ***except for arsenic which shall be based on a target risk of one in 100,000,*** while the human health criteria without this footnote are based on systemic toxicity. Other ***target*** risk***s*** ~~factors~~ shall be allowed only as specified in Env-Wq 1703.20. **Edit:** semicolon

(d) The letter "d" shall indicate that criteria for these metals are expressed as a function of the water effect ratio (WER) as defined in 40 CFR 131.36(c), and that because the values displayed in Table 1703-1 correspond to a WER of 1.0, metals criteria for different WERs shall be determined using the procedures described in the EPA publication "Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994, available as noted in Appendix B, provided that for copper, either of the following references, both available as noted in Appendix B, may ***also*** be used:

Edit: replace with commas

(1) The "Streamlined Water-Effect Ratio procedure for Discharges of Copper", EPA-822-R-01-005, dated March 2001; or

(2) The Biotic Ligand Model (freshwater only) as described in "Aquatic Life Ambient Freshwater Quality Criteria - Copper", EPA-822-R-07-001, dated February 2007. **Edit:** semicolon

(e) The letter "e" shall indicate that the following classes of compounds have 2 or more isomers and the appropriate aquatic life criteria apply to the sum of the concentrations of each isomer:

Unclear: even though the footnote in the CFR also states this is where the definition is, it does not appear as though this definition is actually in this CFR.

(1) BHC;

(2) Chlorinated benzenes;

(3) Chlorinated naphthalenes;

(4) Chloroalkyl ethers;

(5) Dichlorobenzenes;

(6) Dichloroethylenes;

(7) Dichloropropanes;

(8) Dichloropropenes;

(9) Dinitrotoluenes;

(10) Haloethers;

(11) Halomethanes;

(12) Nitrophenols;

(13) Nitrosamines;

(14) PCB;

(15) Phthalate esters;

(16) Polynuclear aromatic hydrocarbons;

(17) Tetrachloroethanes; and

(18) Trichlorinatedethanes. ← **Edit:** semicolon

(f) The letter "f" shall indicate that the freshwater aquatic criteria for these metals are expressed as a function of the total hardness, as mg/~~l~~***L*** $CaCO_3$ of the surface water, and that because the values displayed in Table 1703-1 correspond to a total hardness of 20 mg/~~l~~***L*** the aquatic life criteria for other hardness values expressed as calcium carbonate shall be calculated using the equations and tables in Env-Wq 1703.23 and Env-Wq 1703.24. ← **Edit:** semicolon

Edit: "or"

(g) The letter "g" shall indicate that if the methylmercury concentration in the edible portion of the aquatic species of concern exceeds 0.3 mg/kg, a risk assessment shall be conducted to determine whether a consumption advisory should be issued for the surface water. If a consumption advisory is issued by the department, the surface water shall be considered in non-attainment of the fish and/or shellfish consumption designated uses and in violation of these surface water quality regulations. ← **Edit:** semicolon

(h) The letter "h" shall indicate that the freshwater aquatic life criteria for pentachlorophenol are expressed as a function of pH. Values displayed in Table 1703-1 correspond to a pH value of 6.5. For other pH values, the formulas shown in Env-Wq 1703.~~32~~***33*** shall be used. ← **Edit:** semicolon

(i) The letter "i" shall indicate that the values presented for aquatic life protection are dissolved metals and for hardness-dependent metals are based on a hardness of 20 mg/L. To convert dissolved to total recoverable metal, the equations and tables in Env-Wq 1703.23 shall be used. To calculate dissolved or total recoverable fresh water criteria for hardness-dependent metals for hardness values other than 20 mg/l, the equations and tables shown in Env-Wq 1703.23 and Env-Wq 1703.24 shall be used. ← **Edit:** semicolon

(j) The letter "j" shall indicate that these human health criteria prevent taste and odor effects in the surface water and in fish and other aquatic life as prohibited in Env-Wq 1703.03(c)(1)c. and (3). ← **Edit:** semicolon

(k) The letter "k" shall indicate that ***the acute*** ~~these~~ criteria are based on EPA's 304(a) criteria in the 1980 documents listed below and were derived to be used as instantaneous maximum values, or to be applied after division by 2, to obtain a value comparable to an acute criterion ***as a 1-hour average*** ~~derived using the 1985 Guidelines,~~ when assessment is done using an averaging period:

(1) Aldrin/Dieldrin, document number 440/5-80-019;

(2) Chlordane, document number 440/5-80-027;

(3) DDT, document number 440/5-80-038;

(4) Endosulfan, document number 440/5-80-046;

(5) Endrin, document number 440/5-80-047;

Edit: capitalize the "G"

(6) gamma-BHC (lindane), document number 440/5-80-054 **Edit:** semicolon

(7)(~~6~~) Heptachlor, document number 440/5-80-052;

(8)~~(7)~~ Hexachlorocyclohexane, document number 440/5-80-054; or

Edit: capitalize for consistency

(9)~~(8)~~ Silver, document number 440/5-80-071. **Edit:** semicolon

(*l*) The letter "*l*" shall indicate that there is a more stringent drinking water maximum contaminant level (MCL) specified in Env-Dw 700, so if the surface water is a source for a public water system as defined in RSA 485:1-a, XV or is within 20 miles upstream of any active surface water intake for a public water system, the department shall use the MCL values shown in table 1703-2A, below, for the water and fish ingestion human health criteria. ***The following criteria are to be met as a running annual average except for Nitrite-N and Nitrite-N + Nitrate-N which are instantaneous acute criteria***:

Edit: "shall be"

Table 1703-2A: MCL Values for Water and Fish Ingestion Criteria

CAS Number	Chemical Name	MCL (Units per Liter)
15972-60-8	***Alachlor (Lasso)***	***2 ug***
116-06-3	***Aldicarb (Temik)***	***3 ug***
1646-87-3	***Aldicarb sulfoxide***	***4 ug***
1646-88-4	***Aldicarb sulfone (aldoxycarb)***	***2 ug***
1912-24-9	***Atrazine (Atranex, Crisazine)***	***3 ug***
7440-41-7	Beryllium	4 μg
7440-43-9	Cadmium	5 μg
1563-66-2	***Carbofuran (Furadon, 4F)***	***40 ug***
7782-50-5	Chlorine (as Cl_2)	4 mg
10599-90-3	***Chloramines, as Cl2***	***4 mg***
10049-04-4	***Chlorine Dioxide, as ClO2***	***0.8 mg***
94-75-7	Chlorophenoxy herbicides (2,4-D)	70 μg
93-72-1	Chlorophenoxy herbicides (2,4,5-TP)	50 μg
18540-29-9	Chromium+6	see Chromium Total
16065-83-1	Chromium+3	see Chromium Total
7440-47-3	Chromium Total (equal to the sum of Chromium+3 plus Chromium+6)	100 μg
75-99-0	***Dalapon***	***200 ug***
96-12-8	***Dibromochloropropane (DBCP)***	***0.2 ug***
95-50-1	Dichlorobenzene (1,2)	600 μg
106-46-7	Dichlorobenzene(1,4)	75 μg
107-06-2	Dichloroethane (1,2)	5 μg
75-35-4	Dichloroethylene(1,1)	7 μg
156-59-2	***Dichloroethylene (1,2-cis)***	***70 ug***
156-60-5	Dichloroethylene(1,2-Trans)	100 μg
88-85-7	***Dinoseb***	***7 ug***
85-00-7	***Diquat***	***20 ug***
103-23-1	***Di(2-ethylhexyl)adipate***	***400 ug***
145-73-3	***Endothall***	***100 ug***
106-93-4	***Ethylene Dibromide (EDB)***	***0.05 ug***
16984-48-8	***Fluoride***	***4 mg***
58-89-9	gamma-BHC (Lindane)	0.2 μg

Table 1703-2A: MCL Values for Water and Fish Ingestion Criteria

CAS Number	Chemical Name	MCL (Units per Liter)
1071-83-6	***Glyphosate***	***700 ug***
~~72435~~	~~Methoxychlor~~	~~40 µg~~
74-87-3	***Methyl Chloride***	***5 ug***
1634-04-4	***Methyl tertiary-butyl ether (MtBE)***	***13 ug***
14797-65-0	***Nitrite-N***	***1 mg***
14797-55-8	***Nitrate-N***	***10 mg***
14797-55-8 + 14797-65-0	***Nitrate-N + Nitrite-N***	***10 mg***
23135-22-0	***Oxamyl (Vydate)***	***200 ug***
355-46-4	***Perfluorohexane sulfonic acid (PFHxS)***	***18 ng***
375-95-1	***Perfluorononanoic acid (PFNA)***	***11 ng***
1763-23-1	***Perfluorooctane sulfonic acid (PFOS)***	***15 ng***
335-67-1	***Perfluorooctanoic Acid (PFOA)***	***12 ng***
1918-02-1	***Picloram***	***500 ug***
7782-49-2	Selenium	50 µg
122-34-9	***Simazine***	***4 ug***
100-42-5	***Styrene***	***100 ug***
~~108883~~	~~Toluene~~	~~1 mg~~
71-55-6	Trichloroethane 1,1,1	200 µg
1330-20-7	***Xylene, Total***	***10 mg***

(m) The letter "m" shall indicate that ~~this~~***these*** criteria ~~is~~***are*** expressed as micrograms of free cyanide per liter. **Edit:** semicolon

(n) The letter "n" shall indicate that ~~this~~***these*** criteria appl***y***~~ies~~ to total PCBs or the sum of all of its congener or isomer or homolog or Arochlor analyses. **Edit:** semicolon

(o) ***The letter "o" shall indicate that the freshwater aquatic life criteria for selenium are shown in Env-Wq 1703.34.*** ~~The letter "o" shall indicate that the freshwater acute criteria for selenium shall be calculated using the values for the fraction f_1 of selenite and f_2 of selenate measured in the receiving water. To calculate the acute criteria, in µg/l, the number 1 shall be divided by the sum of the fractions f_1 divided by 185.9 and f_2 divided by 12.83, as follows:~~ **Edit:** semicolon

~~Acute Criteria = $(f_1/185.9) + (f_2/12.83)$~~

(p) The letter "p" shall indicate that these human health criteria for silver shall be for the protection of humans from argyria. **Edit:** semicolon

(q) The letter "q" shall indicate that this value is expressed as total cyanide. **Edit:** semicolon

(r) The letter "r" shall indicate that this data was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan. **Edit:** semicolon

(s) ~~The~~ ***Subject to (1) and (2), below, the*** letter "s" shall indicate that this value-is expressed as acid-soluble aluminum. **Edit:** colon

Edit: comma

(1) Where waterbody specific pH, dissolved organic carbon and hardness are available, sample specific total aluminum criteria shall be determined using the procedures described in the EPA publication "Final Aquatic Life Ambient Water Quality Criteria for Aluminum", EPA-822-R-18-

001, dated December 2018, available as noted in Appendix B, provided that for aluminum, either of the following references shall be used to calculate the site-specific criteria:

Edit: available as noted in Appendix B;"

Edit: available as noted in Appendix B;"

a. The "Aluminum Criteria Calculator V2.0 (Excel)(xlsm)", dated December 2018; or

b. The "Aluminum Criteria Calculator R Code and Data V2.0(R)", dated November 15, 2019.

Edit: "; or" or "; and"

(2) For characterizing ambient waters using the criteria in (1), above, analytical methods that measure the bioavailable fraction of aluminum may be used in accordance with this paragraph where permitted by applicable federal regulations. The bioavailable fraction of aluminum shall be measured, as scientifically appropriate, using a less aggressive initial acid digestion than done for total recoverable aluminum, such as to a pH of approximately 4 or lower, that includes the measurement of amorphous aluminum hydroxide yet minimizes the measurement of mineralized forms of aluminum such as aluminum silicates associated with suspended sediment particles or clays.

Edit: semicolon

(t) The letter "t" shall indicate that the total concentration of DDT and its metabolites shall not exceed this value.

Edit: semicolon

(u) The letter "u" shall indicate that the chronic criterion of 20 mg/L shall be the minimum value except where alkalinity is naturally lower, in which case the criterion shall not be lower than 25 percent of the natural level.

Edit: semicolon

Edit: "3"

(v) Unless otherwise indicated in Env-Wq 1703.22 (k), (o), or Env-Wq 1703.26(c), the protection of aquatic life concentration values in Table 1703-1 are acute as a 1-hour average and chronic as a 4-day average, both of which shall not to be exceeded more than once in three years.

Edit: "; and"

(w) The letter "w" shall indicate that for arsenic, the first value is for freshwaters and the second value is for marine waters as it relates to protection of human health.

Env-Wq 1703.23 <u>Conversion Factors For Metals</u>.

(a) Dissolved metal shall be determined by multiplying total recoverable metal by the conversion factor listed in Table 1703-2 for that metal, shown in equation form as follows:

Edit: capitalize for consistency

Dissolved Metal = Total Recoverable Metal x Conversion Factor

(b) Total recoverable metals shall be determined by dividing dissolved metals by the conversion factor listed in table 1703-2, shown in equation form as follows:

Total Recoverable Metal = Dissolved Metal / Conversion Factor

(c) The conversion factors in Table 1703-2 shall be used as translators to go from the dissolved metals criteria listed in Table 1703-1 to permit limits expressed as total recoverable metals by dividing dissolved metal by the conversion factor.

(d) If the hardness of the receiving water is different than 20 mg/~~l~~***L***, then aquatic life criteria for hardness-dependent metals shall be calculated as follows:

(1) The equations in Env-Wq 1703.24(a) and (b) shall be used in conjunction with the coefficients shown in Table 1703-3 to calculate the total recoverable metal for freshwater;

(2) The equations shown in (a) and (b), above, shall be used in conjunction with the factors shown in Table 1703-2 to convert total recoverable metal to dissolved metal or dissolved metal to total recoverable metal;

(3) For hardness less than 20 mg/~~l~~***L***, a hardness of 20 mg/~~l~~***L*** shall be used in the equations; and

(4) For hardness values greater than 400 mg/~~l~~***L***, a hardness of 400 mg/~~l~~***L*** shall be used in the equations.

(e) Table 1703-2 shall be as follows, provided that the conversion factors for cadmium and lead shall be no greater than 1.0:

Table 1703-2: Factors to Convert Total Recoverable Metals to Dissolved Metals

	FRESHWATER Conversion Factors		**MARINE Conversion Factors**	
	Acute	**Chronic**	**Acute**	**Chronic**
Arsenic	1.0	1.0	1.0	1.0
Cadmium	1.136672 - [(Ln Hardness)(0.041838)]	1.101672 - [(Ln Hardness)(0.041838)]	0.994	0.994
Chromium (+3)	0.316	0.860	-	-
Chromium (+6)	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203 - [(Ln Hardness)(0.145712)]	1.46203 - [(Ln Hardness)(0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium	-	-	0.998	0.998
Silver	0.85	-	0.85	-
Zinc	0.978	0.986	0.946	0.946

Env-Wq 1703.24 Freshwater Aquatic Life Criteria For Metals. To calculate freshwater aquatic life criteria for total recoverable metals, the equations described in (a) and (b), below, shall be used in conjunction with the coefficients shown in (c), Table 1703-3, below, provided that the values used for hardness in the equations shall be as specified in Env-Wq 1703.23 (d):

(a) To calculate the acute criteria, in ug/~~l~~***L***, for the metals shown Table 1703-3, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression "m_a" multiplied by the natural logarithm (ln) of the hardness and to which product the value "b_a" shall be added, as follows:

Acute Criteria = e^x where $x = (m_a [\ln (\text{hardness})] + b_a)$

(b) To calculate the chronic criteria, in ug/~~l~~***L***, for the metals shown in Table 1703-3, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression "m_c" multiplied by the natural logarithm of the hardness and to which product the value "b_c" shall be added, as follows:

Chronic Criteria = e^x where $x = (m_c [\ln (\text{hardness})] + b_c)$

(c) Table 1703-3 shall be as follows:

Table 1703-3: Coefficients in Equations for Calculating Total Recoverable Aquatic Life Criteria for Metals

	m_a	b_a	m_c	b_c
Cadmium	0.9789	-3.866	0.7977	-3.909
Copper	0.9422	-1.700	0.8545	-1.702
Chromium+3	0.8190	3.7256	0.8190	***0***.6848
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59	-------	-------
Zinc	0.8473	0.884	0.8473	0.884

Env-Wq 1703.25 Freshwater Acute Aquatic Life Criteria For Ammonia.

(a) Subject to (b) through (d), below, to determine freshwater acute aquatic life criteria for ammonia, in milligrams of nitrogen per liter (mg N/l), the applicant shall use:

(1) Table 1703-4A,where salmonids in the genus Oncorhynchus are or might be present; and

(2) Table 1703-4B, where salmonids in the genus Oncorhynchus are absent.

Edit: "shall be calculated"

(b) The freshwater acute water quality criteria for ammonia in Table 1703-4A where salmonids in the genus Oncorhynchus are or might be present have been calculated by taking the lesser of the value resulting from dividing 0.275 by the sum of one plus 10 raised to the power of 7.204 minus the pH, and adding the resulting value to the value found by dividing 39.0 by the sum of one plus 10 raised to the power of the pH minus 7.204, to the value resulting from dividing 0.0114 by the sum of one plus 10 raised to the power of the pH minus 7.204, and adding the resulting value found by dividing 1.6181 by the sum of one plus 10 raised to the power of the pH minus 7.204 and multiplying this value by 0.7249 multiplied by the value resulting from multiplying 23.12 by 10 raised to the power of 0.036 multiplied by value of 20 minus the temperature, as shown in the following equation:

Freshwater Acute Criteria, Salmonids in the Genus Onchorhynchus Present =

Edit: capitalize for consistency

$$\mathrm{MIN}\ \{\ [0.275\ /\ (1+10^{\ 7.204\text{-pH}}) + 39.0\ /\ (1+10^{\ \text{pH-}7.204})],\ [0.7249\ \mathrm{x}[0.0114/(1+10^{\ 7.204\text{-pH}}) + 1.6181\ /\ (1+10^{\ \text{pH-}7.204})]\ \mathrm{x}\ (23.12\ \mathrm{x}\ 10^{\ 0.036\ \mathrm{x}(20\text{-T})})]\ \}$$

Where MIN indicates the lesser of the two values separated by a comma.

(c) The freshwater acute water quality criteria for ammonia in table 1703-4B where salmonids in the genus Oncorhynchus are absent have been calculated by dividing 0.0114 by the sum of one plus 10 raised to the power of 7.204 minus the pH, and adding the resulting value to the value found by dividing 1.6181 by the sum of one plus 10 raised to the power of the pH minus 7.204, and multiplying this value by 0.7249 multiplied by the lesser of 51.93 or the value resulting from multiplying 23.12 by 10 raised to the power of 0.036 multiplied by value of 20 minus the temperature as shown in the following equation:

Freshwater Acute Criteria, Salmonids in the Genus Onchorhynchus Absent =

$$\{0.7249\ \mathrm{x}[0.0114/(1+10^{\ 7.204\text{-pH}}) + 1.6181\ /\ (1+10^{\ \text{pH-}7.204})]\}\ \mathrm{x\ MIN}\ [\ 51.93,\ (23.12\ \mathrm{x}\ 10^{\ 0.036\ \mathrm{x}(20\text{-T})})]$$

Edit: capitalize for consistency

Where MIN indicates the lesser of the 2 values separated by a comma.

(d) The equations described in (b) and (c), above, shall be used to calculate freshwater acute water quality criteria for ammonia at unlisted pH and temperature values.

(e) Table 1703-4A and table 1703-4B shall be as follows:

Table 1703-4A: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter Salmonids in the Genus Oncorhynchus Present										
pH	**Temperature, Degrees C**									
	0-14	**15**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	33	33	32	27	23	19	16	14	12	9.9
6.6	31	31	30	26	22	18	16	13	11	9.5
6.7	30	30	29	24	21	18	15	13	11	9.0
6.8	28	28	27	23	20	17	14	12	10	8.5
6.9	26	26	25	21	18	15	13	11	9.4	7.9
7.0	24	24	23	20	17	14	12	10	8.6	7.3
7.1	22	22	21	18	15	13	11	9.3	7.9	6.7
7.2	20	20	19	16	14	12	9.8	8.3	7.1	6.0

Table 1703-4A: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter Salmonids in the Genus Oncorhynchus Present										
pH	**Temperature, Degrees C**									
	0-14	**15**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
7.3	18	18	17	14	12	10	8.7	7.4	6.3	5.3
7.4	15	15	15	13	11	9.0	7.7	6.5	5.5	4.7
7.5	13	13	13	11	9.2	7.8	6.6	5.6	4.8	4.0
7.6	11	11	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5
7.7	9.6	9.6	9.3	7.9	6.7	5.7	4.8	4.1	3.5	3.0
7.8	8.1	8.1	7.9	6.7	5.6	4.8	4.0	3.4	2.9	2.5
7.9	6.8	6.8	6.6	5.6	4.7	4.0	3.4	2.9	2.4	2.1
8.0	5.6	5.6	5.4	4.6	3.9	3.3	2.8	2.4	2.0	1.7
8.1	4.6	4.6	4.5	3.8	3.2	2.7	2.3	2.0	1.7	1.4
8.2	3.8	3.8	3.7	3.1	2.7	2.3	1.9	1.6	1.4	1.2
8.3	3.1	3.1	3.1	2.6	2.2	1.9	1.6	1.3	1.1	0.96
8.4	2.6	2.6	2.5	2.1	1.8	1.5	1.3	1.1	0.93	0.79
8.5	2.1	2.1	2.1	1.8	1.5	1.3	1.1	0.90	0.77	0.65
8.6	1.8	1.8	1.7	1.5	1.2	1.0	0.88	0.75	0.63	0.54
8.7	1.5	1.5	1.4	1.2	1.0	0.87	0.74	0.62	0.53	0.45
8.8	1.2	1.2	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37
8.9	1.0	1.0	1.0	0.85	0.72	0.61	0.52	0.44	0.37	0.32
9.0	0.88	0.88	0.86	0.73	0.62	0.52	0.44	0.37	0.32	0.27

Table 1703-4B: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter, Salmonids in the Genus Oncorhynchus Absent											
pH	**Temperature, Degrees C**										
	0-10	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	51	44	37	32	27	23	19	16	14	12	9.9
6.6	49	42	36	30	26	22	18	16	13	11	9.5
6.7	46	40	34	29	24	21	18	15	13	11	9.0
6.8	44	38	32	27	23	20	17	14	12	10	8.5
6.9	41	35	30	25	21	18	15	13	11	9.4	7.9
7.0	38	33	28	23	20	17	14	12	10	8.6	7.3
7.1	34	30	25	21	18	15	13	11	9.3	7.9	6.7
7.2	31	27	23	19	16	14	12	9.8	8.3	7.1	6.0
7.3	27	24	20	17	14	12	10	8.7	7.4	6.3	5.3
7.4	24	21	18	15	13	11	9.0	7.7	6.5	5.5	4.7
7.5	21	18	15	13	11	9.2	7.8	6.6	5.6	4.8	4.0
7.6	18	15	13	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5
7.7	15	13	11	9.3	7.9	6.7	5.7	4.8	4.1	3.5	2.9
7.8	13	11	9.3	7.9	6.7	5.6	4.8	4.0	3.4	2.9	2.5
7.9	11	9.1	7.7	6.6	5.6	4.7	4.0	3.4	2.9	2.4	2.1
8.0	8.8	7.6	6.4	5.4	4.6	3.9	3.3	2.8	2.4	2.0	1.7
8.1	7.2	6.3	5.3	4.5	3.8	3.2	2.7	2.3	2.0	1.7	1.4
8.2	6.0	5.2	4.4	3.7	3.1	2.7	2.3	1.9	1.6	1.4	1.2
8.3	4.9	4.3	3.6	3.1	2.6	2.2	1.9	1.6	1.3	1.1	0.96
8.4	4.1	3.5	3.0	2.5	2.1	1.8	1.5	1.3	1.1	0.93	0.79
8.5	3.3	2.9	2.4	2.1	1.8	1.5	1.3	1.1	0.90	0.77	0.65
8.6	2.8	2.4	2.0	1.7	1.5	1.2	1.0	0.88	0.75	0.63	0.54
8.7	2.3	2.0	1.7	1.4	1.2	1.0	0.87	0.74	0.62	0.53	0.45
8.8	1.9	1.7	1.4	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37

Table 1703-4B: Freshwater Acute Aquatic Life Criteria For Ammonia in mg N/liter, Salmonids in the Genus Oncorhynchus Absent											
pH	**Temperature, Degrees C**										
	0-10	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.9	1.6	1.4	1.2	1.0	0.85	0.72	0.61	0.52	0.44	0.37	0.32
9.0	1.4	1.2	1.0	0.86	0.73	0.62	0.52	0.44	0.37	0.32	0.27

Env-Wq 1703.26 Freshwater Chronic Aquatic Life Criteria For Ammonia.

(a) Subject to (b) through (d), below, Table 1703-4C shall be used to determine freshwater chronic aquatic life criteria for ammonia, in mg N/l.

(b) The freshwater chronic water quality criteria for ammonia in Table 1703-4C have been calculated by adding the value found by dividing 0.0278 by the sum of one plus 10 raised to the power of 7.688 minus the pH to the value found by dividing 1.1994 by one plus 10 raised to the power of pH minus 7.688, and multiplying the resulting value by 0.8876 multiplied by the value resulting from multiplying 2.126 by 10 raised to the power of 0.028 times the value of 20 minus the greater of the temperature or 7, as shown in the following equation:

Freshwater Chronic Criteria for Ammonia:

$$\text{Criteria} = 0.8876 \times [0.0278/(1+10^{7.688-\text{pH}}) + 1.1994/(1+10^{\text{pH}-7.688})] \times [2.126 \times 10^{0.028 \times (20-\text{MAX}(T,7))}]$$

Where MAX indicates the greater of the two values separated by a comma.

(c) The chronic criteria in Table 1703-4C represent a 30-day rolling average, but the highest 4-day average within any 30-day averaging period shall not exceed 2.5 times the chronic criteria.

(d) The equation described in (b), above, shall be used to calculate criteria at unlisted pH and temperature values.

(e) Table 1703-4C shall be as follows:

Table 1703-4C: Freshwater Chronic Aquatic Life Criteria For Ammonia in mg N/l													
pH	**Temperature, Degrees C**												
	0-7	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	4.9	4.6	4.1	3.6	3.1	2.8	2.4	2.1	1.9	1.6	1.5	1.3	1.1
6.6	4.8	4.5	4.0	3.5	3.1	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.1
6.7	4.8	4.5	3.9	3.5	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1
6.8	4.6	4.4	3.8	3.4	3.0	2.6	2.3	2.0	1.8	1.6	1.4	1.2	1.1
6.9	4.5	4.2	3.7	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0
7.0	4.4	4.1	3.6	3.2	2.8	2.4	2.2	1.9	1.7	1.5	1.3	1.1	0.99
7.1	4.2	3.9	3.5	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.95
7.2	4.0	3.7	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0	0.90
7.3	3.8	3.5	3.1	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.1	0.97	0.85
7.4	3.5	3.3	2.9	2.5	2.2	2.0	1.7	1.5	1.3	1.2	1.0	0.90	0.79
7.5	3.2	3.0	2.7	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.95	0.83	0.73
7.6	2.9	2.8	2.4	2.1	1.9	1.6	1.4	1.3	1.1	0.98	0.86	0.76	0.67
7.7	2.6	2.4	2.2	1.9	1.7	1.5	1.3	1.1	1.0	0.88	0.78	0.68	0.60
7.8	2.3	2.2	1.9	1.7	1.5	1.3	1.2	1.0	0.89	0.79	0.69	0.61	0.53
7.9	2.1	1.9	1.7	1.5	1.3	1.2	1.0	0.89	0.79	0.69	0.61	0.53	0.47
8.0	1.8	1.7	1.5	1.3	1.1	1.0	0.88	0.78	0.68	0.60	0.53	0.44	0.41
8.1	1.5	1.5	1.3	1.1	0.99	0.87	0.76	0.67	0.59	0.52	0.46	0.40	0.35
8.2	1.3	1.2	1.1	0.96	0.84	0.74	0.65	0.57	0.50	0.44	0.39	0.34	0.30
8.3	1.1	1.1	0.93	0.82	0.72	0.63	0.55	0.49	0.43	0.38	0.33	0.29	0.26
8.4	0.95	0.89	0.79	0.69	0.61	0.53	0.47	0.41	0.36	0.32	0.28	0.25	0.22

Table 1703-4C: Freshwater Chronic Aquatic Life Criteria For Ammonia in mg N/l													
pH	**Temperature, Degrees C**												
	0-7	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.5	0.80	0.75	0.67	0.58	0.51	0.45	0.40	0.35	0.31	0.27	0.24	0.21	0.18
8.6	0.68	0.64	0.56	0.49	0.43	0.38	0.33	0.29	0.26	0.23	0.20	0.18	0.15
8.7	0.57	0.54	0.47	0.42	0.37	0.32	0.28	0.25	0.22	0.19	0.17	0.15	0.13
8.8	0.49	0.46	0.40	0.35	0.31	0.27	0.24	0.21	0.19	0.16	0.14	0.13	0.11
8.9	0.42	0.39	0.34	0.30	0.27	0.23	0.21	0.18	0.16	0.14	0.12	0.11	0.09
9.0	0.36	0.34	0.30	0.26	0.23	0.20	0.18	0.16	0.14	0.12	0.11	0.09	0.08

Env-Wq 1703.27 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 10 g/kg. The values shown in Table 1703-5 shall be used to determine saltwater acute aquatic life criteria for ammonia, in milligrams of NH_3 per liter (mg NH_3/l), for a salinity of 10 g/kg:

Table 1703-5: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 10 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	270	191	131	92	62	44	29	21
7.2	175	121	83	58	40	27	19	13
7.4	110	77	52	35	25	17	12	8.3
7.6	69	48	33	23	16	11	7.7	5.6
7.8	44	31	21	15	10	7.1	5.0	3.5
8.0	27	19	13	9.4	6.4	4.6	3.1	2.3
8.2	18	12	8.5	5.8	4.2	2.9	2.1	1.5
8.4	11	7.9	5.4	3.7	2.7	1.9	1.4	1.0
8.6	7.3	5.0	3.5	2.5	1.8	1.3	0.98	0.75
8.8	4.6	3.3	2.3	1.7	1.2	0.92	0.71	0.56
9.0	2.9	2.1	1.5	1.1	0.85	0.67	0.52	0.44

Env-Wq 1703.28 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 20 g/kg. The values shown in Table 1703-6 shall be used to determine saltwater acute aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 20 g/kg:

Table 1703-6: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 20 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	291	200	137	96	64	44	31	21
7.2	183	125	87	60	42	29	20	14
7.4	116	79	54	37	27	18	12	8.7
7.6	73	50	35	23	17	11	7.9	5.6
7.8	46	31	23	15	11	7.5	5.2	3.5
8.0	29	20	14	9.8	6.7	4.8	3.3	2.3
8.2	19	13	8.9	6.2	4.4	3.1	2.1	1.6
8.4	12	8.1	5.6	4.0	2.9	2.0	1.5	1.1
8.6	7.5	5.2	3.7	2.7	1.9	1.4	1.0	0.77
8.8	4.8	3.3	2.5	1.7	1.3	0.94	0.73	0.56
9.0	3.1	2.3	1.6	1.2	0.87	0.69	0.54	0.44

Env-Wq 1703.29 Saltwater Acute Aquatic Life Criteria for Ammonia at a Salinity of 30 g/kg. The values shown in Table 1703-7 shall be used to determine saltwater acute aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 30 g/kg:

Table 1703-7: Saltwater Acute Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 30 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	312	208	148	102	71	48	33	23
7.2	196	135	94	64	44	31	21	15
7.4	125	85	58	40	27	19	13	9.4
7.6	79	54	37	25	21	12	8.5	6.0
7.8	50	33	23	16	11	7.9	5.4	3.7
8.0	31	21	15	10	7.3	5.0	3.5	2.5
8.2	20	14	9.6	6.7	4.6	3.3	2.3	1.7
8.4	12.7	8.7	6.0	4.2	2.9	2.1	1.6	1.1
8.6	8.1	5.6	4.0	2.7	2.0	1.4	1.1	0.81
8.8	5.2	3.5	2.5	1.8	1.3	1.0	0.75	0.58
9.0	3.3	2.3	1.7	1.2	0.94	0.71	0.56	0.46

Env-Wq 1703.30 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 10 g/kg. The values shown in Table 1703-8 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 10 g/kg:

Table 1703-8: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH_3/l; Salinity = 10 g/kg								
pH	**~~Tempterature~~ *Temperature* (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	41	29	20	14	9.4	6.6	4.4	3.1
7.2	26	18	12	8.7	5.9	4.1	2.8	2.0
7.4	17	12	7.8	5.3	3.7	2.6	1.8	1.2
7.6	10	7.2	5.0	3.4	2.4	1.7	1.2	0.84
7.8	6.6	4.7	3.1	2.2	1.5	1.1	0.75	0.53
8.0	4.1	2.9	2.0	1.40	0.97	0.69	0.47	0.34
8.2	2.7	1.8	1.3	0.87	0.62	0.44	0.31	0.23
8.4	1.7	1.2	0.81	0.56	0.41	0.29	0.21	0.16
8.6	1.1	0.75	0.53	0.37	0.27	0.20	0.15	0.11
8.8	0.69	0.50	0.34	0.25	0.18	0.14	0.11	0.08
9.0	0.44	0.31	0.23	0.17	0.13	0.10	0.08	0.07

Env-Wq 1703.31 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 20 g/kg. The values shown in Table 1703-9 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 20 g/kg:

Table 1703-9: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 20 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	44	30	21	14	9.7	6.6	4.7	3.1
7.2	27	19	13	9.0	6.2	4.4	3.0	2.1
7.4	18	12	8.1	5.6	4.1	2.7	1.9	1.3
7.6	11	7.5	5.3	3.4	2.5	1.7	1.2	0.84
7.8	6.9	4.7	3.4	2.3	1.6	1.1	0.78	0.53
8.0	4.4	3.0	2.1	1.5	1.0	0.72	0.50	0.34
8.2	2.8	1.9	1.3	***0***.94	***0***.66	***0***.47	***0***.31	***0***.24
8.4	1.8	1.2	***0***.84	***0***.59	***0***.44	***0***.30	***0***.22	***0***.16
8.6	1.1	***0***.78	***0***.56	***0***.41	***0***.28	***0***.20	***0***.15	***0***.12
8.8	***0***.72	***0***.50	***0***.37	***0***.26	***0***.19	***0***.14	***0***.11	***0***.08
9.0	***0***.47	***0***.34	***0***.24	***0***.18	***0***.13	***0***.10	***0***.08	***0***.07

Env-Wq 1703.32 Saltwater Chronic Aquatic Life Criteria for Ammonia at a Salinity of 30g/kg. The values shown in table 1703-10 shall be used to determine saltwater chronic aquatic life criteria for ammonia, in mg NH3 /l, for a salinity of 30 g/kg:

Table 1703-10: Saltwater Chronic Aquatic Life Criteria for Ammonia in mg NH3/l; Salinity = 30 g/kg								
pH	**Temperature (°C)**							
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**
7.0	47	31	22	15	11	7.2	5.0	3.4
7.2	29	20	14	9.7	6.6	4.7	3.1	2.2
7.4	19	13	8.7	5.9	4.1	2.9	2.0	1.4
7.6	12	8.1	5.6	3.7	3.1	1.8	1.3	0.90
7.8	7.5	5.0	3.4	2.4	1.7	1.2	0.81	0.56
8.0	4.7	3.1	2.2	1.6	1.1	0.75	0.53	0.37
8.2	3.0	2.1	1.4	1.0	0.69	0.50	0.34	0.25
8.4	1.9	1.3	0.90	0.62	0.44	0.31	0.23	0.17
8.6	1.2	0.84	0.59	0.41	0.30	0.22	0.16	0.12
8.8	0.78	0.53	0.37	0.27	0.20	0.15	0.11	0.09
9.0	0.50	0.34	0.26	0.19	0.14	0.11	0.08	0.07

Env-Wq 1703.33 Freshwater Aquatic Life Criteria for Pentachlorophenol.

(a) To calculate the freshwater aquatic life acute criteria, in ug/~~l~~***L***, for pentachlorophenol, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression 1.005 multiplied by the pH and to which product the value of 4.869 shall be subtracted, as follows:

$$\text{Acute Criteria} = e^x \text{ where}$$
$$x = [\ 1.005\ (\text{pH}) - 4.869\ ]$$

(b) To calculate the freshwater aquatic life chronic criteria, in ug/~~l~~***L***, for pentachlorophenol, the exponent "e" shall be raised to the power "x" where "x" is equal to the parenthetical expression 1.005 multiplied by the pH and to which product the value of 5.134 shall be subtracted, as follows:

$$\text{Chronic Criteria} = e^x \text{ where}$$
$$x = [\ 1.005\ (\text{pH}) - 5.134\ ]$$

Edit: capitalize for consistency

Env-Wq 1703.34 Freshwater Aquatic Life Criteria for Selenium. Compliance with the freshwater aquatic life criteria for selenium shall be determined using egg-ovary fish tissue measurements, if available and applicable, or, in the alternative using, whole-body or muscle fish tissue measurements, if available, and if neither are available then using the water column values shown in table 1703-11, below, for the freshwater aquatic life protection criteria:

Table 1703-11: Freshwater Selenium Ambient Chronic Water Quality Criteria for Protection of Aquatic Life

Media	***Fish Tissue***		***Water Column***	
Measurement	***Egg/Ovary***	***Fish Whole Body or Muscle***	***Monthly Average Exposure***	***Intermittent Exposure***
Criteria	***15.1 mg/kg dw***	***8.5 mg/kg dw whole body or***	***1.5 µg/L in lentic aquatic systems***	$Criteria_{int\ exp} = [Criteria_{monthly\ average} - C_{bkgrnd}(1-f_{int})] / f_{int}$

		11.3 mg/kg dw muscle (skinless, boneless filet)	***3.1 µg/L in lotic aquatic systems***		

Edit: in previous section this is "egg-ovary". Make sure to be consistent in the spelling of the word.

Env-Wq 1703.35 <u>Notes for Table 1703-11</u> **Edit:** period

Edit: "shall be" **Edit:** "shall be"

(a) Fish tissue measures, egg/ovary and whole-body or muscle, are instantaneous measures expressed as steady-state and are not to be exceeded.

(b) Water column values are based on the total of the dissolved species of selenium in water. Water column values are the applicable criterion in the absence of fish tissue in a steady-state condition and are not to be exceeded more than once in 3-years. **Edit:** comma

(c) Intermittent exposure criteria (Criteria$_{int\ exp}$) is the Criteria$_{monthly}$ average from the monthly measurements, for either lentic or lotic waters, minus the C$_{bkgrnd}$ which is the average background selenium concentration times one minus the f$_{int}$ which is the fraction of any 30-day period during which elevated selenium concentrations occur, divided by the f$_{int}$. **Edit:** "shall be"

PART Env-Wq 1704 ALTERNATIVE SITE-SPECIFIC CRITERIA

Env-Wq 1704.01 <u>Purpose</u>. The purpose of this part is to establish a procedure for determining alternative site-specific criteria in the following cases:

(a) For toxic substances not listed in Env-Wq 1703.21 through Env-Wq 1703.33;

(b) Where site-specific information is available and substantiates the use of different criteria; or

(c) Where new information that was not considered in the development of the criteria becomes available.

Env-Wq 1704.02 <u>Procedures *for Site-Specific Human Health Criteria*</u>. The procedure for determining alternative site-specific criteria for the protection of human health shall be as specified in EPA's "Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," EPA 822-B-00-004, dated October 2000, and the following accompanying technical support documents, all of which are available as noted in Appendix B:

Edit: delete the extra space

(a) "Volume 1: Risk Assessment", EPA 822-B-00-005, dated October 2000;

(b) "Volume 2: Development of National Bioaccumulation Factors", EPA-822-R-03-030, dated December 2003; and

(c) "Volume 3: Development of Site-Specific Bioaccumulation Factors", EPA-822-R-09-008, dated September 2009.

Edit: "shall be" **Edit:** comma

Env-Wq 1704.03 <u>Procedures for Site-Specific Nutrient Criteria.</u>

(a) Subject to the criteria in Env-Wq 1703.14, Env-Wq 1703.25 through 1703.33 and the procedure in Env-Wq 1704.03(b), the following are acceptable procedures for determining alternative site-specific nutrient criteria:

(1) Adopting the nutrient target concentration or load from an EPA approved Total Maximum Daily Load (TMDL) study pursuant to 40 CFR 130.7; **Edit:** lowercase

Edit: lowercase ***(2) Adopting the nutrient target concentration or load from an Advance Restoration Plan;***

(3) Adopting one of the following federal requirements: **Edit:** lowercase

a. Criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

b. The ambient targets and commensurate flows applied in permits issued pursuant to 40 CFR 122;

(4) Approaches in the "Nutrient Criteria Technical Guidance Manual Rivers and Streams", EPA-822-B-00-002 dated July 2000, available as noted in Appendix B;

(5) Approaches in the "Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs", EPA-822-B00-001 dated April 2000, available as noted in Appendix B;

(6) Approaches in the "Nutrient Criteria Technical Guidance Manual Estuary and Coastal Marine Waters", EPA-822-B00-003 dated October 2001, available as noted in Appendix B;

(7) Approaches in the "Nutrient Criteria Technical Guidance Manual Wetlands", EPA-822-B-08-001 dated June 2008, available as noted in Appendix B; and

(8) Approaches in "Using Stressor-response Relationships to Derive Numeric Nutrient Criteria", EPA-820-S-10-001 dated November 2010, available as noted in Appendix B.

(b) Modeling conducted to determine alternative site-specific nutrient criteria shall be conducted as specified in EPA's "Guidance on the Development, Evaluation, and Application of Environmental Models", EPA-100-K-09-003 dated March 2009, available as noted in Appendix B.

Env-Wq 1704.0~~3~~*4* Modifications to Surface Water Quality Standards. If the department determines, based on scientifically valid documentation, that alternative site-specific criteria will protect the existing and designated uses of the waterbody, the department shall revise these rules to incorporate those criteria.

PART Env-Wq 1705 ~~FLOW~~ ***PERMITTING RELATED*** STANDARDS

Env-Wq 1705.01 Assimilative Capacity.

(a) Subject to (b) ***and Env-Wq 1705.03***, below, the department shall hold not less than 10 percent of the assimilative capacity of each surface water in reserve to provide for future needs.

(b) For purposes of combined sewer overflows, the department shall determine compliance based on 99 percent of the assimilative capacity of the receiving surface water.

Env-Wq 1705.02 ~~Low Flow~~ ***Dilution and*** Conditions ***for Permitting***.

(a) The ***ambient upstream*** flow used to calculate permit limits shall be as specified in (b) through ~~(d)~~ ***(g)***, below.

Edit: can either spell out the word or use the symbol, but should be consistent

(b) For tidal waters, the low flow condition shall be equivalent to the conditions that result in a dilution that is exceeded 99% of the time.

(c) For non-tidal rivers and streams, permit limits for all human health criteria for carcinogens shall be developed based on the long-term harmonic mean flow, which is the number of daily flow measurements divided by the sum of the reciprocals of the daily flows.

(d) ~~For~~ ~~for non-tidal rivers and streams,~~ ~~permit~~ ***Permit*** limits ***to meet*** ~~for all aquatic life and human health~~ ***nutrient*** criteria ~~for non-carcinogens shall be based on 7Q10 flow~~ ***including, but not limited to, nitrogen and phosphorus species, shall be based on the following downstream ambient targets and flows:***

(1) The ambient nutrient target used in the reasonable potential analysis conducted pursuant to 40 CFR 122.43(d) shall be based on one of the following methods provided that existing and designated uses are fully protected:

a. Site-specific criteria adopted pursuant to Env-Wq 1704;

Edit/Unclear: Check the citation. Cannot find a paragraph (d) for this section.

Edit: lowercase

b. An EPA approved Total Maximum Daily Load (TMDL) study pursuant to 40 CFR 130.7;or

Edit: insert a space

c. One of the following federal requirements if deemed by the department to be protective of all existing and designated uses:

i. Criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

ii. Permits issued pursuant to 40 CFR 122; and

(2) The flows for nutrients used in the reasonable potential analysis shall be commensurate to, as applicable:

Edit: capitalize

a. site-specific nutrient criteria adopted pursuant to Env-Wq 1704;

b. established conditions for the nutrient target in an EPA approved TMDL;

c. nutrient target used in criteria published by EPA pursuant to 33 U.S.C. 1314(a)(1); or

d. nutrient target used in permits issued pursuant to 40 CFR 122.

(e) For non-tidal rivers and streams, permit limits to prevent ammonia toxicity in aquatic life shall be based on a flow equal to the 7Q10 flow.

Edit: shall

(f) Nutrient effluent permit limits may be based on the 7Q10 flow if the nutrient limit is needed to achieve compliance with other water quality criteria that must have permit limits based on the 7Q10 flow in accordance with (g) below.

(g) For non-tidal rivers and streams, permit limits for all non-nutrient aquatic life criteria and human health criteria for non-carcinogens shall be based on the 7Q10 flow except as described in Env-Wq 1705.02(d)(2) through Env-Wq 1705.02(f), above.

(h) To the maximum extent practicable, data used for setting permit limits and calculating reasonable potential pursuant to 40 CFR 122.44(d)(1)(ii) shall be based upon:

(1) Data, modeling or reasonable estimates of the ambient condition representative in space and time of the limiting conditions as defined in (a) through (g) above, for a particular criterion; and

Edit: comma

(2) Data, modeling or reasonable estimates of the ambient condition representative of the conditions on which a criterion is based.

Unclear: does this mean "best management practices" defined in Env-Wq 1702.06? If so, delete "approved by the department", as that is not a part of the definition. If the intent is to use different "best management practices" than what is defined, need to establish what those practicees a are in the rule.

Env-Wq 1705.03 <u>Restoration Permitting</u>.

Edit: "shall be"

(a) Temporary and infrequent impacts resulting from ecological restoration projects approved by the department are exempt from the assimilative capacity requirements of Env-Wq 1705.01 and dilution requirements of Env-Wq 1705.02.

(b) Any water quality or water quantity impacts from ecological restoration projects approved by the department shall be minimized to the extent practicable and be treated or controlled using best management practices approved by the department.

Legis. Intent/Note to JLCAR: As stated in the notice, this proposal Env-Wq 1706 was revised to align with revisions to RSA 485-A:2, V pursuant to Chapter 208, Laws of 2021 (effective October 9, 2021). The Committee may have questions on why it took over 3 years to make these changes, when there was nothing in the chapter law that allowed for delayed implementation of the statute.

PART Env-Wq 1706 SAMPLING AND ANALYSIS

Env-Wq 1706.01 <u>Procedures</u>.

(a) Unless alternative procedures are specified in the surface water discharge permit, all procedures used for the purpose of collecting, preserving, and analyzing samples shall be as specified in 40 CFR Part 136 for wastewater and 40 CFR Part 141 for drinking water.

Edit: "shall be"

(b) All methods approved in 40 CFR 136 for bacteria testing, as well as analytical methods approved for use in national shellfish sanitation program as specified pursuant to RSA 485-A:8, V are approved methods for NPDES permit compliance.

Edit: comma

PART Env-Wq 1707 MIXING ZONES

Env-Wq 1707.01 <u>Designation of Mixing Zones</u>.

(a) Because RSA 485-A:8, I prohibits the discharge of any sewage or other wastes into class A waters, mixing zones shall be prohibited in such waters.

(b) For class B waters, the department shall designate a limited area or volume of the surface water as a mixing zone if the applicant provides sufficient scientifically valid documentation to allow the department to independently determine that all criteria in Env-Wq 1707.02 have been met.

Env-Wq 1707.02 <u>Criteria for Approval of Mixing Zones</u>. The department shall not approve a mixing zone unless the proposed mixing zone:

(a) Meets the criteria in Env-Wq 1703.03(c)(1);

(b) Does not interfere with biological communities or populations of indigenous species;

(c) Does not result in the accumulation of pollutants in the sediments or biota;

(d) Allows a zone of passage for swimming and drifting organisms;

(e) Does not interfere with existing and designated uses of the surface water;

(f) Does not impinge upon spawning grounds or nursery areas, or both, of any indigenous aquatic species;

(g) Does not result in the mortality of any plants, animals, humans, or aquatic life within the mixing zone;

(h) Does not exceed the chronic toxicity value of 1.0 TUc at the mixing zone boundary; and

(i) Does not result in an overlap with another mixing zone.

Env-Wq 1707.03 <u>Conditions for Mixing Zones</u>. If the department approves a mixing zone, the department shall include such conditions as are needed to ensure that the criteria on which the approval is based are met.

Env-Wq 1707.04 <u>Technical Standards</u>. Mixing zones shall be established in accordance with "Technical Support Document for Water Quality-based Toxics Control", EPA/505/2-90-001, dated March 1991, available as noted in Appendix B.

Edit: "rules"

PART Env-Wq 1708 ANTIDEGRADATION

Env-Wq 1708.01 <u>Purpose</u>. The purpose of these antidegradation provisions is to ensure that the following requirements of 40 CFR 131.12 are met:

(a) Existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected;

(b) Where the quality of a surface water exceeds the level necessary to support recreation in and on the water and propagation of fish, shellfish, and wildlife, such quality shall be maintained and protected, subject to the following:

(1) The department shall not approve a proposed discharge or activity that would cause a significant change in water quality as specified in Env-Wq 1708.09 unless the department finds, after full satisfaction of the intergovernmental coordination and public participation requirements and the

analysis required by Env-Wq 1708.10, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the surface water is located; and

(2) The department shall not approve any proposed discharge or activity that might cause degradation or lower water quality, without such conditions as are necessary to ensure that:

a. Water quality will be adequate to fully protect existing uses;

b. The highest statutory and regulatory requirements will be achieved for all new and existing point sources; and

c. All cost effective and reasonable best management practices for nonpoint source control will be implemented;

(c) Where high quality ~~surface~~ waters constitute an outstanding resource waters (ORW), that water quality shall be maintained and protected; and

Edit: "rules"

(d) In those cases where a potential water quality impairment is associated with a thermal discharge, the antidegradation provisions shall ensure that the requirements of Section 316 of the Clean Water Act are met.

Env-Wq 1708.02 Applicability. Antidegradation shall apply to:

(a) Any proposed new or increased activity, including point source and nonpoint source discharges of pollutants, that would lower water quality or adversely affect existing or designated uses;

(b) Any proposed increase in loadings to a waterbody when the proposal is associated with existing activities;

(c) Any increase in flow alteration over an existing alteration; and

(d) Any hydrologic modifications, such as dam construction and water withdrawals.

Env-Wq 1708.03 Protection of Existing Uses.

(a) A proposed discharge or activity shall not eliminate any existing uses or the water quality needed to maintain and protect those uses.

(b) The department shall determine the existing uses for the waters in question using the information provided pursuant to Env-Wq 1708.07.

Env-Wq 1708.04 Protection of Water Quality in ORW.

(a) Surface waters of national forests and surface waters designated as natural under RSA 483:7-a, I, shall be considered outstanding resource waters (ORW).

(b) Subject to (c), below, water quality shall be maintained and protected in surface waters that constitute ORW.

(c) The department shall allow a limited ***activity, or*** point or nonpoint source discharge to an ORW only if:

(1) The discharge ***or activity*** will result in no more than temporary and short-term changes in water quality, wherein "temporary and short term" means that degradation is limited to the shortest possible time;

(2) The discharge ***or activity*** will not permanently degrade water quality or result at any time in water quality lower than that necessary to protect the existing and designated uses in the ORW; and

(3) All practical means of minimizing water quality degradation are implemented.

Env-Wq 1708.05 Protection of Class A Waters.

(a) As specified in RSA 485-A:8, I, discharges of sewage or waste to class A waters shall be prohibited.

(b) Proposed new or increased activities that the department determines do not involve the discharge of sewage or waste shall be reviewed in accordance with this part.

Env-Wq 1708.06 Protection of Water Quality in High Quality Waters.

(a) Subject to (b) through (d), below, high quality waters shall be maintained and protected.

(b) The department shall evaluate and authorize insignificant changes in water quality as specified in Env-Wq 1708.09.

(c) The department shall allow degradation of significant increments of water quality, as determined in accordance with Env-Wq 1708.09, in high quality waters only if the applicant can demonstrate to the department, in accordance with Env-Wq 1708.10, that allowing the water quality degradation is necessary to accommodate important economic or social development in the area in which the receiving waters are located.

(d) If the waterbody is class A water, the requirements of Env-Wq 1708.05 also shall apply.

Env-Wq 1708.07 Submittal of Data. The applicant shall provide all information necessary to:

(a) Identify all existing uses, including:

(1) Freshwater, estuarine, and marine aquatic life present in the affected surface waters;

(2) Other wildlife that use or otherwise are dependent on the affected surface waters;

(3) Presence of water quality and physical habitat that support, or would support, aquatic life or other animal or plant life;

(4) Presence of indigenous species and communities;

(5) Presence of a specialized use of the waterbody, such as a spawning area or as a habitat for a federally- or state-listed threatened or endangered species;

(6) Use of the surface waters for recreation in or on the water, such as fishing, swimming, and boating, or use of the surface waters for commercial activity; and

(7) Whether or not current conditions or uses of the surface waters conflict with achieving and maintaining goal uses of the CWA at Section 101(a)(2) and the primary CWA objective to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters;

(b) Determine the level of water quality necessary to maintain and protect all uses identified in (a), above;

(c) Evaluate the potential impacts on existing uses due to the proposed discharge or activity by itself, and in combination with other discharges or activities presently occurring;

(d) Ensure that existing uses and the level of water quality necessary to protect those uses will be maintained and protected;

(e) Evaluate the magnitude, duration, and upstream and downstream extent of any lowering of high quality water due to the proposed discharge or activity by itself, and in combination with other discharges or activities presently occurring;

(f) Evaluate other factors as necessary to determine whether the proposed activity would cause significant or insignificant degradation, in accordance with Env-Wq 1708.09;

(g) If the discharge or activity is determined by the department to be significant, in accordance with Env-Wq 1708.08 and Env-Wq 1708.09, determine if a proposed lowering of water quality is necessary to achieve important economic or social development in accordance with Env-Wq 1708.10; and

(h) Ensure that all water quality criteria applicable to the waterbody in question will not be violated.

Env-Wq 1708.08 Assessing Waterbodies.

(a) The applicant shall characterize the existing water quality and determine whether there is remaining assimilative capacity for each parameter in question.

(b) Existing water quality shall be calculated in accordance with Env-Wq 1705.02, based on point sources discharging at their allowed loadings and the highest loadings anticipated from nonpoint sources.

(c) Where flows will or might be altered, existing conditions shall be established based on the existing maximum allowed water withdrawals or impoundment, diversion, or fluctuation of stream flow, as applicable.

(d) Remaining assimilative capacity shall be evaluated by comparing existing water quality, as specified in (b) and (c), above, to the state's water quality criteria.

(e) If the type and frequency of the proposed discharge or activity will or might cause the waterbody to be impacted at flows other than those listed in Env-Wq 1705.02, the applicant shall evaluate the impact of the proposed discharge at those other flows.

(f) Subject to (h), below, if the department determines, based on the information submitted, that there is no remaining assimilative capacity for a specific parameter, no further degradation with regard to that parameter shall be allowed.

(g) Subject to (h), below, if the department determines, based on the information submitted, that there is some remaining assimilative capacity, then the department shall proceed in accord with Env-Wq 1708.09.

(h) Determinations made pursuant to (f) or (g), above, shall account for Env-Wq 1705.01, which requires the department to reserve no less than 10% of a surface water's assimilative capacity.

Env-Wq 1708.09 Significant or Insignificant Determination.

(a) Any discharge or activity that is projected to use 20% or more of the remaining assimilative capacity for a water quality ***criterion*** ~~parameter, in terms of either concentration or mass of pollutants, or volume or flow rate for water quantity,~~ shall be considered a significant lowering of water quality.

(b) The department shall not approve a discharge or activity that will cause a significant lowering of water quality unless the applicant demonstrates, in accordance with Env-Wq 1708.10, that the proposed lowering of water quality is necessary to achieve important economic or social development in the area where the waterbody is located.

(c) Subject to (e), below, any applicant proposing an activity that will cause an insignificant lowering of water quality shall not be required to demonstrate that the activity is necessary to provide important economic or social development, provided the applicant implements best management practices to minimize degradation.

(d) Activities allowed under (c), above shall include, but not be limited to:

(1) Short term or intermittent discharges such as hydrostatic testing of pipelines, fire pump test water, and uncontaminated stormwater discharges or site clean-up activities;

(2) Permanent discharges such as uncontaminated noncontact cooling water, uncontaminated groundwater seepage, or unchlorinated or dechlorinated swimming pool water;

(3) Facilities whose nonpoint source runoff is controlled through the use of best management practices; and

(4) Any discharge or activity that is projected to use less than 20% of the remaining assimilative capacity for a water quality ***criterion*** ~~parameter, in terms of either concentration or mass for pollutants or volume or flow rate for water quantity~~.

(e) If the department determines based on the following factors that the effect of a discharge ***or activity*** results in a greater impact to the water quality than that normally found in insignificant discharges ***or activities***, the department shall determine that the proposed activity or discharge is significant, regardless of the proposed consumption of the remaining assimilative capacity, and require the applicant to demonstrate, in accordance with Env-Wq 1708.10, that a lowering of water quality is necessary to achieve an important economic or social development:

(1) The magnitude, duration, and spatial extent of the proposed change in water quality;

(2) The cumulative lowering of water quality over time resulting from the proposed activity in combination with previously approved activities;

(3) The possible additive or synergistic effects of the activity in combination with existing activities;

(4) The magnitude of the mass load independent of the total assimilative capacity or change in receiving water pollutant concentration;

(5) The toxic or bioaccumulative characteristics of the pollutant(s) in question;

(6) The potential to stress sensitive biological resources such as indigenous species, rare species, and threatened or endangered species and their habitat;

(7) The potential to stress sensitive recreational uses or water supply uses; or

(8) The quality and value of the resource.

Env-Wq 1708.10 <u>Alternatives Analysis; Determination of Net Economic or Social Benefits</u>.

(a) For purposes of this section, the following definitions shall apply:

(1) “Activity” means any of the activities listed in Env-Wq 1708.02 as being subject to this part, including all associated construction;

(2) “Area in which the water-body is located” means the directly affected municipality(ies) and, if necessary to quantify the net social and economic benefits of the activity, one or more of the municipalities that abut the directly affected municipality(ies), as determined by the applicant in consultation with the department;

(3) “Directly affected municipality(ies)” means the municipality or municipalities in which the waterbody that will be impacted by the activity is located; and

(4) “High value resource” means a natural or developed resource that is of particular value to the nation, region, state, or area in which the waterbody is located, including but not limited to state- or federally-listed threatened or endangered species, state or federal parks, public freshwater or saltwater beaches, and lands that are subject to conservation easements.

(b) For any activity that is determined to result in a significant impact to the existing water quality pursuant to Env-Wq 1708.09, the applicant shall provide documentation in accordance with (c) through (f), below, to demonstrate that:

(1) Lowering the water quality is necessary to accommodate the activity;

(2) The activity will provide net economic or social benefits in the area in which the waterbody is located; and

(3) The net social and economic benefits of constructing and operating or otherwise engaging in the activity outweigh the environmental impact that could be caused by the lower water quality.

(c) To determine whether the criteria specified in (b)(1)-(3), above, have been met, the applicant shall complete an alternatives analysis as described in (d), below, and submit the analysis and a request for approval of the preferred alternative to the department together with technically and scientifically valid supporting information.

(d) The alternatives analysis required by (c), above, shall describe the net social and economic benefits, as described in (e), below, and the water quality impacts, as described in (f), below, of constructing and operating or otherwise engaging in the activity and all practicable alternatives, including but not limited to the following:

(1) Alternative methods of production or operation;

(2) Improved process controls;

(3) Water conservation practices;

(4) Wastewater minimization technologies;

(5) Non-discharging alternatives;

(6) Improved wastewater ~~treatment~~ facility operation;

(7) Alternative methods of treatment, including advanced treatment beyond applicable technology requirements of the Clean Water Act;

(8) Alternative sites, and associated water quality impacts at those sites; and

(9) For activities that involve alteration of terrain, alternative site design that incorporates low impact development elements, including but not limited to creating less impermeable area or infiltrating or reusing stormwater.

(e) To determine whether the activity will provide net social and economic benefits in the area in which the waterbody is located, the applicant shall submit information on, and the department shall evaluate, each of the following:

(1) Whether the activity is consistent with municipal and regional master plans and economic development strategies; and

(2) An explanation of the effect that constructing and operating or otherwise engaging in the activity will have, or an explanation of why there will be no effect, on the following factors:

a. Public and social services;

b. Public health and safety;

c. Employment;

d. Tourism and recreation; and

e. Other social or economic factors that are specific to the area in which the waterbody is located.

(f) To determine the environmental impacts of lower water quality, the applicant shall submit information on, and the department shall evaluate, each of the following:

(1) Relative to designated uses, the sensitivity of existing and designated uses to the effects of constructing and operating or otherwise engaging in of the activity;

(2) Relative to pollutants, whether any pollutants are expected to be discharged as a result of constructing and operating or otherwise engaging in the activity and, if so, the nature of the pollutants and the anticipated fate and transport of the pollutants in the waterbody;

(3) Relative to water quality, whether water quality is expected to change as a result of constructing and operating or otherwise engaging in activity, and if so, the estimated degree of change in water quality;

(4) Relative to high value resources, whether any high value resources are present that would be affected by constructing and operating or otherwise engaging in the activity, and if so, the degree to which such resources are expected to be affected;

(5) Relative to flow characteristics or hydrologic modifications, whether any alterations to existing flows or other hydrologic modifications are expected as a result of constructing and operating or otherwise engaging in the proposed activity, and if so, the impacts of such alterations or modifications;

(6) Relative to water treatment technology, whether the activity incorporates any such technology other than passive stormwater treatment best management practices and, if so, the reliability of the treatment technology proposed, and the risk management plan for non-standard situations such as accidents, upsets, or failures; and

(7) Relative to any other factors that are specific to the affected waterbody or the area in which the waterbody is located, a description of the factor and an explanation of the effect of constructing and operating or otherwise engaging in the proposed activity on that factor.

(g) After reviewing the information submitted pursuant to (c) through (f), above, the department shall make a preliminary determination to:

(1) Approve the request, if it determines that the criteria specified in (b)(1)-(3), above, have been met; or

(2) Deny the request, if it determines that the criteria specified in (b)(1)-(3), above, have not been met.

(h) If the department's preliminary determination is to approve the applicant's request, the department shall provide the opportunity for public comment on its preliminary decision in accordance with Env-Wq 1708.11.

Env-Wq 1708.11 Public Participation and Intergovernmental Coordination.

(a) The department shall provide the opportunity for public comment and an opportunity to request a public hearing on preliminary decisions to allow any significant lowering of water quality determined in accordance with Env-Wq 1708.09(b) or (e).

(b) The department shall issue a written notice to the public, the municipality in which the activity is located or proposed to be located, and all potentially affected municipalities of a preliminary decision to allow a significant lowering of water quality.

(c) The notice provided pursuant to (b), above, shall:

(1) Invite written comments to be submitted to the department;

(2) Be posted by the department on its website and in at least one public place in the municipality in which the proposed activity will occur;

(3) Contain the information specified in (d), below; and

(4) For activities related to state surface water discharge permits, be a part of the normal public participation procedures associated with the issuance of the permit.

(d) The notice provided pursuant to (b), above, shall include the following information:

(1) A description of the proposed activity;

(2) A description of each surface water that would be affected and its use classification;

(3) A summary of the antidegradation provisions in these rules;

(4) A determination that existing uses and the water quality necessary thereto will be maintained and protected;

(5) A summary of the expected impacts on high quality waters, if any;

(6) A determination that where a lowering of water quality is allowed, all applicable water quality criteria will be met, designated uses will be protected, and any higher water quality achievable by the most stringent applicable technology-based requirements will be maintained;

(7) A summary of any other information that is relevant to how the activity complies or does not comply with the requirements of these rules;

(8) The summary of the important economic or social development that will be achieved by allowing the proposed activity, if applicable;

(9) A summary of the alternatives analysis and a finding that the lowering of water quality is necessary to provide a net economic and social benefit;

(10) The deadlines for submitting a request for public hearing and submitting written comments; and

(11) The name, address, and telephone number of the department employee to whom all written comments or requests for public hearing can be sent.

(e) To fulfill intergovernmental coordination, the department shall send a copy of the public notice to the following agencies and request comments:

(1) NH department of ***natural and cultural*** resources~~ and economic development~~;

(2) NH department of health and human services;

(3) NH fish and game department;

(4) NH ~~office~~ ***department*** of energy~~ and planning~~;

(5) Local river ***management*** advisory committees, if applicable;

(6) US EPA Region I;

(7) US Army Corps of Engineers;

(8) US Fish and Wildlife Service;

(9) National Marine Fisheries Service;

(10) National Park Service; and

(11) Natural Resources Conservation Service.

(f) The department shall:

(1) Prepare a summary of all comments received as a result of public participation and intergovernmental coordination and provide responses; and

(2) Post the summary of comments and responses on its website.

(g) If the department receives a request to hold a public hearing, the department shall issue public notice and conduct a public hearing in accordance with the provisions of Env-C 200 that apply to non-adjudicative proceedings.

(h) Following this public participation process, the department shall consider all comments and other information submitted during the process and make a final decision to allow or deny the proposed impact on water quality.

(i) The department shall notify the applicant in writing of its decision. If the application is denied and the applicant wishes to pursue the project, the applicant shall:

(1) Revise the submittal to decrease or eliminate the projected impact to high quality waters and resubmit the application for consideration under the full review process; or

(2) Appeal the decision as a permitting decision pursuant to RSA 21-O:14.

Env-Wq 1708.12 Transfer of Water.

(a) In this section, "transfer" means the intentional conveyance of water from one surface water to another surface water for the purpose of increasing the volume of water available ~~for withdrawal from~~ ***in*** the receiving surface water. The term does not include the transfer of stormwater, for the purpose of managing stormwater during construction, between basins created or otherwise lawfully used for stormwater detention or treatment, or both, and does not include the discharge of stormwater from a detention or treatment basin to a surface water.

(b) A transfer shall be subject to (c) and (d), below, if one or more of the following apply:

(1) The transfer was not in active operation, as determined pursuant to (f) through (i), below, prior to the effective date of the 2011 readoption of this section, August 23, 2011;

(2) The transfer is causing or contributing to a violation of surface water quality standards in the source water or receiving water; or

(3) A change that could impact any designated use of the source water or receiving water is made to the transfer on or after August 23, 2011 such that a water quality certification is required under RSA 485-A:12, III or IV.

(c) The transfer of water from one surface water to another shall be allowed only if all of the following conditions are met:

(1) The transferred water does not contain exotic aquatic species or other species of aquatic life that could result in a violation of Env-Wq 1703.19, relative to the integrity of the biological and aquatic community, in the receiving water;

(2) Existing and designated uses will be maintained and supported in the source water and in the receiving water;

(3) The withdrawal from the source water and transfer to the receiving water either:

a. Will not result in any degradation of water quality; or

b. Have both been reviewed under the process specified in Env-Wq 1708.10 and determined by the department to meet the criteria specified for approval in Env-Wq 1708.10(b)(1)-(3); and

(4) A water conservation plan that meets the water conservation requirements set forth in Env-Wq 2101 has been approved by the department and is being complied with.

(d) Transferred water may be treated to comply with the requirements of this section.

(e) The transfer of water shall not constitute a discharge under RSA 485-A:8, I, or RSA 485-A:13, I(a) if:

(1) The transfer is not subject to (c) and (d), above, pursuant to (b), above; or

(2) All of the conditions specified in (c), above, are met.

(f) A transfer shall be deemed to have been in active operation prior to August 23, 2011 if all of the following are true:

(1) The infrastructure necessary for the transfer is in place and in usable condition;

(2) Water has been transferred for at least one day in each of at least 3 years from 2000 through 2011; and

(3) At the time of its original initiation, the transfer complied with applicable legal requirements.

(g) If a transfer does not meet the conditions specified in (f), above, the person responsible for the transfer may request the department to make a determination that the transfer was in active operation by submitting the following information in writing:

(1) The reason(s) why the infrastructure necessary for the transfer is not in place or is not in usable condition, if applicable;

(2) The total time span, in years, over which the transfer has occurred from the first known transfer to the present;

Unclear: overly broad and subjective.

(3) The most recent year during which the transfer occurred; and

(4) Why, based on the information provided in (1)-(3), above, it would be a fair and just result for the department to determine that the transfer qualifies as a transfer that was in active operation prior to August 23, 2011.

(h) If the department determines, based on information provided pursuant to (g), above, that it would be fair and just to determine that the transfer qualifies as a transfer that was in active operation prior to August 23, 2011, then the department shall make that determination.

(i) The department shall notify the person who requested a determination pursuant to (g), above, in writing of its decision.

PART Env-Wq 1709 CHANGE IN DESIGNATED USES

Env-Wq 1709.01 Definition. For purposes of this part, "change in designated use" means the removal of a designated use that is not an existing use, or the establishment of subcategories of a designated use.

Env-Wq 1709.02 Use Attainability Analysis Required. Before determining whether to propose a change in designated use, the department shall conduct a use attainability analysis in accordance with 40 CFR § 131.10.

Env-Wq 1709.03 Process to Propose Change in Designated Use.

(a) Based on the information obtained as a result of the use attainability analysis performed pursuant to Env-Wq 1709.02, the department shall determine whether a change in a designated use should be proposed as specified in (b), below.

(b) The department shall make the determination required by (a), above, when attaining a designated use is not feasible based on 40 CFR 131.10(g), as reprinted in Appendix F.

(c) If the department determines that a change in designated use should be proposed, the department shall conduct a non-adjudicative public hearing in accordance with the provisions of Env-C 200 applicable to non-adjudicative hearings to receive public comment on the determination.

(d) If the department continues to believe after the public comment period that a change in designated use should be proposed, the department shall propose that the change in designated use be made.

APPENDIX A: STATE OR FEDERAL STATUTES OR REGULATIONS IMPLEMENTED

Rule Section(s)	State Statute or Federal Statute or Regulation Implemented
Env-Wq 1701 (also see specific section listed below)	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq.*
Env-Wq 1701.03	RSA 485-A:13, I(a); 33 U.S.C. 1251 *et seq.*; 40 CFR § 122.47
Env-Wq 1701.04	RSA 485-A:13, I(a); 40 CFR § 131.14
Env-Wq 1702	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq.*
Env-Wq 1703	RSA 485-A:4, V; RSA 485-A:8, I, II, & III; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq* **Edit:** should add 40 CFR 131.10 here
Env-Wq 1704	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1705	RSA 485-A:4, V; RSA 485-A:6, VII; RSA 485-A:8, VI; RSA 485-A:13, I(a); 33 U.S.C. 1251 et seq **Edit:** should add 40 CFR 131.7 & 122 here
Env-Wq 1706	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq* **Edit:** should add 40 CFR 136 & 141 here
Env-Wq 1707	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1708	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*
Env-Wq 1709	RSA 485-A:4, V; RSA 485-A:8, VI; 33 U.S.C. 1251 *et seq*

Edit: should add 40 CFR 131.12 here

Edit: should add 40 CFR 131.10 here

APPENDIX B: INCORPORATED REFERENCES

Rule (Env-Wq)	Reference	Obtain At:
1703.05(c)	"EPA Combined Sewer Overflow (CSO) Control Policy", EPA 830-B-94-001, dated April, 1994	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at https://nepis.epa.gov/Exe/ZyNET.exe/2000407X.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000011%5C2000407X.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(d) intro	"Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003QI5.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\91thru94\Txt\00000011\20003QI5.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1703.22(d) (1)	"Streamlined Water-Effect Ratio procedure for Discharges of Copper", EPA-822-R-01-005, dated March 2001	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/901Q0I00.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Quer

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<tr><td>1703.22(d) (2)</td><td>“Aquatic Life Ambient Freshwater Quality Criteria - Copper”, EPA-822-R-07-001, dated February 2007</td><td>Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at:
http://nepis.epa.gov/Exe/ZyNET.exe/P1000PXC.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\06thru10\Txt\00000002\P1000PXC.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL</td></tr>
<tr><td>1703.22(s)
Edit: "(s)(1)"</td><td>“Final Aquatic Life Ambient Water Quality Criteria For Aluminum”, EPA-822-R-18-001, dated December 2018</td><td>Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at:
https://nepis.epa.gov/Exe/ZyNET.exe/P100VWXJ.txt?ZyActionD=ZyDocument&Client=EPA&Index=2016%20Thru%202020&Docs=&Query=Final%20Aquatic%20Life%20Ambient%20Water%20Quality%20Criteria%20Aluminum%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C16THRU20%5CTXT%5C00000010%5CP100VW</td></tr>
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1703.22(s)(1)a **Edit:** insert a period	The "Aluminum Criteria Calculator V2.0 (Excel)(xlsm)", dated December 2018	Available at no charge from EPA at https://www.epa.gov/wqc/2018-final-aquatic-life-criteria-aluminum-freshwater
1703.22(s)(1)b	The "Aluminum Criteria Calculator R Code and Data V2.0", dated November 15, 2019	Available at no charge from EPA at https://www.epa.gov/wqc/2018-final-aquatic-life-criteria-aluminum-freshwater
1704.02 intro	"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," EPA 822-B-00-004, dated October 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003D2R.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000001\20003D2R.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(a)	"Volume 1: Risk Assessment", EPA 822-B-00-005, dated October 2000 **Edit/Unclear:** This is not the full title of the document, needs to be the full title	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/20003D81.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000001\20003D81.txt&User=ANONYMOUS&Password=anonymous&Sort

Rule (Env-Wq)	Reference	Obtain At:
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1704.02(b)	"Volume 2: Development of National Bioaccumulation Factors", EPA-822-R-03-030, dated December 2003 **Edit/Unclear:** This is not the full title of the document, needs to be the full title	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1005EZQ.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\00thru05\Txt\00000022\P1005EZQ.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h|-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p|f&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
1704.02(c)	"Volume 3: Development of Site-Specific Bioaccumulation Factors", EPA-822-R-09-008, dated September 2009	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: http://nepis.epa.gov/Exe/ZyNET.exe/P1005CAF.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=Methodology%20Deriving%20Ambient%20Water%20Quality%20Criteria%20Protection%20Human%20Health%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\ZYFILES\INDEX%20DATA\06THRU10\TXT\00000011\P1005CAF.txt&User=ANONYMOUS&Password=anonymous&SortMethod=f%3Atitle&MaximumDocuments=15&FuzzyDegree=-1&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionE&Back=ZyActionS&Ba

Rule (Env-Wq)	Reference	Obtain At:
		ckDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(4)	"Nutrient Criteria Technical Guidance Manual Rivers and Streams", EPA-822-B-00-002 dated July 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003CVP.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=EPA822B00002%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000001%5C20003CVP.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(5)	"Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs", EPA-822-B00-001 dated April 2000	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003COV.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=Nutrient%20Criteria%20Technical%20Guidance%20Manual%20Lakes%20Reservoirs%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000001%5C20003COV.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(6)	"Nutrient Criteria Technical Guidance Manual Estuary and Coastal Marine Waters", EPA-822-B00-003 dated October 2001	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/20003FDF.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=EPA822B00002%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTXT%5C00000004%5C20003FDF.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(a)(7)	"Nutrient Criteria Technical Guidance Manual Wetlands", EPA-822-B-08-001 dated June 2008	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P1002DY6.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005&Docs=&Query=EPA822B08001%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000005%5CP1002DY6.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1704.03(a)(8)	"Using Stressor-response Relationships to Derive Numeric Nutrient Criteria", EPA-820-S-10-001 dated November 2010	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P100IK1N.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005&Docs=&Query=EPA822B08001%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000034%5CP100IK1N.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Rule (Env-Wq)	Reference	Obtain At:
1704.03(b)	"Guidance on the Development, Evaluation, and Application of Environmental Models", EPA-100-K-09-003 dated March 2009	Available at no charge from EPA National Service Center for Environmental Publications at https://www.epa.gov/nscep or directly at: https://nepis.epa.gov/Exe/ZyNET.exe/P1003E4R.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=Guidance%20Development%20Evaluation%20Application%20Environmental%20Models%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000007%5CP1003E4R.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
1707.04	"Technical Support Document for Water Quality-based Toxics Control", EPA/505/2-90-001, dated March 1991	Available at no charge from: https://www3.epa.gov/npdes/pubs/owm0264.pdf

APPENDIX C: STATUTORY DEFINITIONS

RSA 485-A:2:

VI. "Industrial waste" means any liquid, gaseous or solid waste substance resulting from any process of industry, manufacturing trade or business or from development of any natural resources.

VIII. "Other wastes" means garbage, municipal refuse, decayed wood, sawdust, shavings, bark, lime, ashes, offal, oil, tar, chemicals and other substances other than sewage or industrial wastes, and any other substance harmful to human, animal, fish or aquatic life.

X. "Sewage" means the water-carried waste products from buildings, public or private, together with such groundwater infiltration and surface water as may be present.

XIV. "Surface waters of the state" means perennial and seasonal streams, lakes, ponds, and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, water courses, and other bodies of water, natural or artificial.

XVI. "Waste" means industrial waste and other wastes.

XIX. "Wastewater facilities" means the structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes, and dispose of the effluent and sludge.

RSA 482-A:2:

X. "Wetlands" means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

APPENDIX D: FEDERAL DEFINITIONS

Legis. Intent: This language is only for Class A & B **designated beach areas** only, not for other than designated beach areas.

40 CFR 122.2:

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 *et seq.*)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. It does not mean:

(a) Sewage from vessels; or

(b) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well [that is] used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

NOTE: Radioactive materials covered by the Atomic Energy Act are those encompassed in its definition of source, byproduct, or special nuclear materials. Examples of materials not covered include radium and accelerator-produced isotopes. See *Train v. Colorado Public Interest Research Group, Inc.*, 426 U.S. 1 (1976).

APPENDIX E: SUMMARY OF BACTERIA STANDARDS FROM RSA 485-A:8

Type of Waters	**Standard**
Class A other than designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli (E. coli) per 100 milliliters, unless naturally occurring; or (2) 153 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Class B other than designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 126 E. coli per 100 milliliters, unless naturally occurring; or (2) 406 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Class A or Class B at designated beach areas	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 47 E. coli per 100 milliliters, unless naturally occurring; or (2) 88 E. coli per 100 milliliters in any one sample, unless naturally occurring.
Tidal waters used for swimming	Not more than: (1) A geometric mean based on at least 3 samples obtained over a 60-day period of 35 enterococci per 100 milliliters, unless naturally occurring; or (2) 104 enterococci per 100 milliliters in any one sample, unless naturally occurring.
Tidal waters used for growing or taking of shellfish for human consumption	Same as for tidal waters used for swimming, PLUS must not exceed a geometric mean most probable number (MPN) of 14 organisms per 100 ml for fecal coliform, nor shall more than 10 percent of the samples exceed an MPN of 28 per 100 ml for fecal coliform, or

Type of Waters	Standard
	other values of equivalent protection based on sampling and analytical methods used by the department of environmental services shellfish program and approved in the latest revision of the National Shellfish Sanitation Program, Guide For The Control of Molluscan Shellfish.

APPENDIX F: CRITERIA FOR DETERMINATION OF CHANGE IN DESIGNATED USE

40 CFR §131.10 Designation of uses.

(g) States may remove a designated use which is not an existing use, as defined in § 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

Exhibit 6

The State of New Hampshire

Department of Environmental Services

Robert R. Scott, Commissioner

FP 2024-219, Env-Wq 1700 Surface Water Quality Standards

Summary of Comments on Initial Proposal with DES Responses

January 29, 2025

Introduction

The department is proposing to readopt with amendment Env-Wq 1700 which establishes narrative and numeric water quality standards for the state's surface waters, specifically for the designated uses identified in RSA 485-A:8. More detailed information on the proposed amendments was included in the Rulemaking Notice (2024-219) published in the *N.H. Rulemaking Register* on October 24, 2024.

Most of the rules in Env-Wq 1700 were last readopted and effective on December 1, 2016, and not scheduled to expire until December 1, 2026. However, the Clean Water Act (CWA) requires states to review and update their water quality standards every three years and submit them to the U.S. Environmental Protection Agency (EPA) for approval. While the 2016 submittal to EPA was being reviewed, changes were made to the RSA 485 regarding regrading dissolved oxygen (DO) criteria and the low flow statistic used in permitting because of perceived impacts on one specific federal wastewater discharge permit. These changes were subsequentially walked back in 2020 allowing EPA to partially approved NHDES' 2016 submission on January 29, 2021, and December 13, 2022. EPAs review was delayed in part due to their active consultation with USFWS as required by the federal clean water act.

This proposed rule package corrects issues identified by EPA in their most recent review. NHDES has been actively engaged with stakeholders and EPA to since 2016 to ensure that these proposed rules reflect the best science and policy to protect New Hampshire's waters.

The Department received comments on the initial proposal (IP) at the hybrid on-line and in-person public hearing held on November 15, 2024, where 11 members of the public attended and 2 people presented oral comments. In addition, prior to the November 22, 2024 deadline the Department received written comments from several stakeholders, including OspreyOwl Environmental, L.L.C., NH LAKES, the City of Rochester, the EPA, Conservation Law Foundation (CLF) (co-signed by Connecticut River Conservancy, Manchester NAACP, Merrimack Citizens for Clean Water, Merrimack River Watershed Council, New Hampshire Healthy Climate, New Hampshire Rivers Council, New Hampshire Safe Water Alliance, Society for the Protection of New Hampshire Forests and Testing for Pease), plus substantially identical form letter comments from 49-members of CLF. These comments and the NHDES' responses thereto are summarized below. Written comments also were received from the Office of Legislative Services, Administrative Rules (OLS); those comments and the Department's responses thereto start on page 8.

At the beginning of each response, one of the following phrases is included to provide a quick status of the Department's position:

> "CHANGES MADE" indicates changes were made based on the comment; and
>
> "NO CHANGES" indicates no changes were made based on the comment.

The words "WILL DISCUSS" added to either of the above means the Department will review the issue with stakeholders , including the Water Quality Standards Information Exchange[1], to inform future rulemaking.

1.1. Responses

Env-Wq 1703.03(c) and Env-Wq 1703.04(a) – Water Quality Criteria Approval

Comment: *EPA commented, "NHDES has removed the following language in (c) and (d) "unless otherwise specifically allowed by a statute, rule, order, or permit." In past triennial reviews, EPA could not approve the language that is being struck because it did not demonstrate how water quality standards would be achieved given those allowances. As such, EPA is supportive of the removal of this language."*

Response: (NO CHANGES)

The refenced language was added during the 2016 updates. NHDES has removed the language based on EPA's feedback.

Env-Wq 1703.17 – Cyanotoxins criteria support and suggested change

Comment:

EPA stated that they are in general agreement with how EPA's "2019 Recreational Water Quality Criteria or Swimming Advisories for Cyanotoxins"[2] is being used in Env-Wq 1703.17, but questions why the annual duration component of the criteria are expressed as a 12-month rolling period rather than a calendar year 12-month period, and if the 12-month rolling period is maintained, how years would be treated in the not more than once in five years.

Response: (CHANGES MADE)

The 12-month rolling period has been changed to a calendar year 12-month period for a simpler evaluation and in recognition that winter months tend to be quieter in terms of cyanobacteria blooms, making for a natural breakpoint. In reviewing Env-Wq 1703.17, NHDES noted that the reference to the

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[1] Water Quality Standards Information Exchange - A temporary water quality standards advisory committee (WQSAC) was established in the fall of 2000, and renewed once in 2011, to assist the agency in drafting revised water quality regulations through formal membership and procedures. Since the end of the formal committee, NHDES has maintained a regular meeting schedule as the format has been helpful to keep the department abreast of issues related to water quality and the public informed of standards developments. The core of the WQSAC activities have been carried forward as the Water Quality Standards Information Exchange (WQSIE). While less formal, the WQSIE is a more inclusive format for public input and solicitation of ideas while providing a venue for the discussion of focused surface water quality standards issues. The WQSIE convenes at the discretion of NHDES with meetings open to the public with full participation in the discussion of issues of interest.

[2] 2019 Recreational Water Quality Criteria or Swimming Advisories for Cyanotoxins | US EPA

criteria as, "…chronic concentrations…" in Env-Wq 1703.17(b) was not appropriate for human health criteria and therefore the word "chronic" has been struck.

Env-Wq 1703.20 – Target Risk for Human Health Criteria framing

Comment:

"EPA does not support this framing as criteria are supposed to express the desired condition of a waterbody rather than the regulatory requirements of a discharge into that waterbody."

Response: (CHANGES MADE)

This would appear to be an artifact of the 1999 updates and change from Env-Ws 430 to Env-Wq 1700. Before 1999, the rule set contained more language related to discharge permitting. The rule is correct in the way it describes the target risk for the numeric human health criteria in Table 1703-1. References to dischargers have been removed.

Env-Wq 1703.21 and Env-Wq 1703.22 (*l*) – Added PFAS criteria

Comment:

Commenters (CLF and co-signers/members and NH LAKES) in general support of NHDES adding numeric criteria for PFAS into Env-Wq 1700.

Response: (NO CHANGES)

The science on PFAS continues to be a rapidly changing and growing. NHDES appreciates the support on this difficult topic.

Env-Wq Table 1703-01 – Add EPA's recent PFAS Section 304(a)(1) criteria guidance

Comment:

Commenters (CLF and co-signers/members and NH LAKES) requests that NHDES adopt EPA's September 2024 recommended aquatic life criteria for PFAS compounds as state surface water quality standards.

Response: (NO CHANGES – WILL DISCUSS)

On October 1, 2024, EPA developed and published freshwater criteria under Section 304(a)(1) of the Clean Water Act for PFOS and PFOA[3]. Those criteria include Acute Water Column (Criterion Maximum Concentration or CMC) (mg/L), Chronic Water Column (Criterion Continuous Concentration or CCC) (mg/L), Invertebrate Whole-Body (mg/kg ww), Fish Whole-Body (mg/kg ww) and Fish Muscle (mg/kg ww) criterion. States and tribes can establish water quality criteria based on the EPA's recommended criteria, modify these recommended criteria to reflect site-specific conditions, or develop criteria using other scientifically defensible methods. EPA is also cognizant that states and tribes need time to evaluate new Section 304(a)(1) criteria guidance to decide which path to take toward adopting new criteria. NHDES is not inherently against adoption such criteria but as the criteria guidance values were published while in the middle of the formal rulemaking process, there has been inadequate time to evaluate the criteria. NHDES will add the PFOS and PFOA Section 304(a)(1) criteria to the list of items to be discussed with the WQSIE and will follow up with rulemaking as warranted.

[3] National Recommended Water Quality Criteria - Aquatic Life Criteria Table | US EPA

Env-Wq 1703.21 – Add EPA's recent PFAS Section 304(a)(2) benchmark guidance

Comment:

Commenter (CLF and co-signers/members) request that NHDES adopt EPA's September 2024 aquatic life benchmarks for PFAS compounds as state surface water quality standards.

Response: (NO CHANGES – WILL DISCUSS)

On October 1, 2024, EPA developed and published[4] separate acute freshwater benchmarks for eight data-limited PFAS as well as saltwater benchmarks for acute exposures to PFOS and PFOA. Benchmarks published under Section 304(a)(2) of the Clean Water Act do not meet the minimum data requirements to develop robust criteria for toxics under EPA's Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses[5]. If there were sufficient high-quality data, EPA would have published those values as Section 304(a)(1) criteria in which case New Hampshire would be required to consider adoption as state surface water quality standards. NHDES will continue to track these PFAS compounds as more studies become available and as EPA develops new or revised Section 304(a)(1) criteria and at that time will consider additional rule updates.

Env-Wq 1703.21 and Env-Wq 1703.22 (*l*) – PFAS criteria and non-use of the EPA MCLs

Comment:

Commenters (CLF and co-signers/members and NH LAKES) state that under the Clean Water Act and state law, DES must develop surface water rules for PFAS that accurately reflect the latest scientific knowledge, using sound scientific rationale, without considering the cost of implementation. Commenters basically assert that DES came up with the proposed PFAS rules using an outdated 2019 analysis and has not accounted for more recent federal actions or scientific developments for PFAS.

EPA commented that that they have published MCLs that differ from those New Hampshire currently has adopted in our drinking water rules, and that they are in the process of proposing human health Section 304(a) criteria "for at least two PFAS".

Response: (NO CHANGES – WILL DISCUSS)

There are currently no final[6] EPA Section 304(a)(1) criteria guidance values for human health covering any PFAS compounds[7] for the department to evaluate for inclusion in surface water quality standards. While the practice of adopting the state approved drinking water maximum contaminant level (MCL) as the water and fish ingestion for human health criteria in surface waters upstream of a drinking water surface withdrawal has been a New Hampshire practice for a long time[8], and is a common approach in other states, that practice is not in and of itself a Clean Water Act requirement. The practice is a

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[4] Fact Sheet: Final Recommended Aquatic Life Criteria and Benchmarks for Select PFAS

[5] Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses | US EPA

[6] Draft values were published December 19, 2024 Technical Fact Sheet: Draft National Recommended Human Health Ambient Water Quality Criteria for PFOA, PFOS, and PFBS

[7] National Recommended Water Quality Criteria - Human Health Criteria Table | US EPA

[8] This practice dates back to at least 1990 when Env-Ws 430 (renumbered to Env-Wq 1700 after 1996 and before 1999) based on the requirement that surface waters not exceed drinking water levels for radioactive substances. The first conventional pollutant requiring use of the MCL as the water and fish ingestion for human health criteria appears in the 1999, Env-Wq 1700.

pragmatic one that is based on a policy determination that we should not be adding pollutants into our surface waters at such concentrations that would then require additional treatment by downstream drinking water suppliers. As such, in Env-Wq 1700, NHDES has made it a practice to adopt state MCLs where those values are more protective of a corresponding human health, water and fish ingestion criterion. As the 4-PFAS MCLs in the proposal became state law in July 2020 when New Hampshire House Bill 1264 was signed, and subsequently adopted into administrative rules Env-Dw 700, NHDES will continue the approach of adopting the state MCLs into Env-Wq 1700. At such time as EPA's PFAS MCLs are adopted as state MCLs, Env-Wq 1700 will follow suite in subsequent rulemaking. Similarly, if and when EPA finalizes Section 304(a)(1) criteria guidance for human health for PFAS, NHDES will evaluate those values for inclusion in subsequent Env-Wq 1700 rule making.

Table 1703-01 – Diazinon "not approved"

Comment:

"EPA notes that the water quality criteria for Diazinon have not been approved by EPA and are currently not in effect for Clean Water Act purposes."

Response: (NO CHANGES)

The diazinon criteria were published by EPA in 2005[9] and NHDES adopted those criteria during the 2016 updates to Env-Wq 1700. To date, EPA has taken no action on the 2016 addition of diazinon to Env-Wq 1700 as their biological consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service has not been completed as required under the Endangered Species Act Section 7 consultations. The lack of formal consultation at the federal level does not preclude the continued use by states of the criteria but NHDES understands that it will continue to impact EPA's ability to approve the change until their consultation is completed.

Table 1703-01 – Toluene "not approved"

Comment:

"EPA notes that the water quality criteria for Toluene have not been approved by EPA and are currently not in effect for Clean Water Act purposes."

Response: (NO CHANGES)

The criteria adopted into Env-Wq 1700 during the 2016 updates were directly from EPA's 1980 "Ambient Water Quality Criteria for Toluene"[10]. As a pollutant tested for and occasionally found at remediation sites, such a numeric target is needed to protect New Hampshire waters.

Table 1703-01, Env-Wq 1703.22 (c) – Arsenic and the Technical Support Document

Comment:

EPA sees no technical issues with the arsenic criteria change, but would like to see stronger justification taking into account the human health implications in the "Updating the Arsenic Human Health Criteria" document[11].

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[9] Aquatic Life Ambient Water Quality Criteria: Diazinon, Final

[10] Ambient Water Quality Criteria for Toluene, October 1980, EPA 440/5-80-075

[11] Updating the Arsenic Human Health Criteria - DRAFT

Additionally, EPA noted that, *"… the arsenic criteria for the protection of water and fish ingestion are being specified for both freshwater and marine waters. NHDES should clarify the appropriateness of a water consumption-related criteria for marine waters."*

Response: (NO CHANGES)

NHDES appreciates the confirmation that there are no technical issues with the arsenic criteria change and feels that the justification document adequately explains NHDES' rationale.

RSA 485-A:8 I and II define the New Hampshire drinking water designated used of surface waters as, "…being potentially acceptable for water supply uses after adequate treatment" and, "…after adequate treatment, for use as water supplies" respectively, without differentiating between freshwater and marine surface waters. As such, NHDES applies the designated use to all surface waters and therefore the human health, water and fish ingestion to both freshwater and marine surface waters. Since the bioconcentration factors differed between fresh and marine waters, separate criteria were calculated. Practically speaking, any method to convert marine surface waters to drinking water (e.g. reverse osmosis or distillation) will address any arsenic in the water rendering the implementation of the human health, water and fish ingestion superfluous.

Table 1703-01 and Env-Wq 1703.22(l) – Methyl tertiary-butyl ether (MtBE) MCL based criterion

Comment:

"EPA does not have any recommended human health criteria or MCLs for MtBE. EPA requests that in its eventual submittal of proposed changes to Env-Wq 1700, NHDES include a justification for how these criteria are based on sound scientific rationale and protective of the applicable designated use(s), pursuant to 40 CFR § 131.11. "

Response: (NO CHANGES)

The MtBE MCLs were adopted into Env-Dw 700 (then Env-Ws 300) in 2000 (rulemaking notice 2000-38). Where a MCL is less than the Table 1703-01 water and fish ingestion criterion for the protection of human health, that is adopted as the applicable criterion for surface water within 20-miles upstream of any active surface water intake for a public water system (Env-Wq 1703.22(l)). As Table 1703-01 had no entry for MtBE, the MCL is being adopted here and the supporting documentation will be provided to EPA upon submittal for CWA approval.

Tables 1703-1 and 1703-2A – Methyl Chloride MCL

Comment:

"EPA does not have any recommended human health criteria or MCLs for Methyl Chloride. EPA requests that in its eventual submittal of proposed changes to Env-Wq 1700, NHDES include a justification for how these criteria are based on sound scientific rationale and protective of the applicable designated use(s), pursuant to 40 CFR § 131.11."

Response: (CHANGES MADE)

NHDES appreciates the catch as there was a mix-up between methyl chloride (74-87-3) and methylene chloride (75-09-2) in Tables 1703-1 and 1703-2A. In Table Env-Wq 1703-1, note *l* has been added to the water and fish ingestion criterion for the protection of human health for methylene chloride (75-09-2), and no Table Env-Wq 1703-1 changes were needed for methyl chloride (74-87-3). Additionally, in Table 1703-2A, methyl chloride (74-87-3) has been corrected to methylene chloride (75-09-2). The 5 ug/L MCL for methylene chloride (75-09-2) is the recognized criterion in EPA's 2018 Edition of the Drinking Water Standards and Health Advisories Tables[12] and Env-Dw 700[13].

Env-Wq 1703.22(o) and Env-Wq 1703.34 – Selenium support and suggested change

Comment:

EPA is supportive of the change and recommends that NHDES add language to the effect that, "When selenium inputs are increasing, water column values are the applicable criterion element in the absence of steady-state condition fish tissue data."

Response: (NO CHANGES)

No change is needed. The proposed Env-Wq 1703.35 (b) states that, "Water column values are the applicable criterion in the absence of fish tissue in a steady-state condition and are not to be exceeded more than once in 3-years." By definition, fish can only be in "steady-state" if the water column is not receiving increased inputs. Therefore, when inputs are changing, the fish tissue cannot be in steady-state and the water column values are the more appropriate measure.

Env-Wq 1703.21 and Env-Wq 1703.22 (s) – Aluminum criteria implementation for NPDES

Comment:

"These comments only address the Aluminum Criteria Implementation in the NPDES Permitting Draft." (OspreyOwl Environmental, L.L.C.)

"EPA has comments on this guidance; however, since this guidance is separate from the triennial review and not referenced in the WQS, EPA will submit those comments separately." (EPA Region 1)

Response: (NO CHANGES)

The "DRAFT - Aluminum Criteria Implementation in NPDES Permitting"[14] is not a surface water quality standard nor is it referenced in the surface water quality standards, hence why EPA has stated that they are providing no comments on the document in this rule making. Rather, the implementation document describes how NHDES expects the aluminum target concentration to be used in the NPDES reasonable potential analysis under 40 CFR 122.44(d)[15]. Specifically, the aluminum target concentration for permitting reasonable potential analysis would be calculated from the many instantaneous criteria values at a given site based on a robust dataset of instantaneous pH, hardness and dissolved organic carbon samples. As such, the viability of in the implementation procedure will be determined at a site by site level when a given facility goes through NPDES permit reissuance and can be discussed at that time as part of that public comment process.

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[12] 2018 Edition of the Drinking Water Standards and Health Advisories Tables (EPA 822-F-18-001)

[13] CHAPTER Env-Dw 700 WATER QUALITY: STANDARDS, MONITORING, TREATMENT, COMPLIANCE, AND REPORTING

[14] DRAFT - Aluminum Criteria Implementation in NPDES Permitting

[15] 40 CFR 122.44 -- Establishing limitations, standards, and other permit conditions.

Env-Wq 1703.21 and Env-Wq 1703.22 (s) – Aluminum criteria implementation for NPDES

Comment:

Requesting clarification as to whether NHDES will be pursuing the aluminum implementation calculations previously presented to the WQSIE attendees (City of Rochester).[16]

Response: (NO CHANGES)

This commenter had not seen the "DRAFT - Aluminum Criteria Implementation in NPDES Permitting" and has been directed to that document. As noted in the preceding response, the draft implementation document is not a surface water quality standard nor referenced in the surface water quality standards.

Env-Wq 1703.22(s) – Aluminum criteria implementation for NPDES

Comment:

EPA states that, "NHDES should clarify which approach they are taking, e.g., by changing footnote (s) to "Unless subject to (1) and (2)…"

Response: (NO CHANGES)

The text already states that the acid soluble aluminum is, "Subject to (1) and (2), below…"

Env-Wq 1704.03(a) – Procedures for Site-Specific Nutrient Criteria

Comment:

*Commenter (City of Rochester) supports the incorporation of procedures for determining alternative site-specific criteria (Env-Wq 1704.03**)** and suggests adding "Env-Wq 1704.03(a): (9) Other modeling or empirical-based methods accepted by the Department.".*

Response: (NO CHANGES)

The department appreciates the support for the revisions but feels that the suggested addition would be redundant to the text already added. The commenter notes that referenced EPA guidance documents, "…are not highly prescriptive regarding how nutrient criteria are derived." and cover, "…broad categories of technical approaches (reference conditions, empirical approaches, modeling, etc.)…", that is, all of the elements in the suggested addition.

Env-Wq 1704.03 – Procedures for Site-Specific Nutrient Criteria

Comment:

"EPA notes that these are not criteria in and of themselves as they do not describe a quality of water that would support a particular designated use, rather they outline the procedures to develop those criteria. As such, EPA does not plan to act on these procedures. Any nutrient criteria developed through the procedures proposed in Env-Wq 1704.03 must go through the same approval process as any other water quality standard submission as required by 40 CFR § 131.21."

Response: (NO CHANGES)

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[16] See links at page 7, Cross-reference table - Env-Wq 1700 rule effective DEC-01-2016 to IP Changes as of Sep-10-2024, particularly Jun-13, 2023 (slides 9-38).

NHDES agrees that the procedures are not, in and of themselves, water quality criteria under the CWA and rulemaking would be needed for numeric criteria developed before they could be used.

Env-Wq 1705.02 – Dilution and Conditions for Permitting

Comment:

EPA has concerns with some of the revisions to Env-Wq 1705.01 but, "…has not made a final determination on what sections of 1705.02 constitute water quality standards requiring EPA action/approval. "

Response: (NO CHANGES)

The "Dilution and Conditions for Permitting" section covered in Env-Wq 1705.02 was discussed at great length including at 11-WQSIE meetings[17] as well as direct conversations with EPA legal staff. The revisions to this section are purely for setting permit limits and outlining tools that can be used to choose numeric targets and related flow conditions for the reasonable potential analysis. The discussions led to the major revisions seen in the initial proposal.

Env-Wq 1705.03 – Restoration permitting questions

Comment:

EPA asked a few questions, "Will the proposed change impact the state's approach to antidegradation reviews?, "After the temporary and infrequent impacts from ecological restoration projects end, will the assimilative capacity of the waterbody be restored to where it was?" and "What defines an ecological restoration project?"

Response: (NO CHANGES)

The proposed change is to make it clear that temporary and infrequent impacts from ecological restoration projects are not subject to a full antidegradation review as the restoration is intended for the attainment of a designated or existing use. After the temporary impacts, the assimilative capacity of the waterbody is expected to return except where the nature of the designated use is changed by the work. Two types of recent ecological restoration projects are alum treatments to sequester excess phosphorus from lakes, thereby decreasing algal and cyanobacteria blooms, and dam removals that restore fish migration routes and eliminate the low dissolved oxygen conditions in what were stagnate upstream impoundments.

1.2. *Office of legislative services*

General – Rate at which the rules are being updated

Comment:

"Legis. Intent/Note to JLCAR: *As stated in the notice, these rules were last readopted and effective December 1, 2016, but the Clean Water Act (CWA) requires that state to review and update their water quality standards every 3 years. There are many substantive changes in this proposal, with a number of them stemming from changes made to standards, statutes, and federal regulations in 2017 through*

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[17] See page 13, Cross-reference table - Env-Wq 1700 rule effective DEC-01-2016 to IP Changes as of Sep-10-2024

2021. The Committee may have questions on why these rules have not been updated for almost 8 years and if there were any internal reviews done that identified the need for these substantive changes earlier."

Response: (NO CHANGES)

This is a reasonable question, and we have tried to provide some background information in the introduction to this document. Further context can be found in the discussion of changes to bacteria and dissolved oxygen criteria, below.

In brief, the surface water quality standards are usable for State purposes once approved by JLCAR but only usable for federal Clean Water Act purposes once approved by EPA. After NHDES submitted a package to EPA in 2016, a significant amount of deliberation occurred (which is discussed throughout this document) leading to EPA's first action on January 29, 2021, which was in and of itself a partial approval, and second action on December 13, 2022 which was also a partial approval. NHDES did not expect any further action on the 2016 package after the partial approvals in 2021 and 2022 which left a few bits of the rules which were not approved for CWA purposes but which essential paved the way to prepare this update to Env-Wq 1700 and catch-up with additional developments. NHDES has been working diligently since adoption of the 2016 package to advance the science and policy supporting these rules. In addition to discussions with legislators, municiplaities and EPA, the water quality standards information exchange (WQSIE[18]) was convened 16-times since the 2016 package submittal to EPA. The WQSIE is a public forum helpful to keep the department abreast of issues related to water quality and the public informed of standards developments. During that time, all parts of the chapter law were being enacted (as discussed below), even as Env-Wq 1700 update efforts were undeway.

Env-Wq 1701.04 – Citing the RSA procedure for adopting rules

Comment:

"This is the procedure for adopting rules. Is this the right citation? Doesn't seem to make sense here."

Response: (CHANGES MADE)

Under the CWA, any new or revised water quality standard variance must be adopted as part of the state's water quality standards according to state law before EPA can approve them for any CWA purpose. Inclusion of the reference to RSA 541-A:3 in the revised Env-Wq 1702.04 was intended to make that clear. Based on OLS' comment the rule has been changes to reference the commissioner's rulemaking authority under RSA 485-A:6, I, & XI-c, XIV & XV and RSA 485-A:8, VI.

Env-Wq 1703.06 – Application of changes to the bacteria criteria in Chapter 208, Laws of 2021

Comment:

*"**Legis. Intent/Note to JLCAR:** As stated in the notice, this proposal Env-Wq 1703.06 [Bacteria] was revised to align with revisions to RSA 485-A:2, V, pursuant to Chapter 208, Laws of 2021 (effective October 9, 2021). The Committee may have questions on why it took over 3 years to make these changes, when there was nothing in the chapter law that allowed for delayed implementation of the statute."*

Response: (NO CHANGES)

[18] Surface Water Quality Standards | NH Department of Environmental Services

This is a well-placed question. The referenced change to the RSA was related to the issuance of to national pollution discharge elimination system (NPDES) permits under the CWA which in New Hampshire are issued by the US EPA. As the new RSA supersedes the administrative rules, the referenced change to the RSA was implemented from its effective date in NPDES permitting via NHDES's CWA Section 401 certification of those EPA issued NPDES permits.

Env-Wq 1703.06 – The Appendix E summary includes requirements that are not in the statute.

Comment:

*"**See the Legis. Intent comment on Appendix E**. The summary includes requirements that are not in the statute."*

In appendix E,

*"**Legis. Intent:** This language is only for Class A & B **designated beach areas** only, not for other than designated beach areas."*

Response: (NO CHANGES)

Env-Wq 1703.06 sets forth the narrative criteria for bacteria and numeric criteria for all surface waters, including more stringent numeric criteria for designated beaches, by referring to RSA 485-A:8, I and II. NHDES has always interpreted the first sentences of both RSA 485-A:8 I and II to consist of three separate clauses, separated by semi-colons, in which the last clause ("unless naturally occurring") applies to both of the preceding clauses. This is a practical necessity, since naturally occurring bacteria is present in waters whether or not they are within a designated beach area. Collectively, the NHDES understands the "unless naturally occurring clause" to cover all surface waters.

> "I. Class A waters shall be of the highest quality and shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or greater than 153 Escherichia coli per 100 milliliters in any one sample; and for designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or 88 Escherichia coli per 100 milliliters in any one sample; unless naturally occurring.
>
> "II. Class B waters shall be of the second highest quality and shall have no objectionable physical characteristics and shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 126 Escherichia coli per 100 milliliters, or greater than 406 Escherichia coli per 100 milliliters in any one sample; and for designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or 88 Escherichia coli per 100 milliliters in any one sample; unless naturally occurring."

Env-Wq 1703.07(a) – Dissolved oxygen criteria for class A waters.

Comment:

"The statute RSA 485-A:8, I does not seem to [have] requirements for dissolved oxygen content for class A waters. Is this a federal requirement?"

Response: (NO CHANGES)

RSA 485-A:8 states,

"I. Class A waters shall be of the highest quality …"

"II. Class B waters shall be of the second highest quality…". "The commissioner shall adopt rules, under RSA 541-A, relative to dissolved oxygen water quality standards in a manner consistent with Environmental Protection Agency guidance on dissolved oxygen water criteria published pursuant to section 304(a) of the Clean Water Act, and other relevant scientific information."

It would stand to reason that the class A waters must be afforded equal or higher protections of class B waters per RSA 485-A:8. As such, at a minimum, all class A waters have criteria at least as high as class B. In the case of dissolved oxygen criteria, class A & B water are treated the same except that class A waters shall have a minimum of 6 mg/L whereas class B requires only 5 mg/L. The 6 mg/L and 5 mg/L come from EPA's 1986 Section 304(a)(1) guidance[19]. In particular, the values from Table 2 in that guidance document were used to identify criteria that would lead to "no" to "slight production impairment" in class A waters and "slight" to "moderate production impairment" in class B water depending upon life-stage and upon whether the waters were for salmonids or non-salmonids fish species.

Env-Wq 1703.07(b)(1) – Dissolved oxygen saturation criterion for class B waters.

Comment:

"***Legis. Intent/Note to JLCAR:*** *As stated in the notice, this proposal Env-Wq 1703.07(b)(1) was revised to align with revisions to RSA 485-A:8, II pursuant to Chapter 211, Laws of 2017 (effective September 8, 2017). The Committee may have questions on why it took over 7 years to make these changes, when there was nothing in the chapter law that allowed for delayed implementation of the statute.*"

Response: (NO CHANGES)

The surface water quality standards are usable for State purposes once approved by JLCAR but only usable for CWA purposes once approved by EPA. The referenced RSA changes pursuant to Chapter 211, Laws of 2017 (effective September 8, 2017) occurred while EPA was reviewing the 2016 updates to Env-Wq 1700. That change in the statute effectively removed the dissolved oxygen precent saturation as an option for the surface water quality standards. This was done because of the expressed concerns of one specifc discharger. At that time, NHDES acted promptly to implement the legislation (which, at the time, meant removing all dissolved oxygen percent saturation assessments from the draft 2018[20] list of impaired waters (under CWA section 303(d)) and in January 2018 sent a request to EPA to approve adopted amendments to the state's surface water quality standards to reflect the change enacted by this new statute. At the same time, NHDES was in close communication with stakeholders and legislators regarding this issue. What is clear from all of these communications is that it was subsequenttaly determined that the issue of changing the dissolved oxygen saturation standard was much more complicated than originally thought and had the chance of increasing the burden on the regulated community. As a result in, in 2020, HB 496 (Chapter 10, Laws of 2020) restored NHDES' flexibility to modify surface water quality standards while, at the same time, addressing the issues raised by EPA with the request prompted by Chapter 211, Laws of 2017. NHDES then sent a request to EPA to approve ammendments to the submitted 2018 303(d) list which restored the impairments listed in 2016 where

[19] Quality Criteria for Water 1986, EPA 440/5-86-001, pages 214-224

[20] See NHDES RESPONSE to 9- 3 in Response to Public Comment on the Draft 2018 Section 303(d) List of Impaired Waters and the Draft Consolidated Assessment and Listing Methodology

supported by water quality data and approve the 2020 amendments to RSA 485-A:6[21]. During the above steps, the WQSIE group was called together 10-times, and 4-times since[22], to seek input and keep all abreast of the process[23]. The net result is that NHDES had to walk-back the implementation of the 2017 changes based on the 2020 changes.

Env-Wq 1703.08 – Benthic deposits

Comment:

"There does not seem to be any requirements in RSA [485-A], or authority to set requirements through rules, for benthic deposits in RSA 485-A. Is this a federal requirement? If so, what is the specific citation for that federal requirement?"

Response: (NO CHANGES)

EPA's regulations at §§ 131.5(a)(2), 131.6(c), and 131.11(a) explicitly require states and authorized tribes to adopt water quality criteria that protect designated uses. Under 40 CFR 131.11(b) those criteria may be numeric or narrative. In the federal water quality criteria documents from 1968 through 1986[24], it was recognized that "substances may coat the bottom, destroy benthic organisms, and interfere with spawning areas", "…oxygen demand of benthic accumulations, and reduction in downward transfer of oxygen hastens the development of anaerobic conditions…" and it was recommended that, "All waters [be] free from substances attributable to wastewater or other discharges that: (1) settle to form objectionable deposits:…". In the 1970 New Hampshire water quality standards the focus was on "sludge deposits" [25] and in 1990 refined to "benthic deposits"[26] to come into agreement with EPA's 1986 water quality criteria. In referring to both the Quality Criteria for Water, 1976 ("Red Book") and Quality Criteria for Water, 1986 ("Gold Book"), EPA states, "The criteria in these documents are still current where a more recent criteria has not been published."[27] EPA has not published any additional criteria for benthic deposits since 1986. Accordingly, the Env-Wq 1703.08 narrative criteria for benthic deposits have been retained as they are protective of state waters and are necessary to make the water quality standards approvable by EPA pursuant to their regulations at §§ 131.5(a)(2), 131.6(c), and 131.11(a).

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[21] December 13, 2019 Re: Request for approval of amendments to New Hampshire Surface Water Quality Standards

[22] Surface Water Quality Standards | NH Department of Environmental Services

[23] See pages 4-5 in Cross-reference table - Env-Wq 1700 rule effective DEC-01-2016 to IP Changes as of Sep-10-2024

[24] 1968 Water Quality Criteria, Federal Water Pollution Control Administration, 800R68900 (a.k.a. "Green Book")

1972 Water Quality Criteria, National Academy of Sciences at the request of the EPA (a.k.a. "Blue Book")

1976 Quality Criteria for Water, EPA PB-263 943 / EPA 440-9-76-023 (a.k.a. "Red book")

1986 Quality Criteria for Water, EPA 440/5-86-001 (a.k.a. "Gold book")

[25] At that time, RSA 149

[26] At that time, Env-Ws 430 and RSA 149.

[27] Historical Water Quality Criteria Documents | US EPA, accessed January 10, 2025

Env-Wq 1703.10 – Color

Comment:

"There does not seem to be any requirements in RSA [485-A], or authority to set requirements through rules, for water color in RSA 485-A. Is this a federal requirement? If so, what is the specific citation for that federal requirement?"

Response: (NO CHANGES)

EPA's regulations at §§ 131.5(a)(2), 131.6(c), and 131.11(a) explicitly require states and authorized tribes to adopt water quality criteria that protect designated uses and under 40 CFR 131.11(b) and provides that those criteria may be numeric or narrative. The color of water controls the degree to which plants and phytoplankton can photosynthesize to survive and also controls where aquatic predators and prey are successful in finding a meal or avoiding becoming a meal. In the federal water quality criteria documents from 1968 through 1986[24], it was recommended that healthy waters be free of substances producing objectionable color, odor, taste, or turbidity. There have been criteria for color in the New Hampshire water quality standards since 1970 and the criteria used have been functionally the same since 1976[28]. In referring to both the Quality Criteria for Water, 1976 ("Red Book") and Quality Criteria for Water, 1986 ("Gold Book"), EPA states, "The criteria in these documents are still current where a more recent criteria has not been published."[27] EPA has not published any additional criteria for color since 1986. The Env-Wq 1703.08 narrative criteria for color have been retained as they are protective of state waters and are necessary to make the water quality standards approvable by EPA pursuant to their regulations at §§ 131.5(a)(2), 131.6(c), and 131.11(a).

Env-Wq 1703.22(d) – Reference to 40 CFR 131.36(c)

Comment:

*"**Unclear:** even though the footnote in the CFR also states this is where the definition is, it does not appear as though this definition is actually in this CFR."*

Response: (CHANGES MADE)

The reference to 40 CFR 131.36(c) was added in 1996 based on the 40 CFR 131(b)(1) table footnotes e. and m.[29]. However, as OLS points out, 131.36 (c) is not about the water effect ratio (WER) but rather, about applicability of the criteria in paragraph (b). In recognition of this, Env-Wq 1703.22(d) has now been proposed to be revised by eliminating the CFR refence and instead relying on the EPA publication

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[28] At that time, RSA 149

[29] e. Freshwater aquatic life criteria for these metals are expressed as a function of total hardness (mg/L as CaCO3), the pollutant's water effect ratio (WER) as defined in § 131.36(c) and multiplied by an appropriate dissolved conversion factor as defined in § 131.36(b)(2). For comparative purposes, the values displayed in this matrix are shown as dissolved metal and correspond to a total hardness of 100 mg/L and a water effect ratio of 1.0.
m. Criteria for these metals are expressed as a function of the water effect ratio, WER, as defined in 40 CFR 131.36(c).
CMC = column B1 or C1 value × WER
CCC = column B2 or C2 value × WER

"Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994[30] to explain the details of the WER.

Env-Wq 1705.02(d)(1) – Reference to 40 CFR 122.43(d) for reasonable potential analysis

Comment:

*"**Edit/Unclear:** Check the citation. Cannot find a paragraph (d) for this section."*

Response: (CHANGES MADE)

The reference has been corrected to 40 CFR 122.44(d)[31].

Env-Wq 1705.03(b) – Regarding "best management practices"

***Comment:** "**Unclear:** does this mean "best management practices" defined in Env-Wq 1702.06? If so, delete "approved by the department", as that is not a part of the definition. If the intent is to use different "best management practices" than what is defined, need to establish what those practicees a [sic] are in the rule."*

Response: (CHANGES MADE)

NHDES agrees that this sentence was confusing and has modified Env-Wq 1705.03(b) by removing the reference to approval for best management practices.

Env-Wq 1706 – Application of the bacteria changes in Chapter 208, Laws of 2021

***Comment:** "**Legis. Intent/Note to JLCAR:** As stated in the notice, this proposal Env-Wq 1706 was revised to align with revisions to RSA 485-A:2, V pursuant to Chapter 208, Laws of 2021 (effective October 9, 2021). The Committee may have questions on why it took over 3 years to make these changes, when there was nothing in the chapter law that allowed for delayed implementation of the statute."*

Response: (NO CHANGES)

The referenced RSA change was relevant to national pollution discharge elimination system (NPDES) permits issued by the US EPA under the CWA. As the RSA supersedes the administrative rules, the RSA change was implemented from its effective date in EPA's NPDES issued permits via the NHDES's CWA Section 401 certification of those EPA issued NPDES permits.

Env-Wq 1708.12 (g)(4) and Env-Wq 1708.12 (h) – Regarding, "…fair and just…"

Comment:

*"Unclear: overly broad and subjective**.***

Response: (CHANGES MADE)

Env-Wq 1708.12(g) provides an opportunity for an entity to make the case that even though their transfer is not considered to be in active operation prior to August 23, 2011 per Env-Wq 1708.12(f), the department should treat their water transfer as active before that date. The department agrees the words "fair and just" do not add value to Env-Wq 1708.12 (g)(4) and Env-Wq 1708.12 (h) and have

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[30] Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994

[31] eCFR :: 40 CFR 122.44 -- Establishing limitations, standards, and other permit conditions.

therefore been removed. NHDES is only aware of one instance since August 23, 2011, where there was some potential for an entity to request such a consideration and they chose not to go down that path.

Appendix A – Regarding several added CFR refences

Comment:

The review asks for added CFR refences.

Response: (CHANGES MADE)

The missing CFR references have been added.

Appendix B – Regarding refences for 1703.22(s), notes for aluminum criteria

Comment:

“**Edit:** "(s)(1)””

Response: (CHANGES MADE)

The reference has been corrected to Env-Wq 1703.22(s)(1).

Appendix B – Regarding incomplete refence title for 1704.02(a), risk assessment procedures for use in site-specific criteria

Comment:

“**Edit/Unclear:** This is not the full title of the document, needs to be the full title”

Response: (CHANGES MADE)

Added full title, “Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000), Technical Support Document, Volume 1: Risk Assessment”

Appendix B – Regarding incomplete refence title for for 1704.02(b), development of national bioaccumulation factors procedures for use in site-specific criteria

Comment:

“**Edit/Unclear:** This is not the full title of the document, needs to be the full title”

Response: (CHANGES MADE)

Added full title, “Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000), Technical Support Document, “Volume 2: Development of National Bioaccumulation Factors”

Appendix B – Regarding incomplete refence title for for 1704.02(c), development of site-specific bioaccumulation factors for use in site-specific criteria

Comment:

“**Edit/Unclear:** This is not the full title of the document, needs to be the full title”

Response: (CHANGES MADE)

Added full title, "Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000), Technical Support Document, Volume 3: Development of Site-Specific Bioaccumulation Factors"

Appendix E– The Appendix E summary includes requirements that are not in the statute.
Comment:

"Legis. Intent: This language is only for Class A & B designated beach areas only, not for other than designated beach areas."

Response: (NO CHANGES)

Repeated from earlier comment on Env-Wq 1703.06.

Env-Wq 1703.06 sets forth the narrative criteria for bacteria and numeric criteria for all surface waters, including more stringent numeric criteria for designated beaches, by referring to RSA 485-A:8, I and II. NHDES has always interpreted the first sentences of both RSA 485-A:8 I and II to consist of three separate clauses, separated by semi-colons, in which the last clause ("unless naturally occurring") applies to both of the preceding clauses. This is a practical necessity, since naturally occurring bacteria is present in waters whether or not they are within a designated beach area. Collectively, the NHDES understands the "unless naturally occurring clause" to cover all surface waters.

> "I. Class A waters shall be of the highest quality and shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or greater than 153 Escherichia coli per 100 milliliters in any one sample; and for designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or 88 Escherichia coli per 100 milliliters in any one sample; unless naturally occurring.
>
> "II. Class B waters shall be of the second highest quality and shall have no objectionable physical characteristics and shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 126 Escherichia coli per 100 milliliters, or greater than 406 Escherichia coli per 100 milliliters in any one sample; and for designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or 88 Escherichia coli per 100 milliliters in any one sample; unless naturally occurring."

Exhibit 7

Aluminum Criteria Implementation in NPDES Permitting

April 15, 2025

NEW HAMPSHIRE
DEPARTMENT OF
Environmental
Services

STATE OF NEW HAMPSHIRE

Aluminum Criteria Implementation in NPDES Permitting

STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
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Acronyms

7Q10	7-Day average flow that occurs on average once in 10-years.
CCC	Criterion Continuous Concentration, a.k.a. aquatic life use- chronic criteria.
CCC-5	The lower 5^{th} percentile of all the instantaneous CCC values calculated for the site.
CCC-10	The lower 10^{th} percentile of all the instantaneous CCC values calculated for the site.
CCC-50	The lower 50^{th} percentile of all the instantaneous CCC values calculated for the site.
CCC-L95-PI	The lower 95^{th} percentile prediction interval of the CCC from a power regression at 7Q10 flow.
cfsm	Flow in cubic feet per second per square mile of watershed area.
CMC	Criterion Maximum Concentration, a.k.a. aquatic life use- acute criteria
CMC-5	The lower 5^{th} percentile of all the instantaneous CMC values calculated for the site.
CMC-10	The lower 10^{th} percentile of all the instantaneous CMC values calculated for the site.
CMC-50	The lower 50^{th} percentile of all the instantaneous CMC values calculated for the site.
CMC-L95-PI	The lower 95^{th} percentile prediction interval of the CMC from a power regression at 7Q10 flow.
DOC	Dissolved Organic Carbon.
ICV	Instantaneous Criterion Value.
MLR	Multiple Linear Regression.
PI	Prediction Interval.
RP	Reasonable Potential.
RPC-CCC	Reasonable Potential criterion representing the CCC.
RPC-CMC	Reasonable Potential criterion representing the CMC.
NPDES	National Pollutant Discharge Elimination System.
WWTF	Wastewater Treatment Facilities.

1. Executive Summary

In 2018 the EPA published Clean Water Act section 304(a) recommended aluminum freshwater aquatic life criteria (USEPA, 2018), and the New Hampshire Department of Environmental Services (NHDES) adopting the 2018 304(a) recommended criteria effective February 25, 2025. The new criteria are based on total aluminum lab studies and calculate instantaneous criteria values (ICV) based on the instantaneous; dissolved organic carbon (DOC), pH and hardness. The validity of the methods described here was first established by the evaluation of a focused 12-month study (2020-2021) of concurrently sampled DOC, pH and hardness across the NHDES river trend monitoring network sites and further corroborated by the evaluation of all of the riverine DOC, pH and hardness data in the environmental monitoring database. The procedure described here will be used by EPA – Region 1 and NHDES to determine the chronic and acute reasonable potential criterion (RPC) to be used in the reasonable potential (RP) analysis for National Pollutant Discharge Elimination System (NPDES) permits. NPDES permits for toxics are calculated based on the permitted facility design flow and the river 7Q10 flow in New Hampshire waters per the Env-Wq 1700 rules. The aluminum criteria used in the NPDES permitting RP analysis must be low enough to be protective of designated uses of the receiving water. This document provides the guidance on the calculation of an aluminum criteria to be used in the RP analysis from the ICVs. To meet that need, this document considers the relationship between river flow and the ICVs in the development of reasonable potential criterion used for RP analysis. In instances where there is a significant relationship ($p < 0.05$) and the lower 95th prediction interval at 7Q10 is greater than the 50th percentile of the ICVs then the 50th percentile will be used. In cases where there is not a significant relationship between flow and the ICVs ($p > 0.05$) or the lower 95th prediction interval at 7Q10 is less than the 50th percentile of the ICVs then the 5th or 10th percentile of the ICVs will be used for RP analysis depending on whether or not endangered species are present.

2. Data Requirements

2.1. Background Ambient Water Quality Data

If the permittee would like the permitting agency to consider the relationship between river flow and the ICVs, the permittee will collect representative concurrent upstream ambient DOC, pH, hardness and total aluminum using 40 CFR 136 approved methods on a quarterly basis, or bioavailable aluminum should a 40 CFR 136 method be approved, yielding 20-samples during the permit term. This monitoring intensity mirrors that written into many recent NPDES permits for wastewater treatment facilities (WWTFs). As the ultimate decision on the aluminum criteria to apply to reasonable potential will, in part, be determined by the statistical power of the analysis described in the document from the ICVs, the applicant is encouraged to collect the complete dataset and may perform additional sampling. To that end, if a facility has an upcoming permit renewal and would like to make use for the aluminum multiple linear regression (MLR) criteria, they may accelerate the sampling effort.

If the permittee plans to conduct additional sampling, either to go beyond the quarterly sampling or because their permit sampling requirement will generate an inadequately representative dataset (in terms of seasonality, flows, number of samples, etc.), then a sampling plan should be submitted to NHDES and EPA for review. Any such monitoring plan should intend to collect a minimum of 20-samples and should be shared with the department to ensure that the collected data will be acceptable for the aluminum criteria analysis. Possible sampling scenarios that would provide a dataset covering sufficient seasons and flows ranges might include the following.

- Monthly sampling for 2-years (n=24).
- Bi-monthly sampling for one year (n=24).

If relying upon less than the complete dataset, the data shall be evaluated by NHDES to ensure the complete flow regime and seasonality is represented. Further, the permittee should be aware that accelerated sampling increases the risk that factors such as seasonality or flow are not adequately represented in their dataset. All data, related to water quality and quantity, as well as all calculations performed should be submitted to the NHDES and EPA in an electronic format.

2.2. River Flow

WWTFs that may look to make use of this document are well represented by active USGS flow gages. The analysis here relies upon paired water quality and river flow measurements, and a calculated 7Q10. There are two common scenarios for how the permit 7Q10 is calculated for a particular facility. Either from, 1) a nearby USGS gage (or gages) whose watershed areas are transposed to the facility, or 2) from some combination of USGS gages and the "Dingman equation" (Dingman & Lawlor, 1995) as the Wastewater Engineering Bureau (WEB) has described in their 7Q10 policy (NHDES, 2002).

2.2.1. Flow Scenario 1) Direct from Nearby Gage(s)

For facilities where the 7Q10 is calculated via a nearby USGS gage (or gages), the flow values to pair to the ICVs shall be calculated the same way and the 7Q10 used in this analysis shall be that used for the permit limits. As NHDES currently provides the 7Q10 for the RP analysis, NHDES will provide the flow dataset in these cases.

2.2.2. Flow Scenario 2) Use of the Dingman Equation

The 7Q10 used in the RP analysis will continue to be calculated by the Wastewater Engineering Bureau (WEB) as described by their 7Q10 policy (NHDES, 2002), including the use of the Dingman equation (Dingman & Lawlor, 1995) as needed. However, since the aluminum implementation criteria uses the full range of flow conditions and the Dingman equation is only usable for 7Q10 estimation, the 7Q10 that includes the Dingman equation cannot be used in the statistical analysis described in section 3. Due to the limitations of the Dingman equation, the flows to pair with the ICVs and the 7Q10 used the analysis described here will be per the WEB 7Q10 policy pro-rating from existing river gage datasets without the inclusion of the Dingman equation flows.

2.2.3. Flow Scenario "X"

The department recognizes that there are many ways to generate a valid synthetic hydrograph for a river. As such, other approaches may be considered by the department with adequate documentation. However, any such approaches must be shared with and approved by the department and EPA ahead of the analysis to ensure that the generated data will be acceptable for the aluminum criteria analysis.

3. Calculation of the Aluminum ICVs

3.1. Criterion Continuous Concentration

Calculate aluminum ICVs for the CCC (Criterion Continuous Concentration, a.k.a. aquatic life use chronic criteria) using either the Excel or R code provided by EPA for the 2018 304(a) guidance.

3.2. *Criterion Maximum Concentration*

Calculate aluminum ICVs for the CMC (Criterion Maximum Concentration, a.k.a. aquatic life use- acute criteria) using either the Excel or R code provided by EPA for the 2018 304(a) guidance.

4. Data Evaluation

The following steps are necessary to generate the needed statistics as part of this NPDES implementation guidance. NHDES has built a template for the following steps.

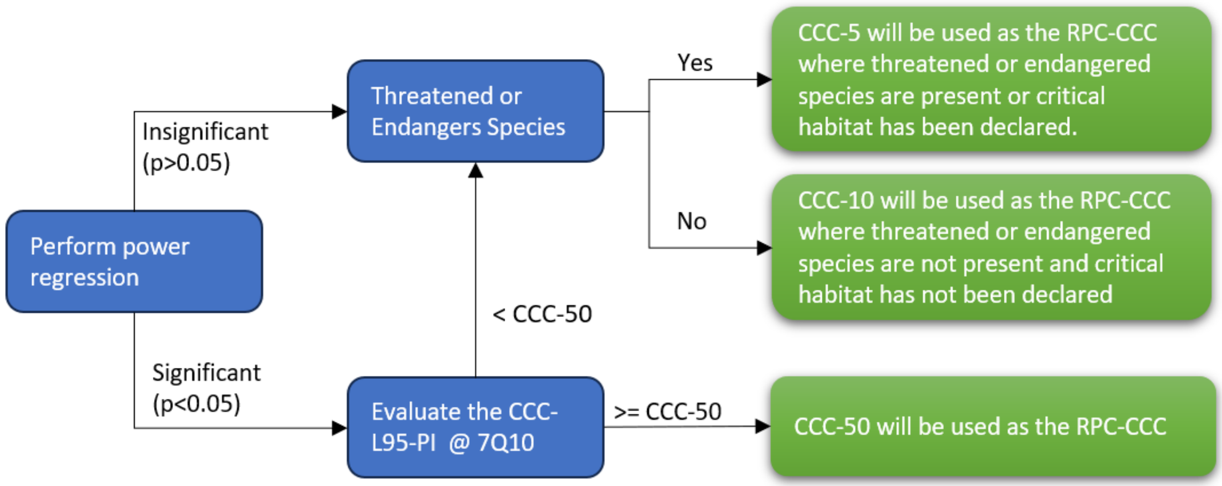
1) Perform a power regression of flow in cubic feet per second per square mile of watershed area (cfsm) verses aluminum CCC and determine the 95th percentile upper and lower prediction intervals for the regression.
2) Calculate the 7Q10 from the representative gage(s) or the more site representative synthetic hydrograph depending upon the method used to generate the flow data for the power regression.
3) Calculate the 5th, 10th and 50th percentile CCC from the ICVs calculated for the site (CCC-5, CCC-10, CCC-50). Percentiles shall be calculated based on a linear interpolation percentile.
4) Calculate the CCC of the 95th percentile lower prediction interval at the 7Q10. (CCC-L95-PI).

5. CCC for Reasonable Potential Analysis

The aluminum RPC-CCC used in the reasonable potential analysis at the 7Q10 flow must be protective of surface water quality criteria and designated uses. The procedure for data analysis to determine the RPC-CCC to be used in the RP analysis are described below and illustrated in Figure 1.

1) If the power regression is insignificant (p>0.05):
   a) CCC-5 will be used as the RPC-CCC where threatened or endangered species are present or critical habitat has been declared.
   b) CCC-10 will be used as the RPC-CCC where threatened or endangered species are not present and critical habitat has not been declared.
2) If the power regression is significant (p<=0.05):
   a) If CCC-L95-PI >= CCC-50 then the CCC-50 will be used as the RPC-CCC.
   b) If CCC-L95-PI < CCC-50 then,
      i) CCC-5 will be used as the RPC-CCC where threatened or endangered species are present or critical habitat has been declared.
      ii) CCC-10 will be used as the RPC-CCC where threatened or endangered species are not present and critical habitat has not been declared.

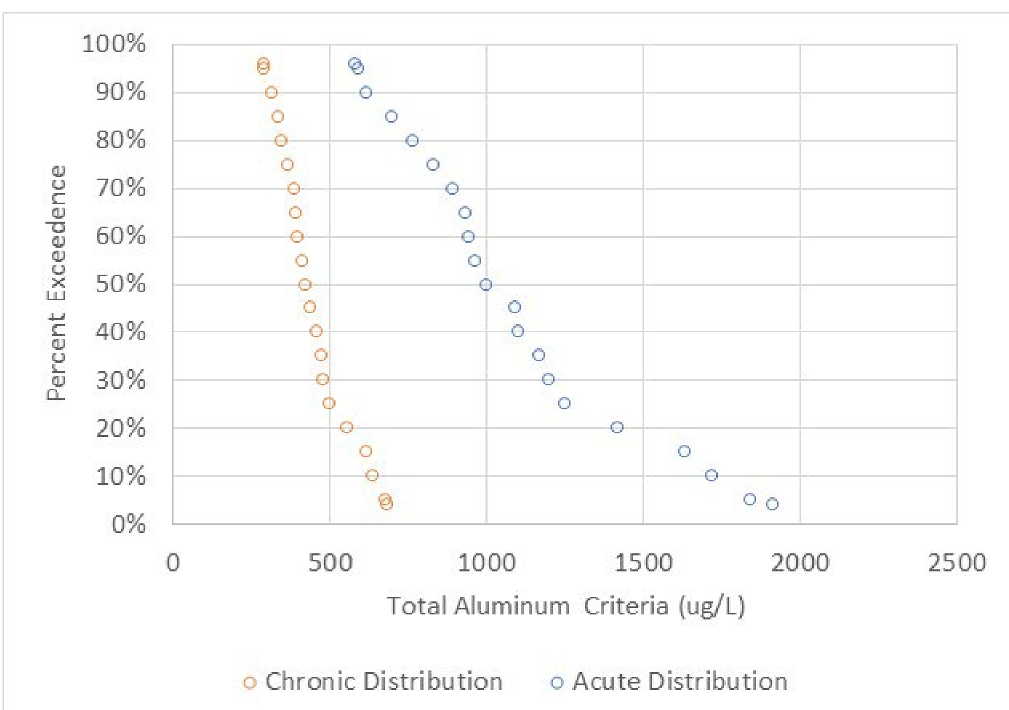
Figure 1 – Flow chart for decisions described in Section 5.



6. CMC for Reasonable Potential Analysis

The steps described in Section 5 to calculate the CCC for reasonable potential analysis are then repeated to determine the CMC for reasonable potential analysis (RPC-CMC). From the data evaluated to date, the CMC distribution has had a larger relative percent different between the 10th and 90th percentiles than the CCC distribution (Figure 2). The relative differences suggest that there may be situations where the median can be used for the RPC-CMC but the 5th or 10th percentile of the CCC ICVs will need to be used for the RPC-CCC in the RP analysis.

Figure 2 – Distributions of CCC and CMC ICVs for 02-SHG on the Souhegan River from the monthly 2020-2021 dataset plus summer samples from 2017-2024 (n=19).



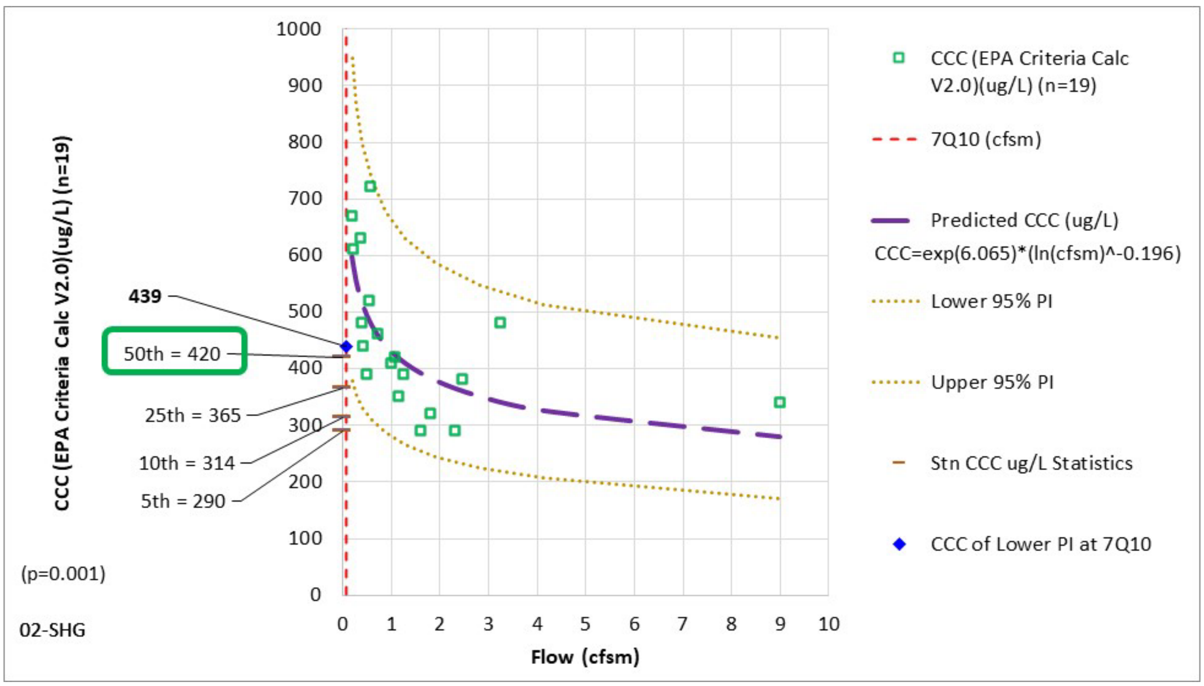
7. Site Level Examples

The reasonable potential procedures described above and illustrated in Figure 1 are demonstrated below using data collected monthly from November 2020 to October 2021 during the 12-month study of the river trend monitoring sites plus summer samples collected before and after the 12-month study. As this is in some cases less data than will be used in the analysis for a given WWTF and is not as well distributed across the seasons, it is not surprising that some of the relationships are poor.

7.1. Significant Relationship, 50th Percentile CCC from ICVs Justified for RP Analysis

The example below is from 19-data points collected from 02-SHG (Souhegan River, Rte 3 Bridge, Merrimack, NH) during the 12-month study plus the additional summer samples. As the regression is significant and the CCC-L95-PI (439 µg/L) exceeds the CCC-50 (420 µg/L), the CCC-50 (420 µg/L) would be used as the RPC-CCC for permitting and protective of designated uses (Figure 3).

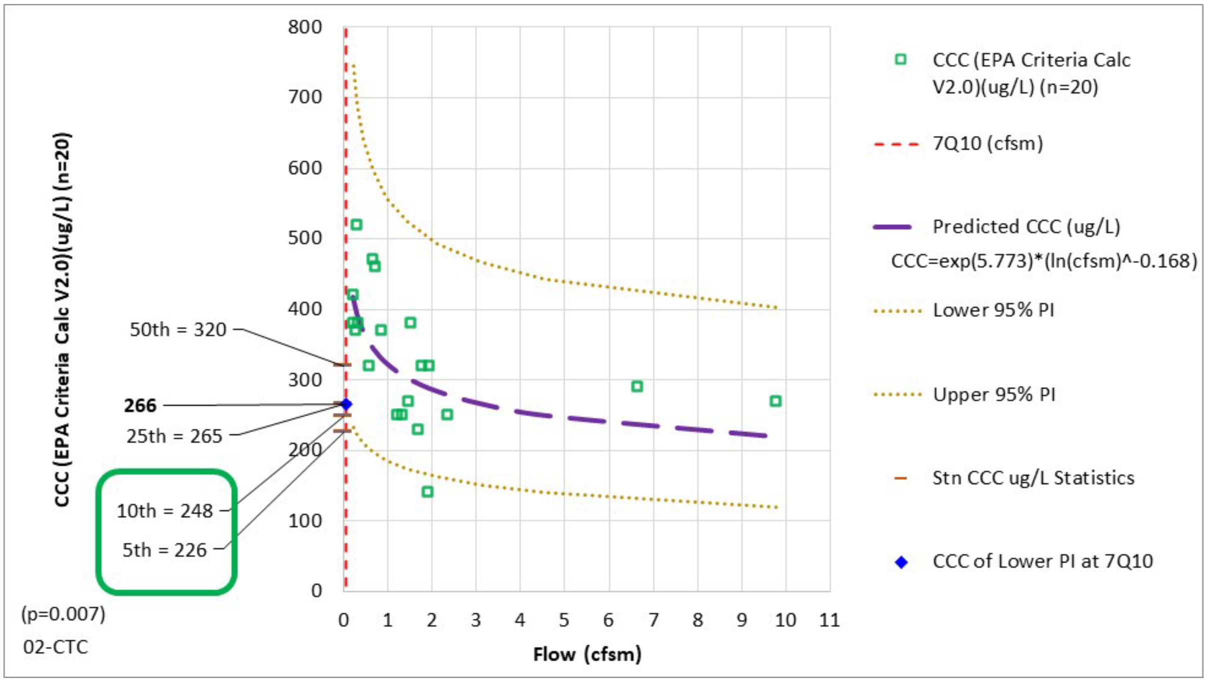
Figure 3 - Example power regresssion and aluminum ICV statistics for station 02-SHG on the Souhegan River. Use the 50th percentile CCC from the calculated aluminum criteria (420 µg/L) for RP analysis as the regression is significant and the predicted CCC at the lower 95th prediction interval (439 µg/L) exceeds the median of the CCC-ICVs.



7.2. Significant Relationship, 10th or 5th Percentile CCC from ICVs Justified for RP Analysis

The example below is from 20-data points collected from 02-CTC (Contoocook River, Canal St Bridge, Boscawen, NH) during the 12-month study plus the summer samples collected from 2017-2024. The regression is significant; however, the CCC-L95-PI (266 µg/L) is lower than the 50th percentile (320 µg/L) of the CCC-ICVs, therefore only the 10th or 5th (248 or 226 µg/L) percentiles of the CCC-ICVs may be used (Figure 4). If threatened or endangered species were present and there was designated critical habitat present the 5th percentile (226 µg/L) would be used as the RPC-CCC for permitting. If threatened or endangered species are not present and there is no designated critical habitat, the 10th percentile (248 µg/L) would be used as the RPC-CCC for permitting.

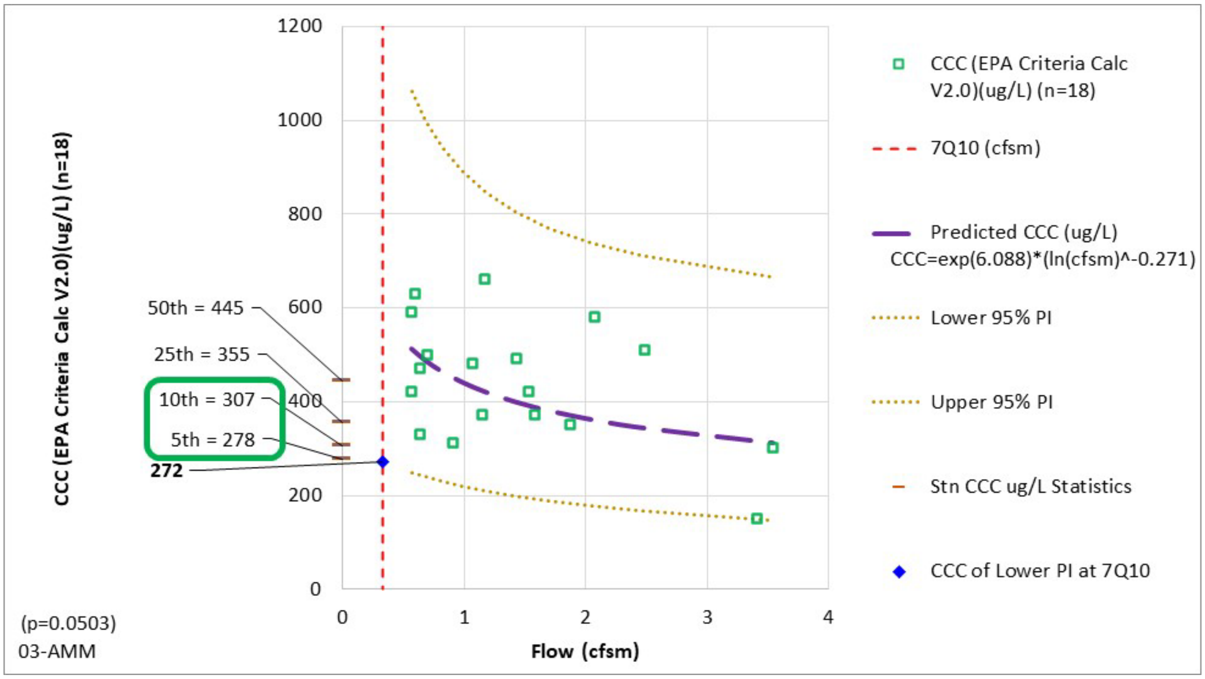
Figure 4 - Example power regresssion and aluminum ICV statistics for station 02-CTC on the Contoocook River. The regression is significant but the predicted CCC at the lower 95th prediction interval is lower than the median of the CCC-ICVs therefore the 5th (226 µg/L) or 10th (248 µg/L) percentiles should be used depending upon threaten or endangered species status.



7.3. *Insignificant Relationship, 10th or 5th Percentile CCC from ICVs Justified for RP Analysis*

The example below is from just 18-data points collected from 03-AMM (RR Bridge NW of the RTE 302/112 Intersection) during the 12-month study, plus the summer samples collect from 2017-2024. As the regression is not significant only the 10th or 5th percentiles (307 or 278 µg/L) of the CCC-ICVs may be used (Figure 5). If threatened or endangered species or designated habitat exists for the site, the 5th percentile (278 µg/L) would be used as the RPC-CCC for permitting. If threatened or endangered species were not present and there was no designated critical habitat present, the 10th percentile (307 µg/L) would be used as the RPC-CCC for permitting.

Figure 5 - Example power regresssion and aluminum ICV statistics for station 02-ASH on the Ashuelot River. The regression is not significant therefore the 5th (278 µg/L) or 10th (307 µg/L) percentiles should be used depending upon threaten or endangered species status.



8. References

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Exhibit 8

Updating the Arsenic Human Health Criteria

April 8, 2024

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

STATE OF NEW HAMPSHIRE

Updating the Arsenic Human Health Criteria

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DEPARTMENT OF ENVIRONMENTAL SERVICES
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1. Executive Summary

Arsenic is a known carcinogen that can increase mortality from multiple internal organ cancers (liver, kidney, lung and bladder) and increase the incidence of skin cancer (EPA's Integrated Risk Information System (IRIS) Arsenic Summary). The current adopted, and United States Environmental Protection Agency (EPA) approved, version of the human health criteria (HHC) in administrative rule Env-Wq 1700 for arsenic is based on EPA 304(a) guidance last modified by EPA in 1992 (based on a fish consumption rate of 6.5 g/day and drinking water intake rate of 2.0 L/day). New Hampshire adopted the 1992 criteria based on the target risk for cancer of 1:1,000,000 (10^{-6}), as was done for all other carcinogens in Env-Wq 1700. Determining what is an acceptable target risk within the range of 10^{-4} to 10^{-6} range after considering all the issues related to the inorganic arsenic criteria is, based on EPA guidance, a state policy decision, provided that risk to highly exposed populations does not exceed a 10^{-4} level (EPA, 2000).

The current HHC established under the Clean Water Act (CWA) are based on the inorganic fraction of arsenic and are currently 0.140 µg/L for consumption of organism only and 0.018 µg/L for the consumption of water and organism, respectively. In contract, the current New Hampshire drinking water maximum contaminant level (MCL) is 5 µg/L (NHDES, 2018), or one-half the National Primary Drinking Water Regulations standard. The current arsenic MCL is based on risk for developmental and cognitive delays in children balanced against costs of treatment, but still results in an excess estimated lifetime cancer risk of 1.5 in 1,000 (NHDES, 2018). The current discrepancy between the water quality standard and the MCL is large. There may be cases where due to natural arsenic sources, water can be distributed to residents but then after treatment at a wastewater treatment facility (arsenic is not efficiently removed without expensive advanced processes) that water remains too high in arsenic for discharge if there is inadequate dilution resulting is implementation challenges. Here, the New Hampshire Department of Environmental Services (NHDES) updates the arsenic HHC for Env-Wq 1700 to a target risk of 1:100,000 (10^{-5}) while also updating all other equation input variables to the more robust values currently recognized as best practices and an upper fish consumption rate specific to New Hampshire residents.

2. Human Health Criteria

2.1. Current Surface Water Quality Standards and EPA 304(a) Guidance

The current criteria in Env-Wq 1700 were adopted into Env-Ws 430 (predecessor to Env-Wq 1700) in 1996 from the December 22, 1992 "National Toxics Rule" published in the Federal Register (57 FR 60848, 1992) .

The 1992 "National Toxics Rule" (57 FR 60848, 1992) states that the calculated criteria are, "… 0.018 µg/L (water and aquatic life consumption) and 0.14 µg/L (aquatic life consumption) criteria were calculated from the unit risk factor [drinking water unit risk] of 5×10^{-5} (µg/L). The unit risk factor [drinking water unit risk] of 5×10^{-5} (µg/L) is on IRIS and available for public inspection." Several of the inputs EPA used in 1992 either have more appropriate current default values, or there are more appropriate New Hampshire specific inputs that could be used in deriving new criteria.

EPA Headquarters (HQ) had previously noted that they are reassessing the toxicity information for arsenic and planned to go out for public notice on their assessment in 2022, which has now passed. EPA's IRIS lists the current status of the arsenic assessment as "undergoing interagency consultation" as of October 2023 (Arsenic, Inorganic CASRN 7440-38-2 | IRIS | US EPA, ORD). The reassessment is reviewing the cancer slope (potency) factor and bioconcentration factor. However, EPA HQ does not expect the reassessment to result in a relaxation of the 304(a) recommended HHC under the CWA.

Given the toxicity of inorganic arsenic compared to other forms of arsenic found in the environment, many states find regulating arsenic in wastewater challenging. As such, many states have been re-evaluating the risk assessment basis (i.e., exposure factors, inorganic fractions, bioconcentration/bioaccumulation factors) and approaches to meeting the arsenic criteria (e.g. variances). Until New Hampshire changes the standard in Env-Wq 1700, EPA must use the current standard as a basis for National Pollutant Discharge Elimination System (NPDES) permit limits.

2.2. *Input Variables for Calculating Arsenic Criteria*

2.2.1. Target Risk

EPA guidance states that target risk thresholds of 10^{-6} or 10^{-5} are acceptable for the general population and that highly exposed populations should not be exposed to more risk than expressed at the 10^{-4} level. After considering the issues related to the inorganic arsenic criteria and EPA guidance, the final target risk applied is a state policy decision (EPA, 2000). While NHDES strives for the lowest possible and reasonable risk, the decision of target risk must also consider the benefits of consuming fish and shellfish. If NHDES were to maintain the existing HHC and conduct broader arsenic sampling, there is a possibility that NHDES would recommend reduced fish and shellfish consumption which would be detrimental to public health at the population level due to the loss of health benefits from the consumption of fish and shellfish. From a risk management perspective, there are a lack of risk assessment models and tools to quantitatively balance the benefits and risks for arsenic in seafood. Thus, NHDES made a qualitative determination to adjust the target risks from 10^{-6} to 10^{-5} in an effort to strike a balance between public health protection and excessive risk conservatism. Therefore, New Hampshire is revising the arsenic criteria based on a target risk of 10^{-5}.

2.2.2. Cancer Potency Factor (q1*) (cancer slope factor)(mg/kg-d)

The Cancer Potency Factor (q1*) (a.k.a. cancer slope factor or oral slope factor) was updated since the 1.75 $((mg/kg/)/day)^{-1}$ value used when EPA derived the 1992 guidance. The updated value of 1.50 $((mg/kg/)/day)^{-1}$ (IRIS Summary) is based on an increased risk for dermal (skin) cancer in addition to other cancer sites is scientifically defensible, has been used by other states and accepted by EPA. The lower cancer potency factor makes the arsenic criteria less stringent.

2.2.1. Body Weight (BW) (kg)

The original 1980 criteria, the basis of New Hampshire's current human health criteria, used a mean body weight of 70 kg (57 FR 60848, 1992). Current estimated mean body weight is 80 kg as described in the EPA Exposure Factors Handbook table 8-1 (EPA, 2011). Currently, New Hampshire does not have state-level summary statistics for body weight data necessary for risk assessment or comparable to the data described in the EPA Exposure Factors Handbook. In the absence of local or state-level data, the default recommendation for updated information is the most recent values provided by the EPA Exposure Factors Handbook. The increased mean body weight makes the arsenic criteria less stringent.

2.2.2. Drinking water intake (DW) (L/d)

As stated in the 1992 FR (57 FR 60848, 1992) the water and organism criterion used an "…average daily consumption of 2 liters of water…" as the drinking water intake rate. Up until the early 2000's, 2.0 L/day remained the default ingestion rate (EPA, 2000)(pg 4-23). In current risk assessment efforts such as this one, NHDES uses the 90th percentile drinking water intake for all adults. The Exposure Factors Handbook table 3-12 (EPA, 2019) estimates the 90th percentile for all adults at 2.698 L/day (rounded to 2.7 L/day). The increased drinking water intake makes the water and organism criterion for arsenic more stringent.

2.2.3. Fish Consumption Rate (FCR) (kg/d)

The original 1980 criteria and the 1992 FR (57 FR 60848, 1992) used the 6.5 g/day as an average population consumption rate (Stephan, 1980).

> "Residue data for a variety of inorganic compounds indicate that bioconcentration factors for the edible portion of most aquatic animals are similar, except that for some compounds bivalve molluscs (clams, oysters, scallops, and mussels) should be considered a separate group. An analysis (U.S. EPA, 1980a) of data from a food survey was used to estimate that the per capita consumption of freshwater and estuarine fish and shellfish is 6.5 g/day (Stephan, 1980). The per capita consumption of bivalve molluscs is 0.8 g/day and that of all other freshwater and estuarine fish and shellfish is 5.7 g/day." (EPA, Ambient Water Quality Criteria for Arsenic, 1980)

For those states that use a higher target risk for cancer (i.e. 10^{-4} rather than 10^{-5} or 10^{-6}), there is an understandable push to base the final criteria on the fish consumption rates of an upper percentile consumption rate for the most susceptible population to ensure that those individuals are protected. Independent of New Hampshire specific consumption rates, NHDES would typically use consumption rates from EPA's analysis of National Health and Nutrition Examination Survey (NHANES) datasets. For the northeast region, Table 8b of EPAs 2014 fish consumption rates (data collected 2003-2010) reports a 95th percentile of 82 g/d and a 90th percentile of 65.2 g/d (EPA, 2014). However, in 2021 Dartmouth and Middlebury Colleges surveyed New Hampshire residents to characterize fish consumption patterns (Crawford, et al., 2024). In keeping with the hierarchical recommendations in EPA's 2000 Methodology (EPA, 2000), the recent consumption rate for New Hampshire residents is preferable over the EPA's generalized 2014 fish consumption rates report based on data collected from 2003-2010 for the entire northeast (PA, NY, NJ, CT, RI, MA, NH, VT, and ME) region (Table 1).

Table **1**. Comparison of the 2021 survey of New Hampshire residents in the Granite State Panel to EPA's report on National Health and Nutrition Examination Survey (NHANES) data from 2003-2010. All consumption rates are presented as raw weight (uncooked) grams of tissue consumed per day.

Estimate Source	**Metric Type and Units**	**50th Percentile (± 95th CI)**	**75th Percentile (± 95th CI)**	**90th Percentile (± 95th CI)**	**95th Percentile (± 95th CI)**
NHANES Northeast (Table 8b)*	Total fish (g/day)	23.9 (20.0, 28.7)	42.5 (36.3, 49.8)	65.2 (55.9, 76.1)	82.0 (70.0, 96.1)

NHANES Northeast (Table 12b)*	Total shellfish (g/day)	5.9 (4.5,7.7)	13.3 (10.7, 16.5)	24.6 (19.6, 30.8)	34.2 (27.1, 43.2)
New Hampshire Granite State Panel survey**	Total seafood (g/day)	33.9 (26.0, 41.8)	43.9 (29.9, 57.8)	69.7 (54.4, 85.0)	92.2 (78.5, 105.8)

* EPA Report: Estimated Fish Consumption Rates for the U.S. Population and Selected Subpopulations (NHANES 2003-2010)

**Calculated using midpoint for portion size (oz) category of dinner portion reported in the last 7 days, frequency as times per year using reported frequency over the last 12 months, and converting to g/day, then calculated percentiles of total seafood g/day accounting for survey weights (n=1029 participants); represents the mean of 10 types of seafood, including canned tuna and shrimp (Crawford, et al., 2024).

The calculations in Section 2.2.7, below, use the more human health protective 95th percentile of 92.2 g/d from the Dartmouth/Middlebury study (Crawford, et al., 2024). Note that while a larger consumption rate increases the criteria, the water and organism HHC is predominantly driven by the water consumption rate. Overall, use of the New Hampshire specific consumption rates increases the certainty that the revised HHC will be protective of New Hampshire residents.

Another criteria adjustment that some states have done is a “wild caught weighting” on the consumption rates utilizing datasets such as the Dartmouth survey dataset. While such differentiation will increase the acceptable concentration in surface waters to protect Organism Only HHC, it will do little to change the Water and Organism HHC that is predominantly driven by the water consumption rate. As such, the “wild caught weighting” adjustment has not been pursued thereby limiting the increase in the calculated criteria.

2.2.4. Inorganic Fraction (IF) (Percent)

The BCFs described in the Section 2.2.5 are based on total arsenic, whereas arsenic’s carcinogenicity is based on inorganic arsenic. The proportion of total arsenic that exists as inorganic arsenic instead of organic arsenic is referred to as the inorganic fraction (IF). Some states have adjusted the derivation of criteria by applying an IF to the organism intake portion of the criteria calculations. This is done because the data used to calculate the BCFs represents accumulation of total arsenic as it is unrealistic to assume all arsenic in the water column accumulates as inorganic in the organism tissue. Maine Department of Environmental Protection (MEDEP) used 30% (MEDEP, 2012), Oregon Department of Environmental Quality Commission (ODEQ) used 10% (ODEQ, 2011), Colorado used 30% and Maryland used 4% (the last two reported in (ODEQ, 2011)). The 10% IF is in keeping with what EPA found as the consensus in the literature for the edible portions of marine fish and shellfish where most arsenic found in seafood exists as organic arsenic compounds; however, less is known about the forms of arsenic in freshwater fish and the available evidence suggests inorganic forms predominate (EPA, 2003). That said, in freshwater brown trout (*Salmo trutta*), muscle tissue had lower arsenic than other parts of the body (Culioli, Calendini, Mori,C., & Orsini, 2009). More recently, Canadian researchers testing muscle tissue found average IFs of 8.3% in lake whitefish (range 0.9-19.6%) and 5.3% in northern pike (range 1.1 - 14.1%) (Tanamal, Blais, Yumvihoze, & Chan, 2021) reinforcing ODEQ’s findings. The IF has an impact on the water and organism criteria but a stronger influence on the organism-only criteria (although the latter is the higher, or less restrictive, criterion).

In practice, the use of an IF in the criteria calculation means that even though it is the IF that is of concern, the criteria can be applied as total recoverable arsenic directly in NPDES permitting work and in assessing ambient water quality data (EPA, 2013). While inclusion of the IF limits some permitting flexibility, fewer waters are likely to exceed the HHC water quality criteria which might trigger the automatic need for a NPDES permit holder to meet water quality criteria at the end-of-pipe. As such, the IF determined by Oregon (10%) has been applied in section 2.2.7.

Overall, based on the research compiled by Oregon from 20 studies for their arsenic criteria revisions, plus the recent Canadian study (Tanamal, Blais, Yumvihoze, & Chan, 2021), an IF of 10% is human health conservative but approaching the central tendency of the freshwater fish datasets and human health conservative by an order of magnitude for marine organisms (Table 2).

Table 2. Inorganic arsenic as a percent of total arsenic in seafood measured as ng/g wet weight (EPA, October 17, 2011)**.**

Biota Group	Mean (%)	Range (%)
Freshwater	7.2	0.5-26.6
Anadromous fish	1.1	0.03-3.04
Marine fish	1.0	0.001-6.9
Marine Crustaceans	1.3	0.001-7.3
Marine Mollusks	1.8	0.04-6.5

2.2.5. Bioconcentration Factor (BCF) (L/kg)

The 1980 criteria used a BCF of 44 L/kg based on two species, the eastern oyster (BCF=350) and bluegill (BCF=4), and an assumed water concentration for the marine portion of the dataset.

> "Thirteen percent of the arsenic exposure results from the consumption of aquatic organisms which exhibit an average bioconcentration potential of 44-fold. The remaining 87 percent of arsenic exposure results from drinking water." (EPA, 1980)

In 2011, ODEQ revised their water quality criteria for arsenic. While the Water Quality Standards Review and Recommendations: Arsenic report (ODEQ, 2011) and memorandum (Pedersen, 2011) on their website, still mark the arsenic discussion as "draft" (October 2023), they are the same as and considered the final versions (Sturdevant, 2022). Oregon ultimately chose to use, and EPA approved, different BCFs for fresh and marine water because marine shellfish (oysters) have much higher BCFs for arsenic than freshwater finfish (ODEQ, 2011), and it is those oysters that drove the overall BCF higher. Oregon used the following factors in their 2011 report to make their final BCF decisions.

> "A more recent analysis by EPA (EPA Headquarters, personal communication, November 2010) incorporated more recent BCF data for rainbow trout with the prior data for bluegill and oysters to provide Oregon several scientifically defensible BCF options, shown in Table 6 [Table 3] below, for use in setting Oregon's criteria. The BCF options are based on geometric means of data from the following four studies, which include five BCF test values reported. EPA used the

first two studies listed to derive the BCF of 44 in the early 1980s; the second two studies are more recent. (See Appendix A for more detail on the results of these studies.)

- Ambient Water Quality Criteria for Arsenic (EPA, 1985), which refers to Barrows et al., 1980, Ann Arbor Science Pub., Inc., Ann Arbor MI. pp. 379-392. Whole-body measurement of total arsenic in immature bluegill. [(EPA, 1984) (Barrows, Petrocelli, Macek, & Carroll, 1980)]
- Ambient Water Quality Criteria for Arsenic (EPA, 1985), which refers to Zaroogian and Hoffman, 1982, Environmental Monitoring and Assessment 1:345-358. BCF value for arsenic eastern oysters. [(EPA, 1984), (Zaroogian & Hoffman, 1982)]
- McGeachy and Dixon, 1990. Canadian Journal of Fisheries and Aquatic Sciences. 47:2228-2223. Two studies of whole-body total arsenic in immature rainbow trout. [(McGeachy & Dixon, 1990)]
- Rankin and Dixon, 1994. Canadian Journal of Fisheries and Aquatic Sciences. 51: 372-380. Whole-body measurement of total arsenic in immature rainbow trout. [(Rankin & Dixon, 1994)]"

Table 3 Bioconcentration Factor (L/kg total arsenic) Options (from Table 6 in (ODEQ, 2011))

Species	BCF	# of Studies	Range of values
All freshwater finfish	14	4	4-27
Coldwater fish (trout)	21	3	17-27
Saltwater (eastern oyster)	350	1	350
All freshwater and saltwater species	26	5	4-350

The ODEQ noted that they only included studies where the water concentration was below 50 µg/L inorganic arsenic, which is similar to surface waters in New Hampshire. The studies likely overestimated the BCF for the primary edible portions of finfish as all of these studies quantify total arsenic and whole body BCFs rather than fillet tests. One such example measured arsenic in rock bass and found the highest concentrations of arsenic in intestines, with lower concentrations found in the bone and scales, followed by muscle and liver tissues (Azcue & Dixon, 1994). A recent review by Hoy et. al. (2023) summarized multiple studies evaluating arsenic is fish tissue and generally found muscle tissue to be middle of the range for tested fish parts to the lowest of the tested fish parts. The ODEQ concluded that since only the oyster study had a markedly higher BCF and that, "EPA stated in a 2003 review of arsenic bioaccumulation in aquatic organisms that estuarine and marine data indicate a possible need for deriving separate BAFs for saltwater systems ((EPA, 2003), p.7)", it was reasonable and protective to calculate the HHC for fresh and marine waters using different and biologically relevant BCFs.

In 2005, the MEDEP evaluated this issue with respect to BCFs based on finfish and shellfish and the implication for arsenic HHC. In their response to comments for Maine's arsenic HHC update, MEDEP wrote:

> "The 44 L/kg value is the current BCF for USEPA (*Ambient Water Quality Criteria for Arsenic, 1984*) and Maine (2005). It is based on a limited data set of studies for two species: eastern oyster (1982) and bluegill (1980). A more recent analysis by USEPA calculated the proposed 26

L/kg value from the geometric mean of the previous studies and three additional studies on rainbow trout (1994). The revised BCF of 26 L/kg was approved by USEPA for marine waters in Oregon (2011) and USEPA HQ has recommended it for use in Maine waters statewide." (MEDEP, 2012)

Here, NHDES followed suit with Oregon and applied a BCF of 14 in freshwaters and 26 in marine waters. Applying the eastern oyster BCF to all waters was determined to be inappropriate because shellfish consumption is not a designated use in New Hampshire's freshwaters, and this BCF would misrepresent the estimated arsenic uptake for freshwater finfish. As ODEQ reported (ODEQ, 2011) and EPA concurred (EPA, October 17, 2011), the New Hampshire data illustrates that despite the higher BCF for arsenic in shellfish (e.g., BCF=350), the very low inorganic fraction in shellfish (e.g., IF < 1%) (EPA, 2003) and the lower rate of shellfish consumption (34.2 g/d)(Table 12b (EPA, 2014)) results in a less stringent criteria than calculated based on the finfish consumption rate and a BCF of 26, IF of 10% and consumption rate from the Dartmouth/Middlebury study (Crawford, et al., 2024). That is, using the single BCF for marine organisms results in a more conservative final criteria than if marine shellfish and finfish were separated.

2.2.6. Discussion of Uncertainties

Many of the variables for the equations used to calculate the criteria for inorganic arsenic have a degree of uncertainty. The text below provides a discussion about the degree of uncertainty and how the values NHDES selected influence the final calculation of the HHC. Each variable, as well as the final calculated criteria, must be weighed against the health and economic benefits of fish consumption to New Hampshire residents. While NHDES strives for the lowest possible risk, the decision of risk must also consider the benefits of consuming fish and shellfish.

- *Target Risk* – There is no inherent uncertainty in the target risk factor used in the equation, however by increasing the risk from 10^{-6} to 10^{-5} NHDES is accepting 10-times more risk. Unlike the other input variables here, this change was made to manage the benefits of consuming fish verses the risk of cancer. The increase in target risk makes the final criteria less stringent.

- *Body Weight* (BW) (kg) – This proposed change would update the mean body weight from 70 to 80 kg making the criteria reflective of the current estimates for the US population. The increase in body weight makes the final criteria less stringent.

- *Drinking water intake* – This proposed change would update the water intake from 2.0 to 2.7 L/day thereby setting the water ingestion rate at the upper 90th percentile of US Adults, more consistent with current behavior. The increase in drinking water intake makes the final criteria more stringent.

- *Cancer Potency Factor (q1*) (a.k.a. cancer slope factor)* – The decrease in the cancer potency factor from 1.75 to 1.50 as reported in the IRIS Summary makes the final criteria less stringent.

- *Fish Consumption Rate* – This proposed change would update the fish consumption rate from 6.5 g/day based on a national average (Stephan, 1980) to an upper 95th percentile of 92.2 g/day based on the 2021 survey of New Hampshire residents (Crawford, et al., 2024). The New Hampshire specific 92.2 g/day is a bit higher than the 2014 NHANES based 95th percentile of 82.0 g/day for total fish and roughly 3-times higher than the 2014 NHANES based 95th percentile of 34.2 g/day for total shellfish that would be applicable to those that only consume shellfish.

The increase in fish consumption rate makes the organism and water criterion as well as the organism only criterion more stringent.

- *Inorganic fraction* – Considering all of the arsenic in surface waters to be taken up as inorganic arsenic in organisms is unrealistic and not reflective of the available data. There is some argument for an IF as low as 1% but that low of a fraction would have a higher uncertainty. NHDES proposes to apply an IF of 10% to constrain the uncertainty. The decrease in the IF makes the final criteria less stringent.

- *Bioconcentration Factor* – This proposed change would decrease the BCF from 44 to 14 in freshwaters and 44 to 26 in marine waters. The certainty in freshwater BCF is more robust than that of the marine organisms given that all the fish BCFs were derived from freshwater species. While the final chosen BCF for the marine environment is lower than that for the one experimental shellfish organism, it is expected that the marine fish will accumulate at a similar rate as the freshwater fish, and it is known that fish are more widely consumed than shellfish. Both revisions are based on a larger dataset than the existing HHC. Decreases in the BCFs makes the final criteria less stringent.

2.2.7. Summary of Chosen Variables for Calculating Arsenic Criteria

The criteria are based upon more current and more robust input variables. The change in target risk for cancer is intended to balance the risk of inorganic arsenic intake, the real benefits of fish and shellfish consumption and the financial and technical treatment challenges. The change in the criteria is not anticipated to increase the concentration of arsenic in the aquatic environment, and the subsequent absorption of arsenic into aquatic organisms. Table 4 provides a summary of the input variables and proposed criteria.

Table 4 Input variables and resulting criteria for existing EPA 304(a) guidance, Maine, Oregon, and potential New Hampshire criteria.

Input Variables	**Current Env-Wq 1700 - All waters**	**Revised Env-Wq 1700 - Freshwaters**	**Revised Env-Wq 1700 - Marine**	**Simplified Rational**
Risk	10^{-6}	10^{-5}	10^{-5}	Balancing health risks of arsenic with health benefits of fish consumption.
Body Weight (BW) (kg)	70	80	80	Current guidance (EPA, 2011)
Conversion factor (CF) (fixed value) (ug/mg)	1,000	1,000	1,000	Fixed value
cancer potency factor (q1*) (*cancer slope factor*) (fixed value) (per (mg/kg)/d)	1.75	1.5	1.5	Current IRIS q1* (IRIS Summary)
Drinking water intake (DW) (L/d)	2.0	2.7	2.7	Current guidance (EPA, 2019)
Fish Consumption Rate (FCR) (kg/d)	0.0065	0.092	0.092	95th percentile from New Hampshire 2021 survey (Crawford, et al., 2024).
Inorganic fraction (IF) (Percent)	-na-	10	10	Based on Oregon's work. (ODEQ, 2011)

Input Variables	**Current Env-Wq 1700 - All waters**	**Revised Env-Wq 1700 - Freshwaters**	**Revised Env-Wq 1700 - Marine**	**Simplified Rational**
Bioconcentration Factor (BCF) (L/kg)	44	14	26	Based on Oregon's work. (ODEQ, 2011)
Organism Only Criterion (ug/L)	0.140	4.10	2.20	
Water and Organism Criterion (ug/L)	0.018	0.19	0.18	

Equation 1 Water Concentration Criteria for Fish and Shellfish Consumption

$$\mathrm{WCC} = \mathrm{CF} \times \frac{\mathrm{TR} \times \mathrm{BW}}{\mathrm{q1^*} \times \mathrm{BCF} \times \mathrm{FCR} \times \mathrm{IF}}$$

Where:

WCC – Water Concentration Criteria (µg/L)

CF – Units Correction Factor (1,000 µg/mg)

TR – Target Risk

BW – Human Body Weight (kg)

q1* – Cancer Potency Factor (mg/kg-d)

BCF – Bioconcentration Factor (L/kg)

FCR – Fish or Shellfish Ingestion Rate (kg/d)

IF – Inorganic Fraction (%)

Equation 2 Water Concentration Criteria for Fish/Shellfish Consumption and Water Ingestion

$$\mathrm{WCC} = \mathrm{CF} \times \frac{\mathrm{TR} \times \mathrm{BW}}{\mathrm{q1^*} \times [\mathrm{DW} + (\mathrm{BCF} \times \mathrm{FCR} \times \mathrm{IF})]}$$

Where:

WCC – Water Concentration Criteria (µg/L)

CF – Units Correction Factor (1,000 µg/mg)

TR – Target Risk

BW – Human Body Weight (kg)

q1* – Cancer Potency Factor (mg/kg-d)

DW – Drinking Water Intake (L/d)

BCF – Bioconcentration Factor (L/kg)

FCR – Fish or Shellfish Ingestion Rate (kg/d)

IF – Inorganic Fraction (%)

3. Env-Wq 1700 Modifications

Completing the arsenic HHC changes requires modification to 3-parts of Env-Wq 1700:

1. Env-Wq 1703.20 defining the target risk used for human health criteria as related to discharges.
2. Table 1703-01 covering water quality criteria for toxic substances.
3. Env-Wq 1703.22(c) defining the target risk used for the HHC in Table 1703-1.

Additionally, the three sections of the existing rules referenced above use the term “risk factor” whereas “target risk” is the currently accepted terminology.

3.1. Env-Wq 1703.20 Risk Factors for Human Health Criteria

Env-Wq 1703.20 ***Target*** Risk ~~Factors~~ for Human Health Criteria.

(a) ***Except as provided in (d) below***, ***t***~~T~~he department shall use a ***target*** risk ~~factor~~ of one in 1,000,000 when determining human health criteria for all new discharges.

(b) ***Except as provided in (d) below, t***~~T~~he department shall use a one in 1,000,000 ***target*** risk ~~factor~~ when determining human health criteria for any modification to a permit for an existing discharge unless the applicant for a water discharge permit can demonstrate that the criteria obtained using the one in 1,000,000 ***target*** risk ~~factor~~ cannot be achieved because it is either technologically impossible or economically unfeasible.

(c) When establishing an alternative ***target*** risk ~~factor~~ under (b), above, the department shall not allow ~~a~~ ***more*** risk ***than allowed by*** ~~factor~~ ~~greater than~~ one in 100,000.

(d) The department shall use a target risk of one in 100,000 when determining human health criteria for all existing and new discharges that contain arsenic.

3.2. Table 1703-01: Water Quality Criteria for Toxic Substances

CAS Number	**Chemical Name**	**Protection of Aquatic Life Concentration in micrograms per liter (µg/~~l~~L)[v]**				**Protection of Human Health Units per Liter**	
		Fresh Acute Criteria	**Fresh Chronic Criteria**	**Marine Acute Criteria**	**Marine Chronic Criteria**	**Water & Fish Ingestion**	**Fish Consumption Only**
7440-38-2	Arsenic	340 [d, i]	150 [d, i]	69 [d, i]	36 [d, i]	~~18 ng~~ ***0.19/0.18 ug*** [b, c, w]	~~140 ng~~ ***4.1/2.2 ug*** [b, c, w]

3.3. Env-Wq 1703.22 Notes For Table 1703-1

Env-Wq 1703.22 Notes For Table 1703-1. The following shall apply to Table 1703-1:

(b) The letter “b” shall indicate that the criteria refer to the inorganic form only.

(c) The letter "c" shall indicate that these criteria for the protection of human health are based on carcinogenicity using a ***target*** risk ~~factor~~ of one in 1,000,000, ***except for arsenic which shall be based on a target risk of one in 100,000,*** while the human health criteria without this footnote are based on systemic toxicity. Other ***target*** risk***s*** ~~factors~~ shall be allowed only as specified in Env-Wq 1703.20.

(w) The letter "w" shall indicate that for arsenic, the first value is for freshwaters and the second value is for marine waters as it relates to protection of human health.

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Exhibit 9

Draft Final

Technical Support Document:
Derivation of Proposed Primary and Secondary Drinking Water Standards for Methyl *tert*-Butyl Ether in NH Drinking Water Supplies

February, 2000

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OCPH Publication #

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EXECUTIVE SUMMARY

In 1999 the New Hampshire Legislature passed Senate Bill 70 (SB70), which required the Commissioner of the Department of Environmental Services (DES), in consultation with the Commissioner of Department of Health and Human Services (DHHS), to adopt primary and secondary drinking water standards for Methyl Tertiary-Butyl Ether (MTBE) pursuant to RSA 485:3 and an ambient groundwater quality standard pursuant to RSA 485-C:6. SB70 requires the DES Commissioner to begin rulemaking no later than January 1, 2000.

This report provides the technical rationale to support adopting both a primary and secondary standard for MTBE. A primary drinking water regulation is an enforceable standard for public water supplies, and is set at a level that is deemed to be protective of public health. The New Hampshire DHHS, Bureau of Health Risk Assessment (DHHS-BHRA) has statutory authority under RSA-125H to provide completed risk assessments to other state agencies, such as the Department of Environmental Services (DES) for use in risk management activities. This statute also designates authority to the DHHS to develop proposed environmental quality standards to protect human health. The DHHS-BHRA proposes a primary Maximum Contaminant Level (MCL) of 13 micrograms per liter (ug/L) and a Secondary Maximum Contaminant Level (SMCL) of 20 ug/L for MTBE.

MTBE has been added to fuels since 1979 in concentrations of 2% to 3% by volume in regular gasoline, and up to 9% by volume in premium gasoline. Beginning in 1995 reformulated gasoline (RFG), which contains 11% by volume of MTBE, has been required to be used year-round in the four southern NH counties of Strafford, Rockingham, Hillsborough, and Merrimack. Due to distribution issues it is our understanding that service stations in most of the state have received RFG, at least occasionally throughout the year, since it became available.

The large-scale use of MTBE-containing gasoline has resulted in an inadvertent introduction of MTBE to surface and groundwater. Once MTBE enters the groundwater, it spreads more quickly than other components of gasoline. MTBE is also substantially more water-soluble than some of the other common gasoline groundwater contaminants, and is not as likely to adsorb onto soil particles to impede mobility. Beginning in 1995 the DHHS-BHRA has observed an increase in the number of private wells that have had detections of MTBE, with there being 38, 51, 76, 100, and 145 wells with some level of MTBE for the years 1995, 1996, 1997, 1998, and 1999, respectively. The majority of these wells were believed to have received contamination by way of release from some known point source, such as a leaking underground storage tank (LUST). Surveillance of public drinking water systems has shown that 154 (13%) out of 1,150 total non-transient public water systems have had confirmed MTBE detections since monitoring began. About 166 (14%) non-transient public systems are estimated to currently have some level of MTBE (including both confirmed and nonconfirmed), and of these about 135 (~81%) have levels below 5 ppb, and 22 (13%) have levels between 5 and 15 parts per billion (ppb).

The primary MCL proposed herein is based on positive carcinogenic effects observed in experimental animals. Positive dose-responses have been observed for both sexes of the rat in a chronic oral gavage study, in male rats of a different strain in a chronic inhalation study, and in male and female mice in an 18-month inhalation study. The DHHS-BHRA concurs with

CalEPA's conclusion that MTBE is an animal carcinogen in two species, both sexes and at multiple sites. As urged by SB70, the DHHS-BHRA reviewed the scientific record that led the state of California to adopt a public health goal of 13 ppb. The DHHS-BHRA believes that MTBE may best be classified according to the 1986 U.S. Environmental Protection Agency's Guidelines for carcinogen risk assessment as having a weight-of-evidence for carcinogenicity on a continuum between a group B2 (probable human carcinogen) and group C (possible human carcinogen). The available studies that have examined genetic toxicity reveal a general lack of evidence for mutagenic or clastogenic activity of MTBE. Upon reviewing the scientific record, the DHHS-BHRA concurs with the California Environmental Protection Agency's (CalEPA's) position that there is currently not sufficient information available to demonstrate that the consistent positive carcinogenic findings observed in laboratory animal studies can be ruled out with confidence as being irrelevant to humans at environmental exposure levels. However, the DHHS-BHRA acknowledges that some of the positive animal tumor responses for MTBE, such as the induction of liver tumors in mice, may eventually be determined in the future to occur as the result of a non-linear mode of action.

The DHHS-BHRA is proposing a primary standard that is derived based on a conservative upper-bound cancer potency estimate, referred to as a Cancer Slope Factor (CSF). The CSF was derived based on procedures described in the most recent proposed 1996 USEPA guidelines for carcinogenic risk assessment, which recommend applying a low dose linear model when there is neither sufficient evidence to support a nonlinear mode of action nor an alternative biological-based model. The DHHS-BHRA used the most recent version of the linearized multistage (LMS) model contained in the program, Tox_Risk Version 4.0. The curve fitting model contained in the LMS program was used to estimate the lower 95% confidence bound on the dose associated with a 10% risk of cancer (LED_{10}). CSFs were calculated for each of the different tumor response data sets based on the LED_{10}. The DHHS-BHRA derived its CSF based on use of the same tumor response data sets that were used by CalEPA to derive their Public Health Goal; however, we differed slightly from CalEPA in that we decided to apply an adjustment to the tumor incidence data to correct for the number of animals alive at the time the first tumor was observed, which resulted in a slightly different CSF value. A CSF of 2.8E-03 per milligrams per kilogram of bodyweight per day $(mg/kg\text{-}day)^{-1}$ was derived by taking the geometric mean of the CSFs estimated for the Leydig Cell tumor response in male rats (Belpoggi et al., 1998), combined leukemias/lymphomas in female rats (Belpoggiet al., 1998), and renal tumors in male rats (Chun et al., 1992). MTBE's true human cancer potency is not likely to be higher than this estimate, and it may be as low as zero, which is the lower bound based on statistical and biological uncertainties.

The USEPA typically sets primary MCLs somewhere within the upper-bound risk range (for a lifetime exposure) of 1E-6 to 1E-04 (USEPA, 1994). The levels in drinking water that correspond to upper-bound risk levels of 1E-06, 1E-05, and 1E-04 are 13 ug/L, 130 ug/L, and 1,300 ug/L, respectively. In the absence of an EPA-established primary MCL, the DHHS-BHRA will typically adopt a criterion protective of a *de minimis* risk level of 1E-06 (one in one million) to evaluate drinking water supplies. The DHHS-BHRA proposes a primary standard of 13 ug/L in drinking water to protect against a *de minimis* theoretical excess lifetime risk of 1E-06 (one in one million). The proposed primary MCL is considered to provide an adequate margin of safety for potential noncancer risk, including adverse effects to the kidneys and nervous system.

The DHHS-BHRA has also derived a criterion of 50 ug/L, based on noncancer critical effects of increased relative kidney weights observed in a subchronic gavage study performed on rats. Upon review of the most relevant noncancer effect studies, the DHHS agrees that adverse effects to the kidneys observed in exposed laboratory animals is the most sensitive noncarcinogenic endpoint. The DHHS-BHRA used the same default exposure parameters (i.e., assume ingestion of 2 liters of water per day (L/day), adult body weight of 70 kg, lifetime exposure) as those conventionally used by USEPA to derive this noncancer-based drinking water criterion. However, the DHHS-BHRA chose to use a relative source contribution factor of 15%, based on our review and estimation of exposure from all sources.

The median MTBE odor and taste thresholds are within the range of 20–40 ppb (µg/L) identified by USEPA (1997) as an approximate threshold for organoleptic properties. USEPA states that this range can be used as advisory guidance to help ensure consumer acceptance of the taste and odor of MTBE in drinking water. At these levels, there will be sensitive individuals in the population who can smell or taste MTBE. The lowest reported geometric mean odor detection threshold was 13.5 ppb (Shen et al., 1997).

We have adopted a secondary MCL of 20 ppb for MTBE based on the lower end of USEPA's recommended odor and taste threshold range of 20–40 ppb. Given the observed median thresholds of 30 and 38 ppb for odor and taste (across studies), respectively, the criterion of 20 ppb is anticipated to protect most of the public from unacceptable aesthetic qualities related to the taste and odor of MTBE in drinking water.

I. Introduction

The chemical, methyl tert-butyl ether (MTBE), has been added to fuels since 1979 at concentrations of 2% to 3% by volume in regular gasoline, and up to 9% by volume in premium gasoline. Under the Clean Air Act (CAA) Amendments of 1990, Congress took steps to reduce certain motor vehicle emissions, which included requirements to change the formulation of gasoline (HEI, 1996).

Beginning in 1992, in an effort to reduce carbon monoxide emissions in areas that exceed the national standard for this pollutant, the CAA Amendments required the use of oxygenated fuel which contains at least 2.7% oxygen by weight. This type of fuel, known as "oxyfuel" was originally required to be used in certain areas for at least four winter months out of the year. One way to achieve this oxygenate requirement is by adding 15% MTBE by volume. New Hampshire reportedly did not participate in the oxyfuel program (DES-ARD, 1999).

Beginning in 1995, the CAA Amendments required certain areas of the country that were furthest out of compliance with the ozone standard to use reformulated gasoline (RFG) year round (HEI, 1996). Other areas with less severe ozone levels could decide to participate in the RFG program, though it was apparently not required. RFG contains at least 2% oxygen by weight, has a reduced content of benzene and other aromatic compounds, and results in limited emissions of total air toxics. Addition of 11% (by volume) of MTBE provides 2% oxygen in gasoline by weight. Since 1995, RFG has been required for use in four southern NH counties, including Strafford, Rockingham, Hillsborough, and Merrimack. However, due to distribution issues it is our understanding that for the most part service stations in most areas of the state have been receiving RFG at least occasionally throughout the year since it became available (NH DES-ARD, 1999).

The large-scale use of MTBE-containing gasoline has resulted in an inadvertent introduction of MTBE contamination to surface and groundwater (Zogorski et al., 1998). Once MTBE enters the groundwater, it spreads more quickly than other components of gasoline (NGA, 1999). MTBE is also substantially more water-soluble than the other common gasoline groundwater contaminants, and is not as likely to adsorb onto soil particles to impede mobility. Therefore, MTBE concentrations will tend to spread at a higher rate when compared to other gasoline components such as benzene, toluene, ethylbenzene, and xylene (BTEX). In groundwater MTBE is reported to biodegrade more slowly compared to the BTEX compounds, which favor its persistence. As such, remediation of MTBE-contaminated sites tends to be more costly and more difficult.

The Department of Health and Human Services Bureau of Health Risk Assessment (DHHS-BHRA) performs evaluations of contaminated private wells and offers recommendations to well owners. The DHHS-BHRA has reviewed available records between 1995 and 1999 in an effort to assess the potential impact MTBE has on private wells since RFG was introduced in New Hampshire (DHHS-BHRA, 1999). A review of records between 1995 and 1999 revealed a general increase in the number of private wells with MTBE detections relative to the total number of wells that BHRA evaluated as the result of some type of organic chemical contamination during this time period. This relative increase led to heightened concerns over the impact that MTBE might have on groundwater resources in our state.

In July 1999 Governor Shaheen signed Senate Bill 70 (SB70), a law intended to address prevention of MTBE contamination of drinking water and groundwater. SB70 reports the general court believes that there is a sufficient threat of groundwater contamination to warrant preventative action in order to protect drinking water supplies and prevent costly remediation of MTBE contaminated groundwater. SB70 further requires that the Department of Environmental Services (DES) in consultation with the Department of Health and Human Services (DHHS) adopt primary and secondary drinking water standards and ambient groundwater quality standards designed to protect the public health. The law urges the state of New Hampshire to examine the scientific record that led California to adopt their public health goal and secondary standard for MTBE in drinking water. It also states that the scientific review and consequent rulemaking to adopt the primary and secondary drinking water standards is to commence no later than January 1, 2000.

The following is a brief account of the history of the MTBE criterion that the DHHS-BHRA has used to evaluate MTBE in drinking water supplies over the years. In 1991 the DHHS-BHRA revised the MTBE drinking water criterion from 200 ppb to 100 ppb, based on available studies at that time (DHHS-BHRA, 1991). In 1997, the DHHS-BHRA revised this criterion to 70 ppb, taking into account additional published scientific findings. In December of 1997 the U.S. Environmental Protection Agency (USEPA, 1997a) issued recommendations to keep levels of MTBE contamination in the range of 20 to 40 ppb or below to protect consumer acceptance of the water resource and to provide a large margin of exposure (safety) from toxic effects (U.S. EPA, 1997a). This EPA Consumer Advice was not comparable to a drinking water standard as it is not an enforceable value. Available information suggests that MTBE may not undergo proposed rulemaking at the federal level to derive a drinking water standard until as late as the year 2010 (NHDES, 1999).

This report is intended to address portions of SB70 related to establishing allowable MTBE levels in drinking water by proposing: 1) a health-based primary drinking water standard for MTBE, and 2) a secondary standard for MTBE to protect against potential adverse taste and odor properties.

II. Chemical and Physical Properties of MTBE

Chemical Name:	Methyl tert-Butyl Ether (MTBE)
CAS Registry No.:	1634-04-4
Chemical Formula:	C5H12O
Chemical Structure:	CH3 CH3 --- C --- O --- CH3 CH3
Molecular Weight:	88.15 grams/mole
Water Solubility:	4.8 grams/100 grams water (48 grams/L)
Log Kow:	1.24
Vapor Pressure at 25^{o} C:	245 mm Hg
Air Unit Measurement Conversion Factors (at 25^{o}C)	1 ppm = 3.61 mg/m^3 1 mg/m^3 = 0.28 ppm

III. Levels in NH Drinking Water Supplies

One source reports that as of 1990, there were approximately 188,829 private wells in NH, and that over one third of NH households rely on private well water as their drinking water source (Stone et al., 1995). Nearly two-thirds of the NH households (303,910) were reported to rely on municipal public water at that time, with over one third of this public water originating from groundwater.

The large-scale use of MTBE-containing gasoline has led to the inadvertent introduction of MTBE to surface and ground waters. A report recently released by an EPA panel, known as the Blue Ribbon Panel, states that the use of MTBE in the RFG program has resulted in detections of MTBE in drinking water, with between 5 percent and 10 percent of community drinking water supplies in high oxygenated use areas showing at least detectable amounts of MTBE (U.S. EPA, 1999c).

A fact sheet released by the USGS in April of 1997 reported results for groundwater samples collected in the area of the Connecticut, Housatonic, and Thames River Basin between 1993 and 1995 as part of the National Water Quality Assessment (NAWQA) program (USGS, 1997). This effort involved sampling a mix of rural and urban locations in a number of New England states, including western NH. The USGS reported that MTBE was the most frequently detected VOC, and was present in 25% of all wells sampled. Sixty nine percent of MTBE detections were in shallow monitoring wells within one-quarter mile of gasoline stations or other known underground storage tanks (USGS fact sheet). However, they report that a substantial number (31%) of MTBE detections were in shallow wells that were not near gas stations, which when taken together with other findings led USGS to conclude that most MTBE detections in their study could not be attributed to gasoline leaks and spills.

More recently, in October of 1998 the state of Maine released a report which included MTBE test results for 951 randomly selected household wells and other household water supplies, and 793 regulated nontransient public water supplies. They reported 150 (or 16%) out of 951 private wells tested had some level of MTBE detected. Approximately 92% of the private wells tested either had no detectable levels or less than 1 ppb. About 7% of the wells tested were between 1 ppb and 35 ppb. Only 1 % of these wells contained levels of MTBE above Maine's established drinking water standard of 35 ppb (ME DHS-BOH & DEP-BWMR, 1998).

As mentioned above, the DHHS-BHRA administers a program which evaluates test results for private wells and issues recommendations as a service to the public. A tally was done on the number of private wells evaluated between 1995 and 1999 to determine how many wells contained some detectable amount of MTBE. This data set is biased towards finding detections of MTBE since it focuses on samples collected in the vicinity of known point sources such as sites with leaking underground storage tanks (LUST's). An increase in the number of private wells with some detectable level of MTBE is observed over time, with there being 38, 51, 76, 100, and 145 wells with some level of MTBE for the years 1995, 1996, 1997, 1998, and 1999, respectively. Because the number of positive samples will likely depend on the level of sampling efforts in any given year, and these efforts may vary from year to year, it is difficult to determine the significance of this finding. However, despite these possible limitations, this trend has generally led to increasing concerns.

According to a draft table compiled in November of 1999 by the NH Water Division, a total 1,150 non-transient (NT) public water supply systems exist. The draft table reports that 243 NT public water systems (21%) had some level of MTBE detected at some time in the past. Of these, only 154 detections were confirmed (13% of the total NT public systems) and some are now below detection. About 77 systems have been shown to more recently drop below the detection limit, indicating only 166 (14%) would currently have some level of MTBE. Of these 166 systems with detects, 135 (~81%) have levels below 5 ppb, and 22 (13%) have levels between 5 and 15 ppb. Only nine NT systems (~5%) were observed to be above 15 ppb, and one of these nine was found to exceed the current DES Ambient Groundwater Quality Standard of 70 ppb (this system is now inactive) (NH DES WSEB, 1999).

IV. <u>Toxicological Studies – Hazard Identification</u>

This report is not intended to provide an in-depth detailed review of all of the toxicology studies published for MTBE, as these types of reviews have already been completed by a number of different agencies (ATSDR, 1998; NSTC, 1996, 1997; HEI, 1996; CalEPA, 1999). The focus of this report will be to review and evaluate the most critical studies that directly impact the process of deriving a health-based drinking water advisory level for this compound.

IV.A Noncancer Effects

IV.A.1 Systemic Effects

Toxicological studies of the effects of exposure to MTBE include studies of the noncancer effects. Studies with MTBE by oral and inhalation exposure have identified different NOAELs (No Observed Adverse Effect Levels) and LOAELs (Lowest Observed Adverse Effect Levels). An extensive list of these values is available (ATSDR, 1998). A summary of the NOAELS by toxic endpoint is presented in Table 1. While there have been few animal studies by the oral route of exposure, there have been more which have assessed toxicity to MTBE by inhalation.

Robinson et al. (1990) studied subacute and subchronic toxicity of MTBE in Sprague-Dawley rats. In the subchronic study, rats were exposed to MTBE by gavage for 90 days. Animals were exposed to either corn oil (control) or to one of four daily doses of MTBE (100, 300, 900, 1200 mg/kg). All rats were observed daily for physiological and behavioral responses and for mortality. Animals were sacrificed at the end of the study to observe subchronic toxic endpoints. Body weights were decreased in a dose-dependent manner. In female rats, liver weights increased in a dose-dependent manner and kidney weights were heavier for the 300, 900, and 1200 mg/kg dose groups when compared to controls. Male rats at higher doses also had heavier liver and kidney weights when compared to controls. Rats receiving the highest dose of MTBE also showed anesthesia following dosing. Chronic nephropathy was evident in both control and experimental male rats, though tubular degenerative changes were more evident in treated rats. The mean blood urea nitrogen (BUN) values in treated female and male rats were significantly lower than in controls; female rats at doses of 300 and above also showed decreases in calcium and glucose. Increases in serum cholesterol levels were significant in treated female rats when compared to controls. A NOAEL of 100 mg/kg/day was identified based on absence of adverse kidney effects, and a LOAEL of 300 mg/kg/day was identified.

Dodd and Kintigh (1989) performed a subchronic inhalation study on Fischer 344 rats to observe toxic effects. They administered MTBE to 25 rats per sex per group for 13 weeks (6 hours/day, 5 days/week) at concentrations of 0, 800, 4000 or 8000 ppm. The rats exposed to 4000 ppm MTBE displayed slight hematological changes. The rats exposed to 8000 ppm experienced hematological changes and had significantly increased cortisone levels. Also, concentration-related increases in relative weights of liver, kidney, and adrenals were observed and found to be significant at ≥4000 ppm. Decreased absolute brain weights in both sexes were also found in rats exposed to 8000 ppm MTBE (Dourson and Felter, 1997). A NOAEL of 800 ppm was identified in this study.

Chun et al. (1992) performed a longer-term inhalation study on Fischer 344 rats. Fifty rats per sex per group were exposed to 0, 400, 3000, or 8000 ppm MTBE vapors for 6 hours/day, 5 days/week for 24 months. In male rats exposed to 8000 ppm MTBE, ataxia, swollen periocular tissue, glomerulosclerosis and chronic, progressive nephropathy was increased over controls. Nephropathy was the main cause of death in male rats in the 3000 and 8000 ppm groups. These groups had to be sacrificed early, at 97 and 82 weeks, respectively. A 400 ppm NOAEL was determined for male rats for interstitial nephritis, tubular proteinosis and glomerulosclerosis. While survival times did not differ significantly for female rats, they also displayed ataxia, swollen periocular tissue, glomerulosclerosis, and prostration. Exposed female rats also had increased relative and absolute liver and kidney weights, and increased severity of particular renal lesions. A NOAEL of 400 ppm was determined for female Fischer 344 rats for chronic exposure to MTBE by inhalation (USEPA IRIS file for MTBE, last revised 1993).

Burleigh-Flayer et al. (1992) conducted a chronic inhalation study of MTBE using CD-1 mice. Fifty mice per sex per group were exposed to 0, 400, 3000, or 8000 ppm MTBE for 6 hours/day for 5 days/week for 18 months. The authors reported that male mice from the highest group had an increased mortality rate, likely due to a higher occurrence of obstructive uropathy. Absolute and relative adrenal weights were increased for high exposure male mice and absolute and relative kidney weights were increased in the lower and mid-exposure groups but a concentration-response relationship was not observed. Effects noted solely in female mice include increased absolute and relative spleen weights and prostration in the high-exposure group. Both sexes had increased incidence of hepatocellular hypertrophy, decreased absolute brain and body weights, increased kidney and liver weights, and ataxia. The identified NOAEL was 3000 ppm based on significantly increased absolute and relative liver weights, increased anesthetic effects, and decreased body weights (USEPA IRIS file for MTBE, last revised 1993).

IV.A.2 Developmental Effects

Developmental toxicity studies in laboratory animals have been conducted to evaluate MTBE exposure via inhalation and include studies by Greenough et al. 1980, Conaway et al. 1985, Bio/dynamics 1984, Tyl and Neeper-Bradley 1989, Tyl 1989, Neeper-Bradley 1991, Biles et al. 1997, Beven et al. 1997, Chun et al. 1992, and Burleigh-Flayer et al. 1992.

Multiple studies on different species were conducted where animals were exposed to MTBE by inhalation during gestation. Exposure of rats or mice to MTBE vapor for 10 days during gestation did not produce developmental effects at or below 2500 ppm. Exposures at 8000 ppm increased post-implant loss, reduced live litter size and altered sex ratio in some 10-day gestational studies (Neeper-Bradley, 1989) but not others (Conaway et al., 1985; Bio/dynamics, 1984). A study in rats by Conaway et al. (1985) did not find adverse developmental effects at or below 2500 ppm (the highest dose), when animals were exposed during days 6-15 of gestation. Exposure of rabbits during gestational days 6-15 to doses of up to 8000 ppm were not reported to affect development of fetuses, though fetal malformations were not assessed. Conaway et al. (1985) also exposed CD-1 mice to doses of 0, 250, 1000, and 2500 ppm MTBE for 10 gestational days. The markers for developmental effects, including percentage of resorption, percentage of live fetuses, crown-rump distances, external malformations and soft-tissue malformations, were not noted below 2,500 ppm (ATSDR, 1998).

The lowest NOAEL reported in a subchronic developmental study was 300 ppm in a study by Biles et al. (1987). Female Sprague-Dawley rats were exposed 0, 300, 1240, and 2980 ppm MTBE 6 hours/day, 5 days/week for 16 weeks. A NOAEL of 300 ppm and a LOAEL of 1240 ppm was identified based on decreased pup viability in F1b litters.

Neeper-Bradley (1991) exposed Sprague-Dawley rats to 400, 3000 or 8000 ppm MTBE for 10 weeks prior to mating, 3 weeks during gestation, and 3 weeks during the postnatal period. The total number of live and stillborn F_1 or F_2 litter sizes and sex ratios were not affected by exposure to MTBE, but significant weight reductions were observed in F_2 pups from the 3000 and 8000 ppm groups, giving a NOAEL of 400 ppm for pup weight reduction in Sprague-Dawley rats in this study.

IV.A.3 Reproductive Effects

Reproductive effects were also studied in multiple species, and adverse reproductive effects were not observed in most inhalation studies. Acute inhalation exposure to MTBE did not lead to definitive reproductive toxicity in experimental animals. The Agency for Toxic Substances and Disease Registry (ATSDR) concluded in their toxicology review (ATSDR, 1998) that long-term exposure studies (16-28 weeks) in rats showed no structural effect on the reproductive system or effect on performance of male and female rats. However, reproductive effects were observed in one inhalation study (Moser et al., 1996, 1998) in which B6C3F1 mice were exposed to either 0 ppm or 8000 ppm MTBE for 21 days (5 days/week, 6 hours/day). Reduced absolute and relative ovary and uterine weight, and altered histopathology of the uterus, cervix and vagina were observed (CalEPA Dev. and Repro. Tox, 1998).

Non-cancer reproductive effects were not observed in the animal studies in which animals received MTBE doses by oral administration (Belpoggi et al., 1995; ITT Research Institute, 1992; Robinson et al., 1990; and Ward et al., 1994). A 90-day treatment with daily oral doses of 100–1200 mg/kg/day had no significant effect on reproductive tissue, neither did daily oral administration of 357–1428 mg/kg/day administered in rats for 14 days. Doses of 1750 mg/kg/day MTBE for 4 weeks also did not produce effects on reproductive tissue.

IV.A.4 Neurological Effects

Neurological effects related to MTBE exposure have also been published. The results of animal studies suggests a lower NOAEL for neurological effects than for developmental and reproductive effects (see Table 1). Several studies in mice (Chun and Kintigh, 1993; Vergnes and Chun, 1994; Burleigh-Flayer et al., 1992) and rats (Bioresearch Labs, 1990; Chun and Kintigh, 1993; Neeper-Bradley, 1991; and Chun et al., 1992) have found NOAELs associated with neurological effects due to inhalation of MTBE at 400 ppm. A discussion of the study results has been published elsewhere (ATSDR, 1998). Briefly, the studies found that neurological effects occurring above 400 ppm MTBE inhalation exposure include ataxia, hypoactivity and lack of startle response.

Neurological effects have not been well characterized via the oral route of exposure. Robinson et al. (1990) noted a profound but transient anesthesia in Sprague-Dawley rats exposed to MTBE by gavage, which subsided in two hours. ITT Research Institute (1992) also noted that hypoactivity and/or ataxia was associated with MTBE exposure, but that this also subsided. No long-term studies by oral administration report significant long-lasting neurological effects of exposure to MTBE.

There have also been studies of the neurological effects of MTBE by inhalation exposure in humans. These studies have concentrated on self-reported outcomes such as headaches, dizziness, and feeling of spaciness or disorientation. Cain et al. performed a double-blind study in 1994 to assess the effects of MTBE inhalation (vs. clean air) exposure to 22 healthy men and 21 healthy women. They were exposed to 1.7 ppm MTBE for 1 hour on day 1, to uncontaminated air for 1 hour 2 days later, and to 7.1 ppm of a 17-component mixture of VOCs for 1 hour 2 days later. Prah et al. performed a similar study in 1994 where 19 healthy men and 18 healthy women were exposed to 1.39 ppm MTBE for 1 hour and clean air for 1 hour in separate sessions. While the subjects likely knew that they were being exposed (due to the odor of MTBE), no statistical differences were found for headache, difficulty remembering things or concentrating, unusual tiredness, fatigue or drowsiness, dizziness, mental fatigue and pain or numbness in the hands or wrist (ATSDR, 1998). Blinded studies with higher levels of inhalation have not been performed.

Table 1. Lowest No Observed Adverse Effect Levels (NOAELs) for
MTBE Animal Studies (As reported in ATSDR, 1998 and USEPA IRIS, 1993)

Target Organ	Exposure Route/Length	Species	Study	Type of Effect	NOAEL
Systemic	Oral/ Subchronic	Sprague-Dawley rats	Robinson et al. 1990[a]	Effects to the kidneys, including increased kidney weights	100 mg/kg/day
Systemic	Inhalation/ Chronic	Fischer 344 rats	Chun et al. 1992	Increased liver and kidney weights (F), swollen periocular tissue (M and F)	400 ppm
Developmental	Inhalation/ Acute	CD-1 mice	Conaway et al. 1985	No significant clinical changes observed	2500 ppm (highest dose)
Developmental	Inhalation Subchronic	Sprague-Dawley rats	Biles et al. 1987		300 ppm
Developmental	Inhalation/ Subchronic	Sprague-Dawley rats	Neeper-Bradley 1991	Reduced F1 and F2 pup weights	400 ppm
Reproductive	Inhalation	B6C3F1 mice	Moser et al. 1998	Reduced ovary and uterine weights (absolute and relative)	(no dose below 8000 ppm)
Reproductive	Inhalation	Sprague-Dawley rats	Grennough et al. 1980	None noted	1000 ppm (highest dose)
Neurological	Inhalation/ Subchronic, Chronic	Rats	Chun and Kintigh 1993, Neeper-Bradley 1991, Chun et al. 1992	Ataxia, hypoactivity lack of startle response	400 ppm

F = Females M = Males

a. Decrease in BUN levels were observed in all treated groups, including the low dose group, however, this effect did not show a dose-related trend.

IV.B Genetic Toxicity

The majority of mutagenicity assays for MTBE have yielded negative results (ATSDR, 1996). However, a limited number of mutagenicity tests have reported positive findings (Lee et al., 1998; Mackerer et al., 1996). Certain federal agency reviews, such as one by ATSDR (1996), report that MTBE has little or no genotoxic activity. A more comprehensive description of these various mutagenicity tests can be found in the ATSDR Toxicological Profile for MTBE (1996). Mutagenicity tests for MTBE include a variety of *in vivo* and *in vitro* assays.

IV.B.1 In Vivo Assay Results

In vivo assays that have yielded negative results included:

- Sex-linked recessive lethal assay using Drosophila melanogester (McKee et al., 1997; ATSDR, 1996);
- Bone marrow chromosomal aberration assay in F-344 rats exposed by inhalation (McKee et al., 1997; ATSDR, 1996);
- Chromosome aberration assay in Sprague-Dawley rats exposed by oral route (ATSDR, 1996);
- Chromosome aberration assay in CD-1 mice exposed by oral route (ATSDR, 1996)
- HPRT mutant frequency in lymphocytes of CD-1 mice exposed orally (ATSDR, 1996);
- Micronuclei formation in erythrocytes in CD-1 mice exposed by inhalation (McKee et al., 1997; ATSDR, 1996);
- Unscheduled DNA synthesis in hepatocytes of CD-1 mice exposed by inhalation (McKee et al., 1997)

MTBE produced equivicol results for sister chromatid exchange in Chinese hamster ovary cells with activation (ATSDR, 1996). A separate positive *in vivo* test result was observed in the comet assay in rat lymphocytes, which reported a significant increase in DNA strand breakage at the highest dose group exposed by gavage to 800 mg/kg (Lee et al., 1998). In this same assay Lee et al. also measured apoptosis in lymphocytes and reported an increased percentage (though not statistically significant) in apoptotic comets in MTBE treated rats. Interestingly, one study in humans looked at abnormal apoptosis and cell cycle progression in subjects exposed to MTBE and benzene contaminated water, and reported a statistically increased rate of apoptosis in 80.5% of the exposed individuals over the nonexposed control group (Vojdani et al., 1997). Because this increase was observed in subjects exposed to both MTBE and benzene, it is not possible to attribute this observed effect to MTBE.

IV.B.2 In Vitro Assay Results

Negative results have been reported in the following *in vitro* mutagenicity assays:

- Reverse mutation in the Ames assay using five different strains of *S. typhimurium* with and without metabolic activation (Cinelli et al., 1992)

- Induction of gene mutation in Chinese hamster v79 fibroblasts with and without metabolic activation (Cinelli et al., 1992)
- Unscheduled DNA synthesis in rat hepatocytes (Cinelli et al., 1992)
- Gene mutation assay in *S. cerevisiae* with and without metabolic activation (ATSDR, 1996)

The only positive *in vitr*o result was for forward mutations in the mouse lymphoma assay with exogenous activation (Mackerer et al., 1996; ARCO, 1980 as cited in ATSDR, 1996). Mackerer et al. performed some modifications to this assay to assess whether the observed positive response in the presence of activation may be attributable to generation of formaldehyde, and the authors concluded that metabolite, formaldehyde, is responsible for the positive activity seen with MTBE in this assay.

Casanova and Heck (1997) further investigated the involvement of formaldehyde as a metabolite of MTBE in the positive liver tumor response observed in the CD-1 mouse inhalation bioassay (described in section IV.C.2.a below). This study assessed (*in vitro*) the ability of formaldehyde to cause DNA protein cross links (DPX) and RNA forming adducts (RFA) at concentrations that were estimated to be in the range of those that produced a positive liver tumor response *in vivo*. The authors concluded that the metabolism of MTBE to formaldehyde is slow relative to the rate of formaldehyde oxidation, resulting in only a small amount of covalent binding of formaldehyde to DNA and RNA, but relatively large amounts of metabolic incorporation of 14-C into RNA. They report that because the observed DPX and RFA yields were very small and did not show a positive concentration-related response, this argues that the metabolism of MTBE to formaldehyde is not a critical component of its carcinogenic mechanism in mice.

Based upon the above considerations, overall the results for MTBE were mostly negative for genotoxicity. However, the DHHS concurs with CalEPA's comment that most of the *in vivo* mutagenicity test systems were designed to assess chromosomal damage, rather than gene mutations, and further study may be warranted to address gene mutation *in vivo*.

IV.C Cancer Effects

USEPA follows specific guidelines for carcinogen risk assessment to provide a weight of evidence conclusion and USEPA classification of compounds evaluated. Data relevant to the carcinogenicity of a compound include tumor data from human and animal studies. Other information includes structural analog data, physicochemical properties, structure-activity relationships, comparative metabolism and toxicokinetics. Ideally, the mode of action of a chemical is known, but often a weight of evidence conclusion must be made without complete knowledge of the carcinogenic action of a compound. There have not been good human epidemiological studies that evaluated MTBE, but numerous animal studies have been performed in the mouse and rat, which resulted in increased tumors in these species. Below is an overview of the individual animal studies of MTBE toxicity related to cancer effects, and a discussion of the strengths and weaknesses associated with each. Strengths and weaknesses are further discussed in section V.B.6, table 7.

One oral and two inhalation studies, and subsequent evaluations of these studies, have examined the tumor incidence in rodents after administration of MTBE (Belpoggi et al., 1995, 1997, and 1998; and Bird et al., 1997 which reports the results of 1992 studies by co-authors Burleigh-Flayer and Chun).

IV.C.1 Oral Studies

Belpoggi et al. performed carcinogenicity studies for MTBE by oral administration (Belpoggi et al., 1995, 1997, 1998). Sprague-Dawley rats were administered MTBE in olive oil by gavage. Doses were administered 4 days/week for 104 weeks and animals were maintained until natural death. There were 60 rats per sex per dose level, and doses were 0, 250 and 1000 mg/kg body weight/day. They found a significant increase in Leydig cell testicular cancer in male rats (Table 2) and an increased incidence of lymphomas and leukemias in female rats (Table 3). Each endpoint will be discussed separately.

IV.C.1.a Testicular Tumors

In the 1995 Belpoggi et al. study, the highest dosed group had a significantly higher incidence of Leydig cell testicular tumors. One weakness in this study is related to the observed survival in the highest dose group. At 88 weeks, survival was approximately equal among the different groups; at 104 weeks, the highest dose group had higher survival. At 96 weeks of age, when the first Leydig cell tumor was observed, we have to assume that there was already higher survival among the rats in the highest dose group. A National Research Council report (NRC, 1996) criticized the 1995 Belpoggi et al. study, noting that the higher dosed rats had a higher survival, and as such they were more likely to develop late-appearing Leydig testicular tumors, regardless of the contribution of MTBE. Also, the NRC report criticizes the characterization of the tumors. Belpoggi et al. did not describe the criteria used for diagnosis of the tumors in 1995, and the NRC suggested an independent review of the pathology of the lesions.

Table 2: Testicular tumors in Sprague-Dawley rats, Belpoggi et al., 1995, 1998

Dose	Survival	Testes	
Mg/kg body weight/day		Leydig cell testicular tumors (Belpoggi et al., 1995)	Leydig interstitial cell adenomas (Belpoggi et al., 1998)[d]
0 (olive oil)	104 weeks: 30% 120 weeks: 11%	2/26[a] 7.7%	3/26[a] 11.5%
250	104 weeks: 30% 120 weeks: 11%	2/25[a] 8.0%	5/25[a] 20.0%
1000	104 weeks: 43% 120 weeks: 32%	11/32[a] 34.4% difference is significant ($p<0.05$)[b]	11/32[a] 34.4% difference is significant ($p<0.05$)[c]

[a] Number of lesion-bearing animals/total alive at 96 weeks of age, when the first Leydig cell tumor was observed.
[b] Authors reported incidence as significant at p=0.05 using prevalence analysis for nonlethal tumors.

[c]Significant increase ($p<0.05$) compared to controls, as indicated by Fishers exact test.
[d]Significant increased trend ($p<0.05$) by Mantel-Haenzel trend test.

In response to the suggestion to conduct an independent pathologic review, Belpoggi et al. had several pathologists at the Bentivoglio Cancer Research Centre, as well as an independent pathologist, review the specimens using diagnostic criteria used by the National Toxicology Program (NTP). The results of this re-evaluation confirmed the initial findings and are reported in Table 2 above (Belpoggi et al., 1998). A dose-response relationship was again observed, the results reached statistical significance, thereby providing more confidence in the conclusions drawn. Based on the work of Belpoggi et al., MTBE may be responsible for Leydig tumor formation in male Sprague-Dawley rats.

IV.C.1.b Lymphomas and Leukemias

Belpoggi et al. also found an increased incidence of lymphomas and leukemias (combined) in female Sprague-Dawley rats after administration of MTBE.

Table 3: Lymphoma and leukemia tumors in Sprague-Dawley rats, Belpoggi et al. 1995, 1998

Dose	Survival	Hemolymphoreticular tissues (including mesenteric lymph nodes)		
Mg/kg body weight/day (in 1 mL extra virgin olive oil)		Lymphomas and leukemias (Belpoggi et al., 1995)	Dysplastic proliferation of lymphoreticular tissue (Belpoggi et al., 1995)	Lymphomas and leukemias of lymphoid origin (Belpoggi et al., 1998)[d]
0 (olive oil)	56 weeks: 98% 88 weeks: 76%	2/58[a] 3.4%	1/60[b] 1.7%	2/58[a] 3.4%
250	56 weeks: 85% 88 weeks: 60%	6/51[a] 11.8% difference is significant (p<0.01)	15/59[b] 25.4%	7/51[a,c] 13.7%
1000	56 weeks: 78% 88 weeks: 43%	12/47[a] 25.5% difference is significant (p<0.01)	9/59[b] 15.3%	12/47[a] 25.5% difference is significant (p<0.01)

[a] Number of lesion-bearing animals/total alive at 56 weeks of age, when the first leukemia was observed.
[b] Number of lesion-bearing animals/total alive at 26 weeks of age, when the first dysplastic proliferation of lymphoreticular tissue was observed.
[c]Marginally significant increase (p=0.05) compared to controls, as indicated by Fishers Exact test.
[d]Significantly increased trend by (p<0.001) by Mantel-Haenzel trend test.

Survival decreased and incidence of lymphomas and leukemias increased with increasing doses of MTBE. The NRC criticized the choice of doses and the conclusions of the study; they argued that the exposure levels probably exceeded the maximum tolerated dose (MTD) as decreased survival was attributable to the toxic effects of MTBE (NRC, 1996). No increase in these tumors was found in male rats where the MTD was not attained. The 1998 re-evaluation results (subsequent to second pathologic interpretation) are also reported in Table 2. While it does appear that there was also overt toxicity, the dose-response increase in lymphomas and leukemias argues for carcinogenic action of MTBE. Another observation is the dysplastic proliferation of lymphoreticular tissue, which is lowest in the highest dose. It is suggested that these dysplastic proliferations may have developed into lymphomas and leukemias in the female rats exposed to the higher dose (Belpoggi et al., 1995). Observations of benign neoplasias may be considered to add to the weight of evidence of carcinogenicity according to USEPA (1996). If these lesions lead to malignant tumors, then they are important to consider. The study results indicate that, while the doses may be high, MTBE exposure may increase the incidence of lymphomas and leukemias in female Sprague-Dawley rats.

IV.C.2 Inhalation Studies

IV.C.2.a Hepatocellular Tumors

Burleigh-Flayer et al. (1992) and Bird et al. (1997) performed a long-term inhalation study of MTBE in CD-1 mice. The study included 50 CD-1 mice per sex per dose exposed to MTBE vapor by inhalation for 6 hours per day, 5 days a week for 18 months. The doses used were 0, 400, 3000 and 8000 ppm. An increased incidence of hepatocellular carcinoma in male mice (Table 4) and an increased incidence of combined hepatocellular adenomas and carcinomas in female mice (Table 5) were observed.

Table 4: Hepatocellular tumors in male CD-1 mice (Burleigh-Flayer et al., 1992) As reported in Bird et al. 1997, CalEPA, 1999

Dose (ppm)	Hepatocellular adenoma	Hepatocellular carcinoma[d]	Hepatocellular adenoma and carcinoma (combined)[e]
0	11/47[a] 23%	2/42[b] 5%	12/47[a] 26%
400	11/47[a] 23%	4/45[b] 9%	12/47[a] 26%
3000	9/46[a] 20%	3/41[b] 7%	12/46[a] 26%
8000	12/37[a] 32%	8/34[b, c] 24% difference is significant ($p<0.05$)	16/37[a] 43%

[a] Number of lesion-bearing animals per total alive at 49 weeks, when the first hepatocellular adenoma was found.
[b] Number of lesion-bearing animals per total alive at 63 weeks, when the first hepatocellular carcinoma was observed.
[c] Incidence relative to control group was significant by the Fisher Exact test ($p<0.05$).
[d] Significantly increased trend by ($p<0.01$) by Mantel-Haenzel trend test.
[e] Significantly increased trend by ($p<0.05$) by Mantel-Haenzel trend test.

Table 5: Hepatocellular tumors in female CD-1 mice (Burleigh-Flayer et al., 1992) As reported in Bird et al. 1997, CalEPA, 1999

Dose (ppm)	Hepatocellular adenoma[c]	Hepatocellular carcinoma	Hepatocellular adenoma and carcinoma (combined)[c]
0	2/50	0/50	2/50
400	1/50	1/50	2/50
3000	2/50	0/50	2/50
8000	10/50[a] difference is significant ($p<0.05$)	1/50	11/50[b] difference is significant ($p<0.01$)

[a] Incidence relative to control group was significant by the Fisher Exact test ($p<0.05$).
[b] Incidence relative to control group was significant by the Fisher Exact test ($p<0.01$).
[d] Significantly increased trend by ($p<0.01$) by Mantel-Haenzel trend test.

Male CD-1 mice were found to have a significant increase (24 percent overall, $p<0.05$) in hepatocellular carcinoma when adjusted for early mortality (using the number of mice alive at the time when the first tumor was observed). When unadjusted, there was an increase in combined adenomas and carcinomas at the highest dose that was not statistically significant from the control group and that was similar to the reported historical incidence of 33 percent. When adjusted for early mortality, a dose-response relationship was observed which supports the hypothesis that MTBE causes an increase in hepatocellular carcinomas in male CD-1 mice. Below this dose (i.e., 8,000 ppm), a dose-response relationship was not observed for hepatocellular carcinomas in male mice.

Mortality was increased, survival time was decreased, and body weight gain was decreased in the high-dose male mice compared to the control mice. These indicate that the MTD was exceeded with the highest dose. Another criticism of the Burleigh-Flayer study is that it was conducted for 18 months as opposed to the standard 24 months (NRC, 1996). While a longer study may have given more data on late-developing tumors (such as Leydig cell tumors), it appears that hepatocellular tumors develop soon enough to observe the effect of MTBE exposure. As discussed later in sections V.B.5 and V.B.7.f, a duration of 18 months is still considered to represent a major portion of the lifespan for mice, and is therefore considered sufficient duration to meet the requirement for assessing tumor incidence.

Female CD-1 mice in the highest dose group had a significant increase in combined hepatocellular adenomas and carcinomas. In female mice, it was hypothesized that the increase in tumors was not due to a direct DNA acting phenomenon. It has been suggested that anti-estrogenic effects of MTBE may be responsible for liver tumor promotion in the female mice. A non-genotoxic mechanism to explain chemically induced mouse liver tumors may also be increased cell proliferation (Bird et al., 1997). Regarding the study duration of 18 months, had the study been allowed to continue past 18 months to say, 24 months, it is possible that some adenomas in females may have progressed on to carcinomas.

IV.C.2.b Renal and Testicular Tumors

Chun et al. (1992) and Bird et al. (1997) also performed a long-term inhalation study with F-344 rats. These rats were exposed to MTBE by inhalation for 24 months at dose levels of 0, 400, 3000 and 8000 ppm MTBE vapor in air. Fifty rats per sex group were randomly assigned to dose groups and were exposed for 6 hours a day, 5 days per week. Increased incidence of renal cell tumors and testicular tumors were found in male rats of the higher dosed groups. The results are listed in Table 6 for male F-344 rats.

Table 6: Renal tumor incidence for male F-344 rats (Chun et al., 1992) As reported in Bird et al., 1997, CalEPA, 1999				
	Kidney Tumors			Testicular tumors
Dose (ppm)	Renal tubular adenoma	Renal tubular carcinoma	Renal tubular adenoma and carcinoma combined	Leydig interstitial cell tumors
0	1/35 [a] 3%	0/35 [a] 0%	1/35 [a] 3%	32/50 64%
400	0/32 [a] 0%	0/32 [a] 0%	0/32 [a] 0%	35/50 70%
3000	5/31 [a] 16%	3/31 [a] 10%	8/31 [a,b] 26% difference is significant ($p<0.01$)	41/50 [c] 82% difference is significant ($p<0.05$)
8000	3/20 [a] 15%	0/20 [a] 0%	3/20 [a,e] 15%	47/50 [d] 94% difference is significant ($p<0.001$)

[a] Survival-adjusted tumor incidence rates were used to control for excess early mortality (CalEPA, 1999)
[b] Incidence relative to control group was significant by Fisher Exact test ($p<0.01$)
[c] Incidence relative to control group was significant by the Fisher Exact test ($p<0.05$)
[d] Incidence relative to control group was significant by the Fisher Exact test ($p<0.001$)
[e] Early mortality may have influenced tumor incidence.

The MTD was exceeded for male rats in the Chun et al. study. Mortality was increased and the 3000 and 8000 ppm dose groups were terminated early (at weeks 97 and 82, respectively). The major cause of death in males from these groups was chronic progressive nephropathy. The frequency of nephropathy in exposed females was increased to a lesser degree than for males. Renal cell tumors were increased in male rats in the 3000 ppm, but not the 8000 ppm dose group. The absence of an observed increase in renal tumors in the 8,000 ppm dose group is likely related to decreased survival observed in these animals (see section V.B.8 for further discussion).

The way that MTBE interacts to produce renal cell tumors in male rats is not understood, but one mechanism by which kidney damage may be induced is through interaction with α2u-globulin, a protein synthesized in male rats. Humans do not make this protein; therefore, carcinogenicity through this route should not be considered when determining human risk. The USEPA (1991) identified three criteria for determining whether α2u-globulin is the cause of kidney tumors in male rats:

1. An increased number and size of hyaline droplets must be observed in renal proximal tubules of treated rats.
2. The accumulating protein in the droplets must be α2u-globulin.
3. Additional aspects of lesions associated with α2u-globulin must be present.

Chun et al. did observe a protein accumulation in the tubular epithelial cells, but both control and exposed rats showed similar α2u-globulin activity. Prescott-Matthews (1997, 1999) demonstrated that MTBE interacts with α2u-globulin *in vivo* and that MTBE causes a mild induction of α2u-globulin nephropathy. While these data may be suggestive of an α2u-globulin pathway for renal cell tumors, USEPA concluded that the three criteria were not fully met and that the mechanism of action of MTBE kidney carcinogenesis is still unknown (USEPA, 1997). Chun also noted that female rats, which do not produce α2u-globulin, also had some increases in nephropathy in the 3000 and 8000 ppm dose groups. So, while a pathway involving α2u-globulin may be present, it does not fully explain the kidney damage to rats. Based on the observed results in female F-344 rats, some damage to the kidney may be attributable to MTBE by a pathway other than α2u-globulin.

Chun et al. also observed higher incidence of interstitial cell adenomas of the testes in the 3000 and 8000 ppm dose groups. This tumor is frequently observed in aging male rats in the range of 64 to 94 percent (Bird et al., 1997). The laboratory's previous control values were 86 percent and 91 percent; in this study they observed a control value of 64 percent for this tumor. There is a question of whether the significant increase in tumors was exposure related. The exposed groups' incidences were within the range of historical control values, but they were significantly elevated when compared to the controls in this experiment. The USEPA states that, "Statistically significant increases in tumors should not be discounted simply because incidence rates in the treated groups are within the range of historical controls or because incidence rates in the concurrent controls are somewhat lower than average. Random assignment of animals to groups and proper statistical procedures provide assurance that statistically significant results are unlikely to be due to chance alone" (USEPA, 1996). While animals were randomly assigned to dose groups, these data should be considered cautiously. The testicular tumors were statistically significant in this study, but perhaps they are not biologically significant, due to the historically high incidence of testicular tumors in these rats.

In summary, multiple sites of tumor formation in multiple species exposed to MTBE have been observed in the studies conducted to date. While each of the studies has its strengths and weaknesses, we must balance the results to evaluate the carcinogenic effects of MTBE. One way to do this would be to examine the studies and conclude that the most compelling study should be used as an estimate of carcinogenicity. Another approach would be to average results across studies to determine the overall risk of tumor formation from MTBE. It is imperative to have confidence in the study outcomes in order to quantitatively use the results. When looking at the studies together, we see tumor formation in multiple sites, by more than one route of administration, in both sexes, dose-related increases, and in multiple species. These finding add to the weight of evidence that MTBE may be carcinogenic. Future studies (particularly oral studies) should be undertaken to address this issue; lower doses of MTBE should be used, as one flaw in the studies was exceedance of the MTD. While data on the carcinogenicity of MTBE are not perfect, these studies show that there is some carcinogenic activity related to MTBE exposure. Although not consistent between species, tumors have been found at multiple sites in multiple species by multiple routes of exposure.

IV.D Carcinogenicity Studies of MTBE Metabolites

It has been demonstrated that MTBE is metabolized in animals by oxidative demethylation to form t-butyl alcohol (TBA) and formaldehyde, which are considered to be the main metabolites (NSTC, 1996; HEI, 1996). Cytochrome P-450 enzymes were shown to catalyze the oxidative demethylation (Brady et al., 1990). TBA may undergo secondary metabolism to result in formation of 2-methyl-1,2-propanediol and alpha-hydroxy isobutyric acid. The reader is referred to reviews by NSTC, HEI and CalEPA for more comprehensive reviews of the metabolism and disposition of MTBE. Evidence for the carcinogenicity of the two main metabolites is discussed below.

IV.D.1 t-butyl Alcohol

TBA was tested for carcinogenicity in F344/N rats and B6C3F1 mice exposed by administration in drinking water for a chronic duration (Cirvello et al., 1995). Male rats exhibited an increased incidence of renal tubule adenomas and carcinomas. TBA also produced an increased response in transitional epithelial hyperplasia of the kidney in both sexes of rats. NTP (1995) reviewed results of these 2-year studies with TBA and reported that there is some evidence of carcinogenic activity of TBA in male F344/N rats based on increased incidences of renal tubule adenoma or carcinoma (combined) (NTP, 1995 as cited in CalEPA, 1999). It is noted that the site of tumor response in male rats (i.e., the kidney) exposed to TBA is the same as the site in which similar tumors were observed in male rats that were exposed to MTBE by inhalation (Bird et al., 1997).

In mice there was an observed increase in thyroid follicular cell adenomas in females. Treated groups of both sexes of mice showed an increase in follicular cell hyperplasia of the thyroid and inflammation and hyperplasia of the urinary bladder. The USEPA (1997) reports that there is some evidence of carcinogenicity for TBA in female mice based on these findings.

IV.D.2 Formaldehyde

IARC reports that there is sufficient evidence of carcinogenicity of formaldehyde in animals by the inhalation route (IARC, 1995 as cited in USEPA, 1997). An increase in squamous cell carcinomas of the nasal cavity was observed in both sexes of F344 rats exposed by inhalation in a 2-year (chronic) inhalation study (Kerns et al., 1983). There was also a positive concentration-related trend in the incidence of polypoid adenomas (benign) in the nasal cavity in male rats; however, these were not statistically increased over controls. Kerns et al. (1983) exposed B6C3F1 mice to similar concentrations for 2 years by inhalation but did not observe any significant tumor response in the mouse. A separate long-term inhalation study by Woutersen et al. (1989) exposed male Wistar rats to various levels of formaldehyde (up to 10 ppm) and observed a concentration-related increase in degenerative, inflammatory and hyperplasia changes to the nasal respiratory and olfactory mucosa tissues, and an increase in nasal squamous cell carcinomas in the high dose group. The authors reported that only rats with damaged nasal mucosa showed an increase in nasal tumors. A separate study by Sellakumar et al. (as cited in USEPA, 1997) reported an increase in nasal tumors in Sprague-Dawley rats exposed to 14 ppm in air by inhalation over their lifetime.

According to a review by the ATSDR (1999), four different laboratory animal studies have been performed to assess the potential carcinogenicity of formaldehyde in drinking water, including studies by Soffritti et al (1989), Takahashi et al. (1986), Til et al. (1989), and Tobe et al. (1989). Takahashi et al. reported an increase in benign papillomas of the forestomach of treated Wistar rats compared to control animals, however, there was no mention of an increase in leukemia in this study. In a separate study Sprague-Dawley rats were administered formaldehyde by the oral route in drinking water and, upon assessing the response in both sexes combined, there was an increase in leukemia that was significant at the highest dose (1,500 ppm in water) tested (Soffritti et al., 1989 as cited in USEPA, 1997). Soffritti et al. also reported a significant increase in intestinal tumors in both sexes combined in the high dose group. A separate study by Til et al. (1989) exposed Wistar rats to formaldehyde in drinking water for up to 24 months, and did not observe any evidence of carcinogenicity in either sex. The study by Tobe et al. (as cited in ATSDR, 1999) exposed 20 Wistar rats per sex per dose in drinking water for 24 months, including three treatment groups (highest dose was 300 mg/kg/day) and a control group. Tobe et al. did not observe any significant increase in tumors in the exposed group over the controls. However, it is noted that the number of animals per sex per dose used in this study does not meet the desired number of test animals (i.e., 50 animals per sex per dose) preferred to assess carcinogenic outcome, and this may place decreased weight on the findings of this study when comparing it to others.

Looking at both gastrointestinal tumor outcomes and leukemia by the oral route of exposure there are two positive studies and two negative studies for formaldehyde carcinogenicity, indicating less certainty in carcinogenic activity by this route. Only one of these four studies reported a positive finding for leukemia. The induction of leukemia in rats exposed orally to formaldehyde is consistent with the finding of an increase in leukemia observed in the oral exposure-MTBE study by Belpoggi et al. (1998), revealing a similarity in tumorogenic response induced by both the parent compound and one of its major metabolites. The ATSDR (1999) concluded that the evidence for the carcinogenicity of formaldehyde in rats exposed to this compound by the oral route (in drinking water) is not strong due to inconsistency of findings across studies and inconsistent evidence for a dose-response relationship for either leukemia or gastrointestinal tumors in the study by Soffritti et al.

Regarding human studies, IARC concluded that formaldehyde exposure in professional and industrial workers was consistently associated with nasopharyngeal cancer (IARC, 1995 as cited in HEI, 1996).

Formaldehyde is genotoxic in a variety of different experimental systems, including effects of mutation (HEI, 1996). The reader is referred to some of the more comprehensive reviews for a more complete account of various studies reporting on formaldehyde's genotoxicity.

V. <u>Dose Response Assessment</u>

V.A Non-Cancer Effects

As summarized in the previous section, the reported non-cancer effects in animals exposed to MTBE include systemic, developmental and neurological effects. The lowest reported NOAEL (see Table 1) for MTBE in animal studies is 100 mg/kg/day from the Robinson et al. (1990) study. No adverse health effects were observed in male or female rats at this dose level after 90 days of exposure. This NOAEL was used as the basis of USEPA's draft Drinking Water Health Advisory for lifetime exposures (USEPA, 1996).

The NOAEL from the Robinson et al. study will be used to calculate a drinking water standard for MTBE based on non-cancer effects because this study is considered a well-designed 90-day study with a defined NOAEL and LOAEL (USEPA, 1996) that evaluated oral exposures. The NOAEL of 100 mg/kg/day is the lowest reported NOAEL and therefore is protective for all non-cancer effects.

V.B Cancer Effects

V.B.1 Carcinogen Classification – USEPA 1986 Guidelines - Weight of Evidence

Under the current USEPA carcinogenicity assessment guidelines, known as the 1986 Cancer Guidelines, the EPA assigns chemicals to one of six groups based mainly on the weight-of–evidence from human and animal studies of tumor response (USEPA, 1986). Evidence on how an agent produces tumors and its relevance to humans, which may be deduced from information on a chemical's mutagenicity, pharmacokinetics, metabolism, and structure-activity, are taken into account only as supportive information. Supportive information may be used to adjust a classification up or down. The carcinogen groups and descriptors are as follows:

- Group A – Human Carcinogen (sufficient human data are available)
- Group B1 or B2 – Probable Human carcinogen (B1 indicates that limited human data are available, B2 that insufficient human data exists, but animal data are sufficient)
- Group C – Possible human carcinogen (animal data available, but are limited and/or equivocal)
- Group D – No sufficient data exists to classify
- Group E – Data is sufficient to conclude that the chemical is not carcinogenic to humans.

For further discussion on what constitutes sufficient, limited, and equivocal data and how a chemical may be placed in the appropriate weight-of-evidence category, the reader is referred to the sections V.B.4 and V.B.4.a.

For chemicals in groups A and B, a quantitative toxicity value is generated by deriving a cancer slope factor (CSF). A CSF defines quantitatively the relationship between dose and response. CSFs are a measure of a chemical's cancer "potency" and can be used to estimate the theoretical upper-bound lifetime probability of an individual developing cancer from exposure to a carcinogen. Because risk at low exposure levels would be difficult to measure without using prohibitively large numbers of animals in experimental studies, study protocol involves dosing at levels well above expected environmental exposures. Therefore, to derive a CSF, models must be used to extrapolate from high doses administered to animals to lower levels to which humans may potentially be exposed. The current default model is the linearized multistage (LMS), which is one of the more conservative models available, in that it incorporates low-dose linearity.

Chemicals in Group C may be suitable for estimation of cancer potency by a CSF on a case-by-case basis. However, the approach more often employed for chemicals in this group has been to derive a Reference Dose (RfD) based on a non-cancer adverse health effect with appropriate Uncertainty Factors (UF) applied to take into account such factors as the possible difference between animal and human sensitivity and the differing sensitivity within humans, among other factors. Derivation of an RfD is also the method used to estimate a toxicity value for chemicals that either have insufficient evidence of carcinogenicity or are demonstrated to be noncarcinogens (Groups D and E). However, for chemicals that are possibly carcinogenic to humans, an additional UF of between 1 and 10 is applied as protection against carcinogenic effects.

V.B.2 Carcinogen Classification – Proposed USEPA 1996 Guidelines - Weight of Evidence

The 1996 proposed cancer guidelines are currently undergoing review and modification as of the date of this report. The alphanumeric system of the current guidelines has been abandoned. In a recent presentation (Cogliano, 1999), a member of the committee charged with revising the guidelines discussed the current consensus of the committee for summarizing carcinogenic weight-of-evidence with the following group descriptors:

- Carcinogenic to humans
- Likely to be carcinogenic to humans
- Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential
- Data are inadequate for an assessment of human carcinogenic potential
- Not likely to be carcinogenic to humans.

V.B.3 Decisions by Scientific Bodies and Committees on MTBE's Carcinogenicity

Prior to the writing of this Report various agencies, including the USEPA, a research group directed by the University of California, and three scientific committees reviewed the carcinogenicity of MTBE with decidedly mixed opinions, even within entities.

The USEPA has reviewed the carcinogenicity of MTBE (USEPA, 1997). They conclude that the weight-of-evidence, based on positive tumor responses in multiple studies, in two species by two routes of administration, along with supporting carcinogenicity data on metabolites of MTBE, indicates the MTBE is an animal carcinogen. Therefore, MTBE has carcinogenic potential for humans. They also state that, although MTBE does not appear to be a mutagen, a nonlinear mode of action (MoA) has not been established. When a MoA has not been determined, the health protective assumption is to assume a linear dose-response (see sections V.B.7.a and V.B.7.b). However, despite USEPA's statements that a nonlinear MoA has not been established (in which case it is health-protective to assume a linear dose-response, they have chosen to evaluate MTBE with the "margin of exposure" (MoE) approach (see section V.B.7.b for description of MoE approach). USEPA (1997) reported that the available data were not sufficient to support a confident quantitative estimation of risk at low doses, citing some of the concerns that were raised by the NRC (1996) as rationale for not taking this approach. It is noted that both the NRC's 1996 critique of the Belpoggi study and USEPA's 1997 decision not to quantitate risk at low doses were both made prior to the 1998 re-evaluation of the Belpoggi et al. study which supported their original findings, leaving open the question as to whether USEPA maintains their original position.

In a 1997 bill, the State of California legislature directed the University of California to conduct research on the effects of MTBE. In November, 1998 the multi-volume report "Health & Environmental Assessment of MTBE" was issued. One of the conclusions of the Report was that "MTBE is an animal carcinogen with the potential to cause cancer in humans" (UC,1998). The Report also stated that since MTBE's MoA in causing cancer in animals was not known, the risk to humans was also not known, especially at the lower concentrations typical of human exposure.

In early November, 1998, the International Agency for Research on Cancer (IARC), in a yet to be published finding, placed MTBE in Group 3 of the categories IARC has established to describe a chemical's carcinogenic weight-of-evidence. A Group 3 agent is "not classifiable as to its carcinogenicity to humans". The first three IARC categories classify the human cancer potential of a chemical as "known" (Group 1), "probable" (Group 2A,) and "possible" (Group 2B). Because no report has yet been published explaining the basis for IARCs decision, only secondhand information is available describing their rationale (CalEPA, 1998). According to reports, IARC members felt that the animal data was limited based on inadequacies in the studies including unconventional study design in which animals were allowed to live until natural death (Belpoggi et al. study), combining leukemia's and lymphomas (Belpoggi et al. study), low incidence of tumors in the control group compared to historical controls (Chun et al. study-leydig cell tumors), exposure levels in excess of the MTD in several of the studies, difference in survival times that were not adjusted for in the analysis, and, in their opinion, study results that were not confirmed by the other study results (CalEPA, 1998).

On December 2nd and 3rd, 1998, the National Toxicology Program (NTP) Board of Scientific Counselors, Carcinogen Subcommittee meeting was held to determine whether MTBE should be listed as "reasonably anticipated to be a human carcinogen". The motion to list MTBE as a carcinogen was defeated by a vote of 6 "no" to 5 "yes" votes with one member abstaining because of a perceived conflict of interest (NTP, 1998). Reasons cited by those voting not to list included that the mechanisms of induction were not applicable to humans (alpha-2u-globulin in male rats), maximum tolerated doses were exceeded (both inhalation studies), and that the animal tumors observed were not predictive of a response in humans (liver tumors in mice).

On December 10, 1998 the Carcinogen Identification Committee of the Proposition 65 Science Advisory Board of the State of California met to decide whether MTBE has been clearly shown to cause cancer and should be listed as such. The Committee is the State's designated expert advisory board for determining an agent's carcinogenicity. The vote was 3 members for listing to 3 members against listing MTBE as a carcinogen, with one member absent (CalEPA, 1998). Because there was no majority in favor of listing MTBE, it was not placed on the list as a Proposition 65 carcinogen. Rationale by board members for not listing MTBE included the observation that significant tumor response occurred only at doses which were clearly toxic enough to compromise normal metabolism, that the study by Belpoggi et al. was not audited by an "outside" person, and that Proposition 65 language states that a chemical must be "clearly shown" to cause cancer if it is to be listed; the current evidence on MTBE is not of that strength (CalEPA and Cal SAB-CIC, 1998).

V.B.4 DHHS Interpretation of MTBE's Carcinogenic Weight-of-Evidence

The decision regarding which weight-of-evidence group to place MTBE into is of importance since this decision will dictate the appropriate approach(es) used to calculate a chemical's toxicity value. Under the current guidelines, only Group A and B carcinogens are routinely evaluated by the CSF approach; those in Group C (possible carcinogens) are usually evaluated for toxicity by the RfD approach with an extra UF for potential carcinogenicity. Under the proposed guidelines, chemicals in the "known" and "likely" groups would be quantitatively evaluated for carcinogenicity, while chemicals in the "suggestive" group would not.

V.B.4.a USEPA 1986 Carcinogenicity Guidelines

Under the 1986 cancer guidelines, if no positive human data exists, B2 is the highest group a chemical can be placed into (USEPA, 1986). If the animal data are considered "sufficient", the chemical is placed in Group B2; if animal data are considered "limited" or "equivocal", the agent is placed into Group C. Conditions for sufficient evidence include a increased incidence of malignant (or combined benign and malignant) tumors in multiple species or strains, or in multiple experiments in which the routes of administration or the dose levels differ. The conditions which lead to a conclusion of limited/equivocal evidence are that although the data suggest a positive cancer response, limitations exist including only a single positive species, strain, or study, or the confidence in the study is affected by inadequacies in areas such as dose levels, duration of exposure, period of follow-up, poor survival, low number of animals tested, and inadequate reporting of the data. An increase in benign tumor incidence only would also suggest limited evidence.

Comparing the evidence on the carcinogenicity of MTBE to the definitions of sufficient and limited/equivocal evidence, it is clear that if all, or even some, of the positive tumor responses observed in the MTBE studies are accepted as valid; MTBE belongs in Group B2. However, some who have reviewed the evidence on MTBE's carcinogenicity have concluded that each of the studies and/or tumor responses is inadequate in some of the ways cited above so that the overall weight-of-evidence would be of limited/equivocal quality. Those individuals would likely place MTBE in Group C.

V.B.4.b USEPA 1996 Proposed Carcinogenicity Guidelines

A chemical may be placed in the "likely to be carcinogenic to humans" group ("likely") if evidence is sufficient to demonstrate that there is a carcinogenic potential to humans. Animal factors that strengthen the weight toward "likely" include independent studies with consistent results, concordant tumor sites, multiple observations in species, strain, both sexes, early tumor appearance, uncommon tumors, and route(s) of exposure similar to human exposure, among others. Animal factors that weaken the weight include only one positive study, observations in a single species, strain, and sex, benign tumors only, and a route of exposure that is unlike human exposure.

A carcinogenic response in animals has been observed at multiple sites, by two routes of administration, in two species, strains, and both sexes. However, the adequacy of some of the studies and the tumor findings has been disputed. Additionally, there are no human data and the MoA is not known. Therefore, MTBE may belong in the lower end of the "likely" group on the strength of the evidence.

Examples of the type of evidence that may indicate that a chemical belongs in the "suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential" group ("suggestive") include the following: a marginal dose-related increase in tumors, only one positive study is available, a positive study in which the tumor response is one which has a high spontaneous occurrence, or any of the factors previously mentioned above which weaken the weight-of-evidence. In our opinion, the carcinogenic weight-of-evidence for MTBE is much stronger than the examples given for a chemical which might be placed in this group. MTBE appears to merit placement somewhere between the "likely" and "suggestive" carcinogen groups. Therefore, we conclude that it is appropriate, based on the current knowledge on MTBE, to evaluate it quantitatively for carcinogenicity.

Having carefully considered the evidence and the limitations of each study and having reviewed the criticisms of the MTBE studies by others, we believe the weight-of-evidence places MTBE no lower than between a Group B2 and C carcinogen under the current guidelines and between the "likely" and "suggestive" groups under the proposed guidelines. Because the MoA is not yet known, according to the proposed guidelines, it is appropriate to evaluate MTBE quantitatively (with an LED_{10} and a straight line to the origin) and to derive a CSF under the current guidelines. We have chosen to evaluate MTBE using the approach advocated in the current guidelines because it appears to be the future direction of carcinogen risk assessment and because use of the LED_{10} harmonizes with the MoE (for nonlinear carcinogens) approach should MTBE's MoA be found to operate in a nonlinear fashion.

V.B.5 Study Selection – General Considerations

Prior to discussing the rationale for selecting the study-specific datasets to include in order to derive a proposed drinking water standard, it is appropriate to present some of the salient features that were considered when deciding whether or not to include a dataset for possible dose-response assessment. Much of the following discussion is based on various guidelines and principles reported over the years by the U.S. EPA, including their recent proposed Guidelines for Carcinogen Risk Assessment, as well as certain elements discussed in USEPA's 1986 Guidelines for Carcinogen Risk Assessment, and in earlier documents such as the TSCA Test Guidelines which discuss some of the fundamentals of what constitutes a well-conducted animal bioassay (U.S. EPA, 1996g, U.S. EPA, 1986, U.S. EPA, 1985, OSTP, 1985). The reader is referred to these documents for further detailed discussion of these issues.

All carcinogenesis bioassay data must first be reviewed to determine whether the data are of appropriate quality to use for quantitative risk estimation. For example, it is preferred to give first consideration to sufficient quality epidemiological data to assess carcinogenic potential to humans. As with most chemicals, there were no relevant epidemiological studies available for MTBE. In the absence of human studies, regulatory agencies such as the DHHS must rely on chronic bioassays conducted with surrogate animal species.

When evaluating animal bioassay studies, attention should be given to datasets that yield higher tumor incidence and shorter latency in the treated groups relative to controls. Evidence for carcinogenicity is strengthened by observing positive effects in more than one treated group or sex. Additional support of carcinogenicity is provided by positive results observed with different routes of exposure, in replicated experiments, in different animal strains and species, and in multiple organs and tissues. The magnitude of tumor incidence in treated animals relative to controls, and the existence of dose-related trends will also play into determining the strength of evidence of carcinogenicity, and in making a decision as to which data sets to include when attempting to quantitatively estimate a chemical's potency.

Upon reviewing different tumor data sets, preference was given to those studies whereby the route of administration is comparable to the route of exposure that is under evaluation, in this case oral ingestion from drinking water. Overall quality of each bioassay's design was also considered. For example, sponsors of bioassays should be familiar with requirements of Good Laboratory Practice procedures (OSTP, 1985). Some factors to consider when evaluating the quality of a bioassay design are whether a sufficient number of animals per dose are studied, for example at least 100 animals per dose level (50 per sex per dose) is preferred. The start of the study should be as soon as possible after weaning, (=< 6 weeks of age up to 8 weeks), and survival will ideally be at least 50% at time of study termination. The highest dose tested should approximate the maximum tolerated dose (MTD). The MTD is the dose that will produce minimal toxicity and should not substantially alter the normal lifespan due to effects other than carcinogenicity. Treatment should continue for the major portion of the animal's lifespan, for example at least 18 months for mice and 24 months for rats. Attention is given to acceptable quality studies that yield clear-cut dose-response relationships, as well as high levels of statistical significance in increased tumor incidence. When it is possible to determine the time-to-tumor occurrence, a dose-related shortening of time-to-tumor occurrence is considered to offer additional support.

Factors that may decrease the confidence one can place in bioassay findings include inadequate design or reporting, or finding only a marginal response in tumor incidence in tissues known to have high and variable background rates. Tumor responses that occur only at excessive doses that are clearly compromising major organ systems may also be assigned a decreased confidence rating. In general, upon reviewing overall quality of the various datasets, the DHHS-BHRA will select tumor response data set(s) that yield the greatest potency to establish a health-based standard, unless additional factors can confidently demonstrate that these responses are not relevant in humans. When two or more acceptable studies exist that are identical regarding species, strain, sex, tumor type, and of equal quality, then the geometric mean of the cancer slope factors will be selected. DHHS-BHRA agrees with CalEPA's position that "where several equally plausible results are available and are sufficiently close to be regarded as concordant, the geometric mean of all such estimates may be used" (CalEPA, 1999).

V.B.6 Study Selection – Strengths and Weaknesses of Tumor Incidence Data Sets

Upon reviewing the various carcinogenicity bioassays, the strengths and weaknesses associated with each study were carefully considered (see Table 7) to determine which tumor

Table 7: Strengths and Weaknesses Associated with Study Designs/Outcomes for Various Tumor Data Sets

Study (and data set)	**Strengths**	**Weaknesses**
Sprague-Dawley Rat Oral Study by Belpoggi et al, 1998 *Critiques Common to Tumor Responses in both Sexes of SD Rats*	• Oral Dose Route	• Did not report organ weight data
	• Animals exposed for 104 weeks	• Essentially no discussion regarding non-oncological endpoints (especially kidney)
	• Authors experienced in bioassay procedures	• Did not report *individual* animal tumor and pre-neoplastic data
	• Large volume of data on historical background rates in this strain in this laboratory	• Time of termination not scheduled at 104 weeks, inconsistent with usual NTP testing protocol
	• Performed pathologic re-evaluation using NTP diagnostic criteria	
Critiques Specific to Combined Lymphomas/Leukemias In Female SD Rats	• Clear dose-related trend in combined occurrence, highly significant ($p<0.01$) at high dose	• Observed dose-related decrease in survival in Females (only)
	• Marginally signif. response (survival-adjusted) in low dose group ($p=0.05$)	• Early mortality in both dose groups, suggesting may have exceeded MTD
	• Observed increase in dysplasia of lymphoreticular tissue in the treated groups	• Cause of death in early mortalities not reported
	• Consistency of tumor response with oral exposure in separate oral bioassay for metabolite, formaldehyde	• This type of tumor response was not observed in other studies investigating MTBE
	• Sprague-Dawley Rats do not have high incidence of leukemia/lymphomas	

Table 7 (continued)

Study (and data set)	Strengths	Weaknesses
Sprague-Dawley Rat Oral Study by Belpoggi et al, 1998 *Critiques Specific to Testicular Tumors in Male SD Rats*	• Oral dose route • No indication that MTD was exceeded • Increase is above historical background for this rat strain • Tumor response supported by dose-related increase in tissue hyperplasia • No observed atrophy in interstitial cells • Multifocal tumors observed only in the high dose group • Consistency of tumor response, supported by increase in same tumor type in different rat strain in a separate study by inhalation	• Late occurring tumor-type combined with unexplained increased survival in high dose males after 88 weeks may bias results
F344 Rat Inhalation Study by Chun et al., 1992 as reported by Bird et al., 1997 *Critiques Common to both tumor response data sets in male F344 Rats*	• Study protocols consistent with TSCA guidelines • Metabolite, TBA, found to induce increase in renal tumor types by oral exposure • More thorough discussion on non-cancer endpoints • Standard study duration • Allowed independent pathology review of data	• Concerns that MTD was exceeded at the two highest male dose groups • Premature mortality at 2 highest dose groups, and tumor response not significant at highest dose • Study route is by inhalation, thus requiring dose route conversion
Critiques Specific to Combined Renal Tubular Adenomas/Carcinomas in Male F344 Rats	• PBPK model allows more confident conversion to equiv. oral exposure	• Suggested possible role of alpha-2-u-globulin contributing to tumor formation
Critiques specific to Leydig Interstitial cell tumors in Male F344 Rats		• F344 rat reported to have relatively high historical background rate for this type of tumor, and incidence observed in dosed groups was within the normal historical range

Table 7 (continued)

Study (and data set)	**Strengths**	**Weaknesses**
CD-1 Mouse Inhalation Study by Burleigh-Flayer et al., 1992 as reported by Bird et al., 1997 *Critiques common to increased hepatocellular tumors in both sexes of CD-1 mice*	• Study protocols consistent with TSCA guidelines • More thorough discussion on non-cancer endpoints • Allowed independent pathology review of data • Observed increase in liver tumors in both sexes	• Inhalation route of exposure, and no PBPK model available to convert to oral equivalent dose • Possible non-linear mode of action proposed, lessening confidence to use this data to extrapolate to low doses • Study duration not as long as typical NTP duration for this species (2 years), leaving question as to whether adenomas may have progressed to carcinomas with greater duration
Critiques specific to hepatocelluar tumors in male CD-1 mice	• Malignant form of tumor significantly increased in the highest dose group tested	• Premature mortality in high dose males, suggesting MTD was exceeded • Upon combining adenomas and carcinomas, the tumor response is not significant
Critiques specific to hepatocelluar tumors in female CD-1 mice	• MTD not exceeded at any dose	• Tumors mostly (i.e., all but one) benign in high dose group

response data set or combination thereof to use to estimate an appropriate cancer slope factor (CSF). These critiques are provided in summary format in table 7, to facilitate comparison.

V.B.7 Statistical and Modeling Assumptions/Considerations for Estimating CSFs

V.B.7.a Mode of Action

The mode of action (MoA) is defined as the key events and processes beginning with the interaction of a chemical with a cell and the changes that take place to the end result of cancer formation. Information on a chemical's mutagenicity, metabolism, and pharmocokinetics may all be used to determine what the most appropriate approach is for extrapolating from high-doses observed in a study to relevant environmental exposures that will be, in general, comparatively low to the study exposures.

V.B.7.b Approaches for Linear and Nonlinear Carcinogens

An assumption of linearity is appropriate when gene mutation appears to be the MoA for tumor response or some other MoA is anticipated to be linear. Using the LED_{10} as the point-of-departure with a straight line drawn from it to the origin (zero risk, zero dose) is the linear default approach for calculating a CSF (see V.B.7.c fpr definition of LED_{10}). The LED_{10} replaces use of the LMS model as a default curve-fitting procedure for cancer effects believed to operate in a linear fashion. The guidelines state that the results of using either the straight line or the LMS approach to calculate cancer potency values does not result in significantly different values. This assertion is concordant with our derivation of numerical cancer estimates for MTBE using both procedures.

An assumption of non-linearity is appropriate when evidence for nonlinearity exists with no evidence for linearity. The MoE approach, according to the proposed guidelines, is the default method when there is sufficient evidence for a nonlinear dose-response, but not enough information to construct a mathematical model for the relationship. MoEs are calculated by a ratio of an (observed) environmental exposure concentration to the value at the low end in the range of adverse health effects observed in animal studies. Each of these procedures (i.e., either linear quantitation or non-linear MoE approach) may be used to assess different tumor sites when it has been determined that the MoA for a chemical supports using this approach to assess each specific tumor response.

Fig. 1-1 in the Guidelines provides clear guidance that a default assumption of linearity is the appropriate choice when insufficient or no evidence exists for either a linear or nonlinear MoA. The default assumption of linearity in the absence of evidence is a science policy decision in the interests of protecting public health (USEPA, 1996).

V.B.7.c Use of LED_{10} as Point of Departure Dose

Study doses and responses are modeled with an appropriate curve-fitting model. Extrapolation to exposures below the observed range is performed using a biological based model if one exists or a default approach (linear, nonlinear, or both). To extrapolate from observed (high animal) doses to expected exposures (low human) doses, a point of departure between the two, called the lowest effective dose (LED), is used. The LED_{10} is the lower 95% confidence limit on the dose, which produces a response of 10% above background risk in the study animals. The LED_{10} was chosen because a 10% difference in response is usually the lowest discernable difference observable among exposure groups in a typical rodent study.

V.B.7.d Statistical Tests

Prior to applying the LMS to derive a CSF, DHHS-BHRA reviewed each tumor data set to verify a statistically significant increase in tumor incidence as well as a statistically increased trend. A Fisher's exact test was used to test for a difference in incidence between each dosed group and the control group. The Mantel-Haenszel Test was used to assess whether there was a statistically significant increasing trend. The tests applied are "one-sided" tests, and as such are sensitive only to increasing incidences with ascending doses. DHHS-BHRA considered a p value less than 0.05 as significant. Prior to accepting the CSF generated based on the LMS model, a test for the goodness of fit for the curve to the data points was reviewed using the Chi-squared "goodness of fit" statistic, and using a criterion of p=> 0.05 (Crump et al., 1997).

V.B.7.e Interspecies Dose Scaling

As part of the modeling procedures that extrapolate from animal to human exposure, doses of an agent must be converted from an animal to an equivalent human dose. For oral exposure, we decided to adjust the applied dose in animals by applying a scaling factor of body weight to the 0.75 power ($W^{0.75}$), an approach recommended more recently by USEPA (1992b). This factor scales according to the metabolic rate across animals of a different size. This approach is different than that used in the past under the 1986 cancer guidelines, which recommended a scaling adjustment of bodyweight raised to the 0.67 power ($W^{0.67}$).

V.B.7.f Addressing the Need to Correct for Less than Lifetime Exposure Duration

When a bioassay is terminated substantially earlier than the natural lifespan of the test species, it is necessary to apply a correction factor to the CSF in order to account for the likelihood that greater number of tumors would have occurred if the experiment were run for a longer duration. The DHHS relied on guidance described in EPA's draft Water Quality Criteria Methodology to determine the appropriate application of this correction. These guidelines suggest there is no need to apply this correction when the study duration is at least 90 weeks for rats and 78 weeks for mice (USEPA, 1998).

The decision as to whether to apply this "early-termination" correction factor was particularly critical in evaluation of the renal tumor response in the Chun study, which was terminated early (i.e., less than 104 weeks) in the two high dose groups due to premature mortality. As discussed previously, the renal tumor response was not statistically increased in male rats in the high dose group (p=0.13). This may likely be attributable to the animals not having survived long enough to develop tumors. The goodness of fit was poor (Chi Square p = 0.01) as indicated by the Chi-squared statistic when all four dose groups were input into the curve-fitting model. Based on the above considerations taken together with the fact that the MTD was clearly exceeded in the high dose group of male rats in the Chun et al. study, we decided to estimate a CSF after eliminating the high dose response (this resulted in statistically adequate Goodness of Fit). Since the second highest dose group was not terminated until 97 weeks (i.e., greater than or equal to 90 weeks), we decided not to apply a correction factor.

V.B.7.g Model Used to Convert from Inhalation to Oral Dose

In order to estimate a cancer slope factor for the renal tubular cell adenomas/carcinomas response observed in the male F344 rats (Bird et al., 1997), the DHHS-BHRA reviewed the approach taken by the CalEPA, which involved conversion of the applied inhalation concentration to an equivalent orally administered dose, as determined by comparing dose metrics of parent compound levels in the blood, using a physiologically-based pharmacokinetic (PBPK) model for MTBE and TBA in the rat. We reviewed the various assumptions and parameters that entered into CalEPA's approach, as described in their Public Health Goal Document (CalEPA, 1999), prior to deciding whether to use it for our assessment. They reasoned that because there is a lack of a clear mode of action for TBA or other MTBE metabolites in the induction of cancer observed in lab animal studies, it is reasonable to assume (until it is shown otherwise) that the observed cancer effects in animals is the result of the parent compound. The DHHS-BHRA believes this assumption is reasonable in performing a dose route conversion for MTBE. We did not actually perform model runs, but rather relied on CalEPA's application of the PBPK model.

The PBPK model used by CalEPA was based on two previously developed models, including one by Borghoff et al. (1996) and a different one by Rao and Ginsberg (1997). The latter model was an adaptation to the model by Borghoff et al., and differed from it in several important ways, in that it modeled two additional organ compartments (i.e., brain and skin), incorporated a different set of metabolic rate constants (Vmax and Km) for two saturable metabolism pathways for MTBE in the liver (however, they did use the same rate constants for TBA metabolism as those by Borghoff et al.), and used a "back fitted" rather than "measured" TBA partition coefficient for the slowly perfused tissue:blood partition (slowly perfused tissues compose a large portion of total body volume). The reader is referred to the original article by Rao and Ginsberg for a detailed description of their rationale for making these adjustments. Adjustments made to the model yielded better predictions of MTBE and TBA blood levels and clearance rates when compared to Borghoff model. For example, when comparing the results of the Borghoff model to empirical blood clearance data, this model underpredicted MTBE blood levels by a factor of two at a high inhalation dose of 8,000 ppm x 6 hours exposure whereas the Rao and Ginsberg model reported a closer fit to the observed data.

Comparison of model runs by CalEPA to the observed Areas Under the Curve (AUC) reported for MTBE by Miller et al. (1997) revealed fairly close predictions to the observed data points. As an example, for an exposure in male rats at 8,000 ppm for 6 hours the CalEPA model predicted an AUC of 33.9 mM*hr compared to an observed value of 33.6 mM*hour, which is in very close agreement. Regarding the TBA component, the CalEPA model did not seem to yield a very accurate prediction for the TBA AUCs (despite using certain values used by Rao and Ginsberg that were intended to improve these estimates) for either the inhalation or oral dose simulations especially at higher dose levels. As mentioned above, by assuming that the observed cancer effects in lab animals are the result of the parent compound, the ability for the model to predict TBA levels appears to be of less importance. Rather, it is more critical for the model to provide a good fit for the parent compound to the observed data.

Based upon the above discussion, the DHHS accepted the dose conversion approach used by California to estimate an oral equivalent dose in the F344 rat. The converted doses are estimates of a single oral dose that would result in an AUC equal to that which is predicted by the model for the various six-hour (per day) inhalation exposure levels that were used in the Chun F344 rat study. A disadvantage of this conversion method is that it converts from a metered inhalation dose over time to an estimated oral bolus dose. While we would have preferred to have conversion to an oral dose administered over time, for example from intermittent exposure from ingesting MTBE in drinking water, we are not aware of a validated model available to perform this type of conversion. Despite the above-mentioned deficiencies, a strong advantage of using the PBPK model to perform dose conversion is that this method relies on a biological-based model demonstrated to yield fairly reasonable predictions compared to actual measured data in the rat test species. In summary, the DHHS believes that use of a PBPK modeling approach that takes into account biological-based metabolic processes, disposition and kinetics of MTBE is preferred over using a default dose conversion that relies on assuming ppm equivalence between the test species and human and then a default inhalation absorption value (as was done to convert from inhalation to oral dose to assess the mouse liver tumor data sets). The converted oral doses that correspond to the inhalation concentrations that were used in the long-term rat study by Chun (Bird et al., 1997), as derived by CalEPA (for a 0.5 kg male rat), are provided as follows:

Inhalation Concentration (ppm for 6 hr. exp)	Converted Oral Ingestion Dose (mg/kg/day)
400	82.9
3,000	618.8
8,000	1,848.3

V.B.8 Selection of CSFs

All CSFs that were derived using the LED_{10} method are presented in Table 8 (along with the LED_{10} estimate). All CSFs were derived based on tumor incidence data sets that yielded statistically significant increases. One exception is the CSF estimated for the combined hepatocellular carcinoma and adenoma data set for the CD-1 male mice, which yielded a significant positive trend but was not found to yield a statistical increase by the Fisher's Exact test (p=0.07). Despite lack of a statistical increase in hepatocellular carcinomas and adenomas in the male mouse, a CSF was derived for these combined tumor types to allow for comparison of CSFs between males and females.

Upon reviewing the CSFs estimated from the various data sets in table 8, the values range from 1.3E-04 $(mg/kg\text{-}day)^{-1}$ for hepatocellular adenomas in female CD-1 mice (Burleigh-Flayer et al., 1992) to 8.5E-03 $(mg/kg\text{-}day)^{-1}$ for testicular interstitial cell tumor response observed in the male F344 rat study by Chun et al. (1992).

Table 8. Dose Response Parameters for MTBE Carcinogenicity Studies

Study	Original Dose Route	Sex and Species	Tumor site and type[b]	LED_{10} (mg/kg/day)	CSF (mg/kg-day)-1
Belpoggi et al, 1995 and 1998	Oral Gavage	Male SD Rats	Leydig Cell Tumors[a]	30.9	3.24E-03
	Oral Gavage	Female SD Rats	Leukemia/lymphoma[a]	35.7	2.80E-03
Chun et al., 1992 As reported in Bird, 1997	Inhalation[c]	Male F344 Rats	Renal Tubular Cell Adenomas/Carcinomas[a]	40.8	2.45E-03
	Inhalation[c]	Male F344 Rats	Testicular Interstitial Cell Tumors (Leydig Cell)[a]	11.7	8.5E-03
				Air Conc. LED10 (mg/m3)	CSF[d] (mg/kg-day)-1
Burleigh-Flayer et al., 1992, as reported by Bird, 1997	Inhalation	Male CD-1 Mice	Hepatocellular carcinomas	1.81E+03	1.9E-04
	Inhalation	Male CD-1 Mice	Hepatocellular carcinomas & adenomas[e]	1.17E+03	3.0E-04
	Inhalation	Female CD-1 Mice	Hepatocellular adenomas	2.61E+03	1.3E-04
	Inhalation	Female CD-1 Mice	Hepatocellular carcinomas & adenomas	2.57E+03	1.4E-04
		Average of M & F	Hepatocellular carcinomas & adenomas	1.87E+03	2.2E-04

a. Interspecies dose-scaling performed using BW^3/4
b. Correction factors were not applied to these tumor data sets to account for experimental duration less than natural lifespan of animals, since exp. duration was greater than or equal to 78 weeks for mice and 90 weeks for rats.
c. Inhalation doses were first converted to equivalent oral doses in experimental species using a PBPK model described in CalEPA (1999) prior to performing dose-scaling correction.
d. Oral CSFs derived for mouse ihl. responses based on air unit risk concentration, assuming standard default parameters for lifetime exposure (e.g., resp. rate 20 cu/m day, and adult bw = 70 kg)
e. Combined tumor response was not significant when adenomas and carcinomas were combined in males

In deciding which CSFs to rely on to estimate a risk-based concentration, we considered the strengths and weaknesses of each data set first, as described in table 7. We decided not to use the CSF generated based on the testicular tumor response in the F344 rats due to concerns surrounding the elevated historical incidence reported in this particular strain of rats for this tumor type. The testicular tumor incidence observed in the treated groups in this study were within the range observed in historical control rats of this strain, thus persuading us against using this CSF. Also, the incidence observed in the concurrent controls in this study was at the low end of the range of values typically observed in this strain of rats, which led us to further question the amount of weight to place on this specific data set for purposes of quantification.

However, the DHHS-BHRA does regard this data as providing at least qualitative support to suggest a positive dose-response for induction of this tumor type.

Looking at the CSFs for combined liver adenomas/carcinomas in both the male and female CD-1 mouse (2.6E-04 mg/kg-day^{-1} and 1.2E-04 mg/kg-day^{-1}, respectively), these CSFs are about an order of magnitude less than the remaining CSFs under consideration (which range from 2.5E-03 mg/kg-day^{-1} to 3.2E-03 mg/kg-day^{-1}). These CSFs are therefore of a substantially lower degree of potency, which swayed us towards deciding not to use these values to set an acceptable criterion. An additional reason not to use these CSFs is that there is no PBPK model available to allow for conversion from inhalation to oral-equivalent dose levels in the mouse species, thereby decreasing the confidence level relative to the data generated by the rat tumor data sets (for which there was an established PBPK model available). Because the liver tumor response in females was largely benign adenomas, this might also decrease the degree of weight one places on using this CSF for standard setting purposes. Finally, some investigators have proposed a biologically based MoA, which suggests that these mouse liver tumors may be the result of endocrine modulation, which may end up making this particular response a future candidate for a non-linear MOA. However, at the present time it appears that data are insufficient to be able to confidently accept that endocrine-mediated MOA can fully explain the observed increase in liver tumors in this species (CalEPA, 1999). Based upon the above considerations, it appears that the mouse may not be the most sensitive species, and we decided against using either of the CSFs generated based on mouse liver tumor data sets to establish an acceptable drinking water criterion.

We used the CSF's estimated from the three remaining data sets to establish a proposed drinking water standard, including the Leydig Cell Tumor response in male SD rats (3.24E-03 mg/kg-day^{-1}) (Belpoggi et al., 1998), combined leukemias/lymphomas in female SD rats (2.80E-03 mg/kg-day^{-1}) (Belpoggi et al., 1998), and renal tumors in male F344 rats (2.45E-03 mg/kg-day^{-1}) (Chun et al., 1992). Taking the geometric mean of these combined tumor datasets yields a CSF of 2.83E-03 (mg/kg-day)$^{-1}$, which is used herein to develop a proposed drinking water standard that is protective at a *de minimis* risk level for a cancer endpoint. This CSF is appropriately rounded off to 2.8E-03 (mg/kg-day)$^{-1}$ for purposes of deriving a proposed standard.

VI. Quantitative Rationale to Establish Drinking Water Criterion

VI.A Non-Cancer Criterion

The current MTBE drinking water criterion of 70 ug/l is based on an RfD of 0.1 mg/kg/day. The RfD was derived from the no observed adverse effect level (NOAEL) in a study (Robinson et al., 1990) of subchronic duration in which rats were exposed by gavage. The NOAEL of 100 mg/kg/day was chosen based on the absence of adverse kidney effects, which were observed (relative increase in kidney weight in female rats) at the next highest dose of 300 mg/kg/day.

The steps in the derivation of the MTBE drinking water criterion are as follows:

(1) RfD Calculation

$$\text{RfD} = \frac{100 \text{ mg/kg/day}}{1{,}000} = 0.1 \text{ mg/kg/day}$$

Where:

100 mg/kg/day = NOAEL

1,000 = combined uncertainty factors (UFs); 10 each for: extrapolation from an animal study to humans, protection of sensitive human subpopulations, and derivation of a chronic toxicity value based on study of less than chronic duration.

(2) Drinking Water Equivalent Level (DWEL) Calculation

$$\text{DWEL} = \frac{(0.1 \text{ mg/kg/day})\ (70 \text{ kg})}{(2 \text{ L/day})} = 3.5 \text{ mg/L}$$

Where:

0.1 mg/kg/day = RfD

70 kg = default adult bodyweight

2 L/day = default adult daily water consumption rate

(3) Drinking Water Criterion Calculation

$$\text{Criterion} = \frac{3.5 \text{ mg/L} * 15\%}{10} = 0.053 \text{ mg/L} = 53 \text{ ug/L} \quad \text{(round off to 50 ug/L)}$$

Where:

3.5 mg/L = DWEL

15% = relative source contribution (RSC). The rationale behind the choice of 15% as an appropriate RSC is discussed in section VI.B and C.

10 = additional UF to account for possible carcinogenicity

VI.B Relative Source Contribution

Populations may be exposed to chemicals in the environment from multiple sources. The Relative Source Contribution (RSC) allocates the total safe exposure expressed by an RfD among potential media exposure sources to insure that an exposure from one medium does not exceed the RfD (USEPA, 1998b). The total allowable daily exposure to MTBE from all sources is estimated to be 700 ug/day. The total daily allowable intake of 700 ug/day is calculated by multiplying the RfD of 0.1 mg/kg/day by an assumed body weight of 70 kg, and then dividing this value by a factor of 10 to account for possible carcinogenicity.

The RSC has most often been calculated using the Percentage approach. Actual data, if known, are used to allocate the allowable exposure contribution from the medium of concern. EPA has favored use of a 20% floor and an 80% ceiling as default lower and upper limits for the RSC calculation (USEPA, 1989). The rationale for a floor is to avoid setting standards for minimal reductions in exposure when reducing other exposure sources would have a more significant impact. The rationale for a ceiling is to provide an additional safety margin for individuals whose exposure may be greater than indicated by the data. If data are not available, the 20% floor has been the default choice to be health protective.

The subtraction approach is another method that has occasionally been used to determine the RSC. With this approach, contributions from sources other than the one being regulated are subtracted from the total safe exposure (the oral RfD adjusted using a UF for possible cancer effects), leaving the remainder as an acceptable exposure in the regulated medium (water) (USEPA, 1998b). We have chosen to calculate the RSC using a combination of the percentage and subtraction approach. We are using the subtraction approach to determine an appropriate percentage for the RSC, leaving open the possibility to adjust the 20% floor downwards depending on the results of our assessment. The reader is referred to an unpublished paper by Borum (1997) for further description of these approaches, plus several others that USEPA is considering to determine the RSC (USEPA, 1998b).

Several other agencies have previously conducted exposure assessments of MTBE including the National Science and Technology Council (NSTC, 1996), the State of Maine-Bureau of Health (Smith et al., 1998), and the Northeast States for Coordinated Air Use Management (NESCAUM, 1999). Each of the assessments estimated both a central tendency and a high-end exposure.

NSTC's exposure assessment included only non-water related air exposures (NSTC, 1996). They estimated an average daily exposure for a "reasonable worst case" motorist to equal 0.029 ppm (105 ug/m^3). This is an annual time-weighted average (TWA) based on a 6 month oxyfuel (MTBE = 15% by volume) season and a 6 month RFG (MTBE = 11% by volume) season. They caveated this "reasonable worst case" scenario by explaining that it was not meant to represent just a "high average" exposure and that, for most people, annual TWA exposures would be closer to 0.010 ppm (36 ug/m^3), which is their central tendency exposure estimate.

Maine assessed MTBE exposure to derive a drinking water standard, and concluded that for the high-end exposure which represents no Stage 2 recovery at the gas pump, the total allowable daily exposure would likely be exceeded with a drinking water standard of 70 ug/L, but would not be exceeded with a drinking water standard of 35 ug/L (Smith et al., 1998). Therefore, they determined that 10% was the appropriate choice for an RSC to calculate a drinking water standard for MTBE in their State. It was noted in their report that Maine gas stations have only limited use of Stage 2 vapor recovery.

NESCAUM, similar to Maine, assessed exposure to MTBE from both air and water. Their "low" and "high" exposure scenarios used minimum and maximum detected levels of MTBE to estimate exposure by inhalation (in one instance a multiple above highest detected concentration was used to represent a high-end estimate) and assumed drinking water levels of either 35 ug/L or 100 ug/L (NESCAUM, 1999). The results of their assessment for a "high" exposure scenario by inhalation combined with exposure to 35 ug/L in drinking water led them to conclude that the total daily MTBE exposure exceeded the daily allowable level (700 ug/day). The following assumptions were made in their exposure estimate which led them to this conclusion: 1) no Stage 2 vapor recovery, 2) the ambient air concentration is assumed to be ten times greater than the highest measured concentration in the Northeast, and, 3) the residence has an attached garage, significantly increasing indoor air concentrations of MTBE. The "high" exposure scenario did not exceed the established level of concern if the only change made to the scenario was use of Stage 2 recovery. The "low" scenario at a 35 ug/L drinking water concentration without Stage 2 recovery, but evaluated using minimal ambient and indoor concentrations, did not exceed the allowable level. The second analysis, conducted using similar assumptions as the first except for an assumed drinking water level of 100 ug/L, demonstrated that all 4 scenarios, including "low" with Stage 2 vapor recovery, would exceed the allowable level.

VI.C MTBE RSC

The current MTBE drinking water criterion of 70 ppb for our state is based on the default RSC floor of 20%. Virtually all exposure to MTBE is anticipated to occur from inhalation in air and ingestion from water. To determine if the 20% RSC is sufficiently protective for total exposure or a lower RSC is appropriate, microenvironmental modeling was conducted to examine an individual's daily exposure to MTBE. Exposure scenarios for two hypothetical individuals were modeled; one which approximates an average individual's (using values generally at the 50th percentile of a distribution) exposure and a second scenario to approximate an individual at the higher end of an exposure distribution (using a combination of upper and central-tendency values) to estimate an exposure not likely to be exceeded by more than 5% of the population (a 95th percentile exposure) as the result of non-occupationally related exposures.

Non-occupational exposures to MTBE that are believed to be of greatest importance include exposures received while at the service station, while traveling inside of the automobile cabin, and garages. The highest concentrations of MTBE are observed during refueling. MTBE concentrations measured in air during refueling are highly variable, ranging over two orders of magnitude (HEI, 1996). Concentrations measured inside the cabins of cars also vary widely depending on the individual vehicle. Because there is so much variability of exposure levels within various microenvironments, this lends a great deal of uncertainty when attempting to estimate a person's total inhalation exposure under an assumed hypothetical scenario.

Exposure to MTBE at gas stations during refueling vehicles is the major source of total exposure (HEI, 1996). The central-tendency individual is one who is a resident of one of the four southern counties (73% of the State population)(U.S. Census Bureau, 1999) and refuels at a gas station with Stage 2 vapor recovery, which is mandatory in these counties for all new or substantially modified stations, or those whose gallonage is at a certain volume (DES-ARD, 1999). Approximately 85% of the total volume of gas pumped in New Hampshire occurs at stations equipped with Stage 2 vapor recovery (DES-ARD, 1999). The central tendency exposure scenario assumes a more moderate commuting time and fewer miles driven per year compared to the high-end scenario (see below). The high-end individual is a resident of one of the other 6 counties, who refuels at a station without Stage 2 vapor recovery. Recent data from states in the Northeast suggest that Stage 2 recovery is greater than 90% effective in capturing MTBE vapors during refueling (NESCAUM, 1999).

Details on each of the microenvironmental exposures considered in this assessment, the values chosen for each variable, a brief description of the variable's source or the type of exposure it represents, and the references from which they were obtained, are presented in Tables 9 and 10 for the individuals representing central-tendency and high-end exposures, respectively. Assumed inhalation rates for each microenvironment are presented in Table 11.

Table 9: Source of Variables for Central-Tendency Exposure Estimate

Exposure Scenario	MTBE Exposure Variables Concentration	Description	Reference
Refueling	4 ppm (14,000 ug/m^3)	Median for refueling sample at station with Stage 2 vapor recovery (rounded to whole no.)	Table 5, HEI, 1996
At Filling Station (vicinity of pumps)	0.4 ppm (1,400 ug/m^3)	Median of 5 minute breathing zone sample for a station with vapor recovery	Lioy et al., 1994 cited in Table 5, HEI, 1996.
Commuting	40 ug/m^3	Geometric mean of data sets for commuters.	Table 4, Brown, 1997
Ambient Air / Public Building	2 ug/m^3	Mean measured ambient MTBE concentrations in 4 NH Towns in 1999	Data provided by DES-ARD
Indoor Air- awake and sleeping	4 ug/m^3	Sum of ambient background and a calculated contribution from all residential water exposures (whole-house shower model)	DES-ARD data, Schaum et al., 1992 presented in Brown, 1997
Showering	234 ug/m^3	Analytical model for VOC shower inh. exp.	Foster & Chrostowski, 1986
After Showering	202 ug/m^3	Analytical model for VOC shower inh. exp.	Foster & Chrostowski, 1986
	Exp. Time per Event (min/microenv.)		
Refueling	1.5	Avg. gasoline fill-up is 10 gal. NH gas pumps deliver 6-8 gpm. 10 gal/7 gpm = 1.42 min.	Brown, 1997; Per.com. from DES-ARD, 1999
At Filling Station (vicinity of pumps)	3.5	From total time spent at gas station including refueling (5 minutes as average value)	Lioy 1993 and 1994 cited in NSTC, 1996
Commuting	60	50th percentile value for number of minutes spent traveling in a car over a 24–hr. period.	Table 15-121, EFH, EPA-ORD, 1997
Ambient Air / Public Building	400	Assumed time left after other activities are accounted for.	
Indoor Air- awake and sleeping	960	Approximates 16.4 hrs.(with shower time included) as recommended value for residential time indoors	Table 15-176, EFH, EPA-ORD, 1997
Showering-actual	10	79th percentile value of a cumulative frequency distribution for average shower duration	Table 15-4, EFH, EPA-ORD, 1997
After Shower in closed bathroom	5	50th percentile value for minutes spent in shower room immediately after showering Table 15-23	Table 15-23, EFH, EPA-ORD, 1997

Table 9 (Continued): Source of Variables for Central-Tendency Exposure Estimate

	MTBE-Related Exp. Events per Year		
Refueling and At Filling Station (2 scenarios)	70	Calculated from: mean refills for compact, midsize, and SUV car classes, 75th percentile miles driven/yr., combined city/highway mpg, and assumed 10 gal refill. Calculate 68 fill-ups (1.5 min./refill at approx.7 gals/min. pump rate) based on mean of 3 different vehicle size classes; (range of refill visits was between 58 and 80); adjusted up to 70	1995 NPTS; fuel economy guide at www. Fuel economy.gov; See "refueling time" references
Commuting	250	Assumed work days per year (50 wks. X 5 days/wk.)	"Standard Default Exposure Factors", EPA-OERR, 1991
Ambient Air / Public Building	365	Assumed daily exposure	
Indoor Air- awake and sleeping	365	Assumed daily exposure	
Showering-actual and after	365	Recommended Value in Activity Factors Table	Table 15-176, EFH, EPA-ORD, 1997

Notes:
HEI = Health Effects Institute
APA = American Petroleum Association
DES-ARD = Departmental of Environmental Services, Air Resources Division
NSTC = National Science and Technology Council
NPTS = National Personal Transportation Survey, 1995 survey. Conducted once every several years by the U.S. Bureau of transportation. Statistics available at www.bts.gov.
EPA-ORD = Environmental Protection Agency - Office of Research and Development
EPA-OERR = EPA - Office of Emergency and Remedial Response

Table 10: Source of Variables for High-End Exposure Estimate

Exposure Scenario	MTBE Exposure Variables Concentration	Description	Reference
Refueling	6 ppm ($2.2E+04 ug/m^3$)	Median for refueling sample at Non-Stage 2 station (rounded to whole number).	Table 5, HEI, 1996
At Filling Station (vicinity of pump)	0.6 ppm ($2.2E+03 ug/m^3$)	Median of 5 minute breathing zone sample for station without vapor recovery	Lioy et al., 1994 cited in Table 5, HEI, 1996.
At Filling Station (away from pump)	0.3 ppm (1,080 ug/m^3)	High-end median of several 4 to 8 hour breathing zone samples	APA, 1995a; Cook and Kovein, 1994 cited in HEI, 1996.
Commuting	60 ug/m^3	Arithmetic mean of data sets for commuters.	Table 4, Brown, 1997
Ambient Air/Public Building	2 ug/m^3	Mean measured ambient MTBE concentrations in 4 NH Towns in 1999	Data provided by DES-ARD
Public Garage	0.04 ppm (140 ug/m^3)	Avg. of conc's est. from bar graph showing 8-hr ambient samples from CT parking garage.	Fig. 18, Huber, 1993
Indoor Air- awake and sleeping	9 ug/m^3	Sum of median residential indoor air levels from Fairbanks Study plus est. contrib. from all res. water exposures (whole-house shower model)	WHO, 1998; Schaum et al., 1992 presented in Brown, 1997
Home GPDs	10 ppm (36,000 ug/m^3)	Est. reasonable max. conc. of MTBE in breathing zone during a gasoline fill-up (used as a surrogate for fill-up of a home GPD).	Table 1, Scenario II (high-end), NSTC, 1996
Showering	328 ug/m^3	Analytical model for VOC shower inhalation exposure	Foster & Chrostowski, 1986
After Showering	180 ug/m^3	Analytical model for VOC shower inhalation exposure	Foster & Chrostowski, 1986
	Exp. Time per Event (min/microenv.)		
Refueling	2	Average time reported to complete fill-up. At NH pump rate (6-8 gpm), would equal 12-16 gal. pumped.	Lioy, 1993 and 1994 cited in NSTC, 1996; Per.com from DES-ARD, 1999
At Filling Station (vicinity of pumps)	3	From total time spent at gas station including refueling (5 minutes as average value)	Lioy 1993 and 1994 cited in NSTC, 1996
At Filling Station (away from pumps)	5	From total time spent at gas station including refueling (10 minutes as high-end value)	Lioy 1993 and 1994 cited in NSTC, 1996
Commuting	120	Between a 75th and 90th percentile for no. of min. spent traveling in car over a 24–hr. period.	Table 15-121, EFH, EPA-ORD, 1997
Ambient Air/Public Bldg.	315	Assumed time left after other activities are accounted for.	
Public Garage	10	Taken from NSTC assessment	Table 1, NSTC, 1996
Indoor Air- awake and sleeping	950	Approximates 16.4 hrs.(with shower time incl.) as rec. value for residential time indoors	Table 15-176, EFH, EPA-ORD, 1997
Home GPDs	1	Informal survey of several homeowner's who have both lawnmowers and snow blowers	
Showering-actual	15	94% cumulative frequency for average shower duration	Table 15-4, EFH, EPA-ORD, 1997
Showering-after in closed bathroom	20	90th percentile value for minutes spent in shower room immediately after showering	Table 15-23, EFH, EPA-ORD, 1997

Table 10 (continued): Source of Variables for High-end Exposure Estimate

	MTBE-Related Exp. Events per Year		
Refueling and At Filling Station (2 scenarios)	104	Calc. from: mean refills for compact, midsize, and SUV car classes, 95th percentile miles driven/yr., comb. city/hwy mpg, and assumed 14 gal refills (2 min./refill at 7 gals/min. pump rate). Calculate 93 fill-ups based on mean of 3 different vehicle size classes; (range of refill visits was between 79 and 108); adj. up to 104	1995 NPTS; fuel economy guide at www. fueleconomy.gov; See "refueling time" ref's
Commuting and Public Garage	250	Assumed workdays per year (50 wks. X 5 days/wk.)	"Standard Default Exposure Factors", EPA-OERR, 1991
Ambient Air/Public Bldg	365	Assumed daily exposure	
Indoor Air- awake and sleeping	365	Assumed daily exposure	
Home GPDs	20	Sum of yearly lawnmower and snow blower refuels from informal survey	
Showering-actual and after	365	Recommended Value in Activity Factors Table	Table 15-176, EFH, EPA-ORD, 1997

Notes:
HEI = Health Effects Institute
APA = American Petroleum Association
DES-ARD = Departmental of Environmental Services, Air Resources Division
GPD = gasoline-powered device
NSTC = National Science and Technology Council
NPTS = National Personal Transportation Survey, 1995 survey. Conducted once every several years by the U.S. Bureau of transportation. Statistics available at www.bts.gov.
EPA-ORD = Environmental Protection Agency - Office of Research and Development
EPA-OERR = EPA - Office of Emergency and Remedial Response

Table 11: Assumed Inhalation Rates for Various Microenvironments

	Inhalation Rates (m^3/minute)		
Commuting	0.010	Average of male and female inhalation rates during driving.	Table 5A-2, Exposure Factors Handbook (EFH), EPA-ORD, 1997
Indoor Exposure "Awake"	0.016	Average of sedentary and light activity levels for males and females	Table 5-6, EFH, EPA-ORD, 1997.
Indoor Exposure "Sleeping"	0.0081	Inhalation rate for adults at rest.	Table 5-6, EFH, EPA-ORD, 1997
Other Exposures "Awake"	0.016	Average of sedentary and light activity levels for males and females	Table 5-6, EFH, EPA-ORD, 1997

The number of gasoline fill-ups per year was calculated based on 10 gallons pumped per visit (1.5 minute refills at approximately 7 gals./min. pump rate) for a central-tendency individual and 14 gallons pumped per visit (2 minute fills at 7 gals./min.) for the high-end individual, the 75th and 95th percentile values for miles driven per year (15,284 and 29,114 miles, respectively) (NPTS, 1995), and the average miles per gallon for a combination of cars in the compact (26.3 mpg; n = 109), midsize (23.1 mpg, n = 101 vehicles), and SUV (19.2 mpg, n = 155 vehicles) classes (USEPA and USDOE, 1999 Fuel Economy Guide).

The individual with a central tendency exposure visits the gas station to refuel 70 times per year for 5 minutes per visit. He commutes for 1 hour each day, and showers daily for 10 minutes with 5 minutes additional time in the bathroom after showering. The individual representing high-end exposure visits the gas station to refuel 104 times per year for 10 minutes per visit. This person commutes for 2 hours each day, and showers daily for 15 minutes with 20 minutes additional time in the bathroom after showering.

Two additional exposure scenarios evaluated for the high-end individual include parking in a public garage during the workweek and exposure at home when refilling gasoline powered devices (GPDs e.g., lawnmowers, snowblowers, etc.). Parking garage exposure is assumed for 10 minutes per workday and GPD exposure for 20 events per year at 1 minute exposure per event.

Air exposure related to MTBE in drinking water occurs when individuals bathe or shower with MTBE contaminated water. Exposures during showering, and after showering in the bathroom, were estimated with the Foster & Chrostowski shower model (1986). This model has been partially validated by DHHS-BHRA by comparing limited air monitoring data collected from bathrooms of residences with MTBE-contaminated water supplies while the shower was running. As it is a screening model, it generates concentration estimates which are conservative, but not excessively so. MTBE may also be volatilized from other household water uses such as cooking, washing dishes, laundry, and flushing toilets. The indoor air level from all sources of water in the house was estimated at 2 ug/m^3 using the whole-house model developed by Schaum (cited in Brown, 1997). A slightly higher estimate for a background indoor air level of 7 ug/m^3 was used to estimate the high end scenario, and this was the median value measured in a limited number (n=3) of samples taken in indoor air in a sampling survey conducted in Fairbanks, Alaska during a period when they were phasing out the use of oxyfuel (WHO, 1998). A high-end indoor air level of 9 ug/m^3 was derived by summing these two concentrations.

Tables 12 and 13 summarize the total daily exposure from all sources for a central-tendency and high-end exposure, respectively. The central-tendency exposure of 348 ug/day is well below

Table 12: Estimated Exposure for Central-Tendency Individual

Micro-Environment Scenario	Conc. (ppm)	Conc. (ug/m3)	Inhalation Rate (m3/min)	Time per Event (min/event)	Events per Year	Days per year	Exposure (ug/day) at MCL of 70 ug/L[a]	% of Total at MCL of 70 ug/L
Refueling	4	1.4E+4	0.016	1.5	70	365	64	18
At Filling Station – VFP	0.4	1.4E+3	0.016	3.5	70	365	15	4
Commuting		40	0.01	60	250	365	16	5
Ambient Air		2	0.016	400	365	365	13	4
Indoor Air-Sleeping		4	0.0081	480	365	365	16	5
Indoor Air-Awake		4	0.016	480	365	365	31	9
Showering- actual		234	0.016	10	365	365	37	11
Showering – after		202	0.016	5	365	365	16	5
Drinking Water Ingestion					365	365	140	40
Total for Central Estimate							348	
Inhalation From Shower						Summary =	53	15
Inhalation Excluding Shower						Summary =	155	45

VFP = in vicinity of fuel pumps

a. The exposure estimates in this column that are dependent on the assumed drinking water concentration are the daily intakes resulting from drinking water ingestion, the daily intakes in the bathroom from inhalation during and after showering, and the indoor air estimates (for both sleeping and awake estimates).

the total daily allowable value. The high-end estimate of 742 ug/day is found to exceed the total daily allowable exposure of 700 ug/day. Therefore, the DHHS-BHRA believes it is appropriate to use a RSC less than 20%.

Applying a RSC value of 15% (which corresponds to a drinking water criterion of 50 ug/L), we estimated the total exposure to be 662 ug/day, and this is well under the noncancer based threshold intake of 700 ug/day (Table 13). Therefore, we selected an RSC of 15% to derive the noncancer-based criterion.

Table 13: Estimated Exposure for High-End Individual

Micro-Environment Scenario	Conc. (ppm)	Conc. (ug/m3)	Inhalation Rate (m^3/min)	Time per Event (min/event)	Events per Year	Days per year	Exposure (ug/day) at MCL of 70 ug/L[a]	% of Total at MCL of 70 ug/L [b]	Exposure (ug/day) at MCL of 50 ug/L[a]	%of Total at MCL of 50 ug/L[b]
Refueling	6	2.2E+4	0.016	2	104	365	201	27	201	30
At Filling Station – VFP	0.6	2.2E+03	0.016	3	104	365	30	4	30	5
At Filling Station – AFP	0.3	1.08E+3	0.016	5	104	365	25	3	25	4
Commuting		60	0.01	120	250	365	49	7	49	7
Ambient Air/Pub. Bldg		2	0.016	315	365	365	10	1	10	2
Public Garage	0.04	1.4E+2	0.016	10	250	365	15	2	15	2
Home GPD's	10	3.6E+04	0.016	1	20	365	32	4	32	5
Indoor Air-sleeping		9	0.0081	480	365	365	35	5	35	5
Indoor Air-awake		9	0.016	470	365	365	68	9	68	10
Showering- actual		328	0.016	15	365	365	79	11	56	9
Showering – after		180	0.016	20	365	365	58	8	41	7
Drinking Water Ingest.					365	365	140	19	100	15
Total for High End							742	100%	662	100%
Inhalation From Shower						Summary =	137	19	97	15
Inhalation Excl. Shower						Summary =	465	63	465	70

VFP = in vicinity of fuel pumps

AFP = away from fuel pumps

a. The exposure estimates in this column that are dependent on the assumed drinking water concentration are the daily intakes resulting from drinking water ingestion, the daily intakes in the bathroom from inhalation during and after showering, and the indoor air estimates (for both sleeping and awake estimates).

b. Percentages may not sum exactly to 100% due to rounding.

We used upper percentile variables for the high-end exposure scenarios and included most of the possible MTBE exposures to represent a highly exposed individual. However, an additional potential microenvironmental exposure to MTBE we have chosen not to evaluate is vaporization from gasoline in vehicles, gas powered devices, or gas storage cans in attached garages and the potential elevated interior levels that may result from vapor intrusion from the attached garages into the home. Since the DHHS-BHRA believes this source is a potentially significant contributing component for MTBE exposure, we assessed whether it is reasonable to include this source into the overall high-end exposure estimate. A combination of census data and a database tracking homes in NH and VT for sale or recently sold (NNEREN, 1999) led us to conclude that approximately 30% of homes in New Hampshire have attached garages. This preliminary statistic suggests that the majority (i.e., over two thirds) of NH homes are without attached garages. As we include additional exposure scenarios to the hypothetical high-end individual, we are protecting an ever-smaller percentage of the population and approaching an exposure level that is increasingly unrealistic. Therefore, we feel our high-end scenario is sufficiently protective without including an attached garage scenario, a scenario that was included by HEI and NESCAUM in their assessments. Nevertheless, we decided to assess the effects of including this additional source of exposure into the overall estimate, to see what the ultimate effect would be on deriving an RSC. When interior exposure resulting from vapor intrusion from an attached-garage is included into the high-end estimate (assuming an indoor air concentration of 28 ug/m^3 for these types of homes plus an extra 2 ug/m^3 from whole house use of water with 70 ug/L; WHO, 1998), the total intake value reaches 982 ug/day, which provides additional support for using a RSC less than 20%. At 50 ug/L the total intake estimate assuming the attached garage scenario drops to 902 ug/day, which suggests that a lower RSC would be necessary if this scenario were included in the high-end estimate.

An assumption made in this exposure assessment is that MTBE is completely absorbed (100%) for both oral and inhalation exposure. There is some evidence that via inhalation, MTBE is not completely absorbed in either animals or humans. Dourson and Felter (1997) reported that, in animals, absorption of MTBE ranged between about 40% to less than 100%. They chose 50% absorption via inhalation in their extrapolation from an inhaled MTBE dose to an oral dose. In a study conducted with human volunteers exposed to 5 to 50 ppm of MTBE, (Nihlen et al., 1998) absorption efficiency of MTBE ranged from 42% to 49%. USEPA (1998) has proposed that existing data on differences in absorption be used when determining an RSC and, in the absence of data, assuming equal absorption from different routes and sources of exposure. Although there is data on MTBE inhalation absorption as cited above, USEPA has assumed inhalation absorption of 100% when converting MTBE from inhalation to oral exposures (App. A in NSTC, 1996). Therefore, to be conservative, we assumed 100% absorption from inhalation to estimate total intake.

The DHHS-BHRA estimated that total inhalation exposure to MTBE in air resulting from combined inhalation exposures from typical gasoline sources and showering with water containing 70 ug/L equals 82% and 60% of the total daily exposure estimates for the high-end and central-tendency exposures, respectively. At 50 ug/L in water the total high-end inhalation exposure to MTBE in air equals 80% of the total daily exposure. If inhalation absorption is significantly less than 100% for MTBE, virtually all individuals are likely to be protected from non-cancer adverse health effects from MTBE. Our assessment of high-end exposures indicates that total high-end exposure combined with exposure from water containing 70 ug/L exceeds 700 ug/day, which supports the use of a 15% RSC. Given that some experimental studies have observed absorption is less than 100% by inhalation, this supports the conclusion that a RSC of 15% will protect virtually all members of the population against potential noncancer risk.

VI.C Cancer Risk-Based Criterion

In the absence of a federally established MCL, the DHHS typically sets a drinking water advisory at an upper-bound excess lifetime cancer risk level (ELCR) of 1E-06, using standard default exposure assumptions that have been routinely used in the past by EPA to set drinking water standards (USEPA, 1994). However, it is noted that the USEPA will typically set a drinking water standard somewhere in the ELCR range of 1E-06 to 1E-04 level, after taking into account factors such as the cost and feasibility of treating a contaminant in water supplies.

To derive a concentration (C) in drinking water for carcinogens that is protective against a *de minimis* ELCR of 1E-06, the following general equation is used:

$$C\ (\text{mg/L}) = \frac{BW * ELCR}{CSF * CR}$$

Where:

BW = adult body weight (a default value of 70 kg)

ELCR = excess lifetime cancer risk (default de minimis level is 1E-06)

CSF = cancer slope factor (2.8E-03 mg/kg-day)$^{-1}$

CR = daily water consumption rate (a default of two liters per day)

Thus,

$$C\ (\text{mg/L}) = \frac{70\ \text{kg} * 1\text{E-}06}{2.8\text{E-}03\ (\text{mg/kg-day})^{-1} * 2\ \text{L/day}}$$

$$= 1.3\text{E-}02\ \text{mg/L} = 13\ \text{ug/L}$$

In calculating the above concentration that corresponds to a ELCR of 1E-06, it is assumed that exposure occurs over the course of a lifetime (assumed to be 70 years). Since the calculated risk-based drinking water criterion based on noncancer toxicity (50 ppb) is less protective of public health than the cancer-based value of 13 ppb, the proposed primary MCL for MTBE is 13 ppb (or 13 ug/L). This proposed MCL is considered to provide an adequate margin of safety for potential noncancer effects, including adverse effects to the kidneys, neurological and reproductive systems.

VII. Secondary Criterion

MTBE has a characteristic odor and taste; contamination in water supplies nationwide has heightened consumer concerns regarding taste and odor which have caused a reduction in use of some of these supplies (USEPA, 1999). National Secondary Drinking Water Regulations are guidelines for the States to ensure that contaminants in drinking water are not at levels which compromise the aesthetic quality of the water. The USEPA published a drinking water advisory in 1997 with advice on the consumer acceptability of MTBE (USEPA, 1997). This report recommended MTBE concentrations in the range of 20–40 µg/L (20–40 ppb) or below would protect consumer acceptance of the water supply.

VII.A Review of Available Studies

We reviewed studies that examined odor and taste thresholds for MTBE (TRC, 1994; Prah et al., 1994; Young et al., 1996; Shen et al., 1997; Dale et al., 1997; and Malcolm Pirnie, 1998). It is difficult to determine odor and taste thresholds as sensitivity varies within the population and even for individuals tested at different times. Study design and testing protocols also affect the determination of odor and taste thresholds. Therefore, results can vary widely from study to study. We relied on criteria recommended by American Industrial Hygiene Association (AIHA, 1989) in evaluating odor threshold studies. Considerations in study design include:

- Inclusion of at least six judges/panelists. Fewer than six judges will not allow a good estimate of the mean threshold concentration because individual repeatability is poor.
- The group should be a representative sample of the general population.
- Certain people should be excluded, such as pregnant women (for safety reasons, and as they may have heightened sensitivity), smokers, and drug-dependent judges. These conditions may alter their perceptions, and skew the results.
- Concentration presentation of samples should be in ascending order, or specified procedures should be taken to control for adaptation.
- The study should have multiple trials to average individual variation in sensitivity.
- The forced-choice procedure should be used to limit anticipation effects and false positives. In this procedure, the panelist chooses between the test and one or two blanks.
- Concentration steps should be no larger than three-fold the preceding concentration. If the step is larger than three-fold the odor may be perceived differently, and would not fully reflect the human odor discrimination ability.

Among these criteria, we focused on the following three:

1. Concentration presentation of samples should be in ascending order.

2. Concentration steps should be no larger than three-fold the preceding concentration.

3. Inclusion of at least six judges/panelists.

Table 14 summarizes the study design of the six primary MTBE odor and taste threshold studies, relative to these three criteria.

Table 14. Odor and taste threshold study design evaluation

Study	Ascending Concentration Presentation	$\leq$ Three-fold Concentration Steps	Minimum Six Judges/Panelists
TRC (1994)	yes	yes	yes
Prah et al. (1994)	yes	yes	yes
Young et al. (1996)	yes	yes	yes
Shen et al. (1997)	yes	yes	yes
Dale et al. (1997)	yes	yes	no
Malcolm Pirnie (1998)	yes	yes	yes

In the studies evaluated, detection threshold was defined as the concentration at which 50 percent of the judges could distinguish a difference between a blank and the test. In addition to detection thresholds, recognition thresholds were identified. The recognition threshold is the concentration at which judges can describe the characteristic smell of the compound. The studies reported average (geometric mean) threshold concentrations, and in some studies, minimum detected concentrations for individual panelists were also reported.

TRC (1994)

The American Petroleum Institute (API) published odor and taste threshold studies for gasoline, MTBE, ETBE and TAME[1] (TRC, 1994). TRC selected a panel of at least six judges for the odor portion of the study who were considered representative of the general population. TRC studied both air and water odors; only water odors are reported here. Following Standard Method 2150 for the Examination of Water and Wastewater (APHA et al., 1992), the aqueous sample odor determinations were done in flasks containing water and the oxygenate at a fixed ratio. Using the forced-choice procedure, TRC determined the lowest concentration at which 50 percent of the panelists detected an odor. Both detection and recognition thresholds were measured. The average threshold concentration was 45 ppb for odor detection, and 55 ppb for odor recognition. The odor character ascribed to MTBE was alcohol.

The taste detection portion of the study was conducted in accordance with the Standard Method 2160B for the Examination of Water and Wastewater (APHA et al., 1992). Each taste panel included at least six judges. Panelists were given room temperature (25°C) purified water as a blank, and experimental chemicals diluted in purified water as the spiked samples. The procedure included a staircase presentation series (in ascending order) with a forced-choice

[1] Methyl tertiary butyl ether (MTBE), Ethyl tertiary-butyl ether (ETBE), Tertiary-amyl-methyl ether (TAME)

procedure and repeated trials. Concentration steps increased by a factor of two to three. The average taste detection threshold for MTBE in water was 39 ppb. Panelists found the taste to be highly objectionable, even at the lowest concentrations. Characteristics assigned to the taste included nasty, bitter, rubbing alcohol, and nauseating.

TRC also performed a similar study for ARCO chemical company in 1993 and found an odor detection threshold of 95 ppb and an odor recognition threshold of 193 ppb (NSTC, 1998).

Prah et al. (*1994*)

Prah et al. (1994) studied responses of men and women to MTBE in a chamber exposure experiment to determine if MTBE elicited physiologic responses. As part of this experiment, odor threshold data for MTBE in distilled water was collected. Testing was in ascending order of concentration and continued until three correct detections at that concentration were found. Blanks were also included in the exam. The odor threshold was found to be 180 ppb MTBE in distilled water. The authors note that this finding is similar to a MTBE odor threshold of 130 ppb reported by Clark et al. (1993).

Young et al. (*1996*)

Young et al. (1996) performed a taste and odor threshold study of MTBE in still, natural mineral water. The study included nine female judges who were "carefully selected so that their sensitivities were above average to the basic tastes and odors and had been trained in product evaluation and description" (Young et al., 1996). This panel was not representative of the general population, but the overall study design was suitable. The methodology included testing concentrations in ascending order, less than three-fold differences in concentrations used, and the forced-choice procedure. An individual threshold was established at the lowest concentration where the panelist correctly identified the sample of two pairs (a pair is one sample and one blank) and failed to detect the odor or taste in the blanks. Descriptions of the odor and taste were also noted. Odor thresholds tests were performed at 40°C and taste thresholds tests were performed at 25°C. The geometric mean odor threshold concentration was 34 ppb, and the lowest concentration at which an odor was detected by three of the nine panelists was 15 ppb. The most common descriptions of the odor of MTBE were estery, vanilla and sweet. Young et al. found that the odor thresholds were lower than the taste thresholds. The mean taste threshold concentration was 48 ppb, and the lowest concentration at which the taste was detected by four of the nine panelists was 40 ppb. The most frequent descriptive tastes were estery and bitter.

Shen et al. (*1997*)

Shen et al. (1997) studied odor thresholds of MTBE at different temperatures and types of water and found odor thresholds to vary somewhat depending on these conditions. Using USEPA-approved procedures, odor-free water, chloraminated city water (0.17 mg/L combined chlorine), and water with free residual chlorine (0.21 mg/L free chlorine in odor-free water) were spiked with MTBE. Odor threshold information was collected from experienced panelists with samples at room temperature, 40°C and 60°C. Geometric means and ranges for the odor threshold concentrations were reported. The geometric mean odor threshold concentrations in odor-free water ranged from 13.5 to 45.4 ppb across all temperatures tested. In tap water, the geometric mean odor detection thresholds were 13.5 to 43.5 ppb, and in free chlorine water the ranges were 20.9 to 43.5 ppb. Table 2 presents the range of thresholds by temperature. There was no trend towards a lower threshold at higher temperatures in this study; the authors did note that test anomalies were much higher at 60°C than at room temperature or 40°C. Test anomalies included if a panel gave a negative response to the highest concentration sample but detected odor in the lower concentrations or if the panel gave a positive response to the hidden blank. Since MTBE has a boiling point of 55.1°C, it is possible that more MTBE could have escaped the flasks at 60°C than at lower temperatures, making the detections more erratic at the higher temperature.

Dale et al. (*1997*)

The Metropolitan Water District of Southern California presented a report on taste and odor thresholds for MTBE (Dale et al., 1997). The District supplies drinking water to the greater Southern California area from two sources, one of which is the Colorado River. Dale et al. tested taste thresholds in odor-free water and in Colorado River Water which has a high mineral content (~650 ppm total dissolved solids), which may mask the taste of MTBE. They tested odor-free water for odor threshold using the triangle test that required panelists to choose between three samples (either two spiked and one blank or two blank and one spiked). The Flavor Profile Method was also used to examine the aesthetic properties of the water; intensity of odor and descriptors were assigned with this method. In this study, potential panelists were screened to select highly-sensitive individuals. Therefore, the panelists did not represent the general population. Also, only four panelists were used, which limited the power of the study. Samples were evaluated for both odor and flavor, and characteristics were given as both descriptors and intensities. The study design included concentration steps less than a factor of three, and the water samples were tested at 25°C.

The small sample size in this study may affect the results. In particular, one of the four panelists did not detect the odor at any of the concentrations (concentrations ranged from 2 to 190 ppb). The other three panelists detected an odor at 48 ppb, and the odor became objectionable at 99 ppb.

The concentration required for 0.6 probability of correct detection of the taste of MTBE was 24–37 ppb in odor-free water, and 26–58 ppb in Colorado River water. The river water masked the taste of MTBE. The panelists described the taste as sweet solvent. At a concentration of 50 ppb, the panel began to note the taste of MTBE in odor-free water as ‘objectionable’.

Malcolm Pirnie (1998)

Malcolm Pirnie prepared a report on taste and odor properties of MTBE for the Oxygenated Fuels Association, Inc. which critiqued the studies to date, and also reported odor threshold data that they collected from an odor protocol which they developed. The protocol was based on ASTM Method E679-91 and included a forced choice triangle test using consumer panelists, as opposed to trained panelists. Eight concentrations (2 ppb to 100 ppb) were presented in ascending order and MTBE was prepared in odor-free bottled water at room temperature.

Samples were contained in plastic cups covered with watch glasses. Consumers had not participated in sensory testing for at least one year and were chosen from the National Food Laboratory (where the study was conducted) database which represented a cross-section of ages and gender. Fifty-seven panelists completed the odor threshold study and individual threshold concentrations were calculated as the geometric mean of the last concentration missed and the first concentration detected. Individual calculated thresholds ranged from 1.4 ppb to 132 ppb. The panel geometric mean threshold was calculated to be 15 ppb. Statistical analysis was also done to determine the concentration of MTBE that would be detected by a certain proportion of the population. Without controlling for the effect of consumer guessing, the threshold at which 5 percent of the population could detect the odor was calculated to be 0.45 ppb (95% confidence interval: 0.01–1.66). When controlling for consumer guessing, the threshold at which 5 percent of the population could discriminate the odor was raised to 21.88 ppb (95% confidence interval: 11.81–44.87). Although the calculated odor threshold was reported at 22 ppb, Malcolm Pirnie proposed a secondary standard of 15 ppb. As criteria, both values would prevent more than 95 percent of the population from detecting the odor.

Table 15: Odor threshold data for MTBE in water

Study	Temp. (°C)	Average [a] Detectable Odor Threshold (ppb)	Lowest Detectable Odor Threshold (ppb)	Characteristics
TRC (1994)	25	45		alcohol
Prah et al. (1994)		180		
Young et al. (1996)	40	34	15	estery, vanilla, sweet
Shen et al. (1997)	Room	13.5–43.5 [b,c]	2.5-5	
Shen et al. (1997)	40	17.4–35.3 [b,d]	2.5-5	
Shen et al. (1997)	60	15.8–45.4 [b,e]	2.5-5	
Dale et al. (1997)	25	43–71 [f]	6	sweet solvent
Malcolm Pirnie (1998)	25	15	2 [g]	

[a] geometric mean concentrations
[b] range across all water types tested
[c] individual geometric mean concentrations were 13.5, 15.6, 40.3, 22.6, 33.9, 13.5, 43.5, and 31.3 ppb
[d] pooled run geometric mean concentrations were 35.3, 28.5, 17.4, and 20.9 ppb
[e] pooled run geometric mean concentrations were 15.8, 45.4, 19.4, and 32.3 ppb
[f] concentration required for 0.6 probability of detection
[g] individual lowest detections ranged from 2 ppb to 100 ppb

Table 16: Taste threshold data for MTBE in water (at 25°C)

Study	Average [a] Detectable Taste Threshold (ppb)	Lowest Detectable Taste Threshold (ppb)	Characteristics
TRC (1994)	39		bitter, nasty, nauseating, rubbing alcohol
Young et al. (1996)	48	40	estery, bitter
Dale et al. (1997)	24–37 [b]	2	sweet, solvent
Dale et al. (1997)	26–58 [c]	3	sweet solvent

[a] geometric mean concentrations
[b] concentration required for 0.6 probability of detection in odor free water
[c] concentration required for 0.6 probability of detection in Colorado River water

VII.B Summary of Study Results

Odor thresholds in the six studies evaluated ranged from 13.5–180 ppb (geometric mean) with a median threshold concentration of 31.8 ppb (Table 15). Taste thresholds in the three studies evaluated ranged from 24–58 ppb (geometric mean) with a median threshold concentration of 38 ppb.

Shen et al. (1997) reported the lowest detectable odor threshold values for MTBE among the studies evaluated. The sensitivity in the panelists may reflect the use of "experienced" panelists. The odor detection threshold found by TRC (45 ppb) was higher than that of Young et al. (34 ppb). Young et al. used women panelists who were selected based on their high sensitivity. The TRC study aimed to select panelists representative of the general population. Also, the TRC odor tests were done at 25°C, while the Young et al. study was performed at 40°C. A lower temperature would likely have raised the threshold level. The odor threshold of higher temperature water (for example, while showering) may be lower than that of water at room temperature. The median odor threshold based on the studies performed at 25°C is 33 ppb. The median odor threshold based on studies performed at 40°C is 29 ppb; and at 60°C, the median odor threshold was 26 ppb.

TRC (1994) and Dale et al. (1997) reported a lower threshold with taste than odor; Young et al. (1996) found a lower threshold with odor than with taste. The lowest detectable taste thresholds were lower in the Dale et al. (1997) study than in the Young et al. (1996) study, and the characteristics of the taste were described differently (Table 16).

While all of the studies contributed to the data available on MTBE, the methods used in the Dale paper do not meet our criteria for inclusion in our analysis. We focused on three criteria – one being inclusion of at least six panelists in the study. The study by Dale et al. included only four panelists, and was therefore may not be statistically reliable.

The variability in the study methods and results makes it difficult to select a few key studies upon which to base the odor thresholds. We evaluated the impact of six different groupings of studies from which a median odor threshold could be identified. These six groupings are listed in Table 4 and reveal median odor thresholds that range from 19–32 ppb, consistent with USEPA's recommended range of 20–40 ppb. The groupings were designed to evaluate the impact of temperature and chlorination on MTBE odor detection. The highest median odor threshold (32 ppb) was based on all studies combined. The lowest median odor threshold (19 ppb) was based on studies that were conducted at 25°C and did not include chloraminated water (i.e., TRC, 1994; Shen et al., 1997; and Malcolm Pirnie, 1998). Including the Shen et al. (1997) results for chloraminated water raised the median odor threshold to 27 ppb.

VII.C Secondary Drinking Water Standard for MTBE

Varying odor and taste threshold concentrations have been reported for MTBE. As sensitivities vary widely between individuals and even within individuals on different days, it is

Table 17. Matrix of study results and odor threshold statistics

Combination	Median (ppb)	Range (Min-Max) ppb
All studies	32	13.5 – 180
All studies except (7)	30	13.5 – 180
25°C (Studies 1, 4a, 4b, 4c, 8)	27	13.5 – 45
25°C without chloraminated water (Studies 1, 4a, 4b, 8)	19	13.5 – 45
40°C (Studies 3 and 5)	29	17.4 – 35
60°C (Study 6)	26	15.8 – 45

Studies:
(1) TRC (1994)
(2) Prah et al. (1994)
(3) Young et al. (1996)
(4a) Shen et al. (1997) Room Temperature, Odor-free water
(4b) Shen et al. (1997) Room Temperature, Tap water
(4c) Shen et al. (1997) Room Temperature, Chloraminated water
(5) Shen et al. (1997) 40°C
(6) Shen et al. (1997) 60°C
(7) Dale et al. (1997)
(8) Malcolm Pirnie (1998)

impossible to determine a definitive threshold level. Typically, the geometric mean is used to identify average odor and taste thresholds because it accounts for responses which may range over several orders of magnitude. The geometric mean is the concentration at which 50 percent of the judges would be able to detect the odor or taste. Given the variability in sensitivity of taste and odor perception, individual thresholds may be orders of magnitude different from the mean. This was seen in the Dale et al. (1997) and Shen et al. (1997) studies where the individual detection thresholds can be very low but may not be representative of the broader general population. For this reason, we focus on the reported geometric mean detection thresholds.

Odor thresholds in the studies evaluated ranged from 13.5–180 ppb (geometric mean) with a median threshold concentration of 30 ppb (excluding Dale et al., 1997)[2]. Odor was reported as objectionable at concentrations of 90–100 ppb. Taste thresholds in the three studies evaluated

[2] The median threshold concentration for all studies, including Dale et al. (1997), was 32 ppb.

ranged from 24–58 ppb (geometric mean) with a median threshold concentration of 38 ppb. Taste was reported as objectionable at $\leq$ 50 ppb.

The median MTBE odor and taste thresholds are within the range of 20–40 ppb (µg/L) identified by USEPA (1997) as an approximate threshold for organoleptic properties. USEPA states that this range can be used as advisory guidance to help ensure consumer acceptance of the taste and odor of MTBE in drinking water. At these levels, there will be sensitive individuals in the population who can smell or taste MTBE. The lowest reported geometric mean odor detection threshold was 13.5 ppb (Shen et al., 1997).

We have adopted a secondary criterion of 20 ppb for MTBE based on the lower end of USEPA's recommended odor and taste threshold range of 20–40 ppb. Given the median thresholds of 30 and 38 ppb for odor and taste, respectively, the criterion of 20 ppb should protect most of the public from unacceptable qualities related to the taste and odor of MTBE in drinking water. The lower end of the range of values was selected to account for sensitive individuals and for non-chlorinated water supplies which may not mask the taste and odor of MTBE.

VIII. Conclusions

The DHHS-BHRA reviewed the available scientific literature for MTBE as requested under SB70, to derive an appropriate primary and secondary Maximum Contaminant Level (MCL) for this compound in New Hampshire drinking water supplies. Based upon our review, the DHHS-BHRA believes that MTBE may best be classified on a continuum between a group B2 and group C carcinogen, based on an observed positive dose-response in tumor occurrence in laboratory animals. The DHHS concurs with CalEPA's conclusion that MTBE is an animal carcinogen in two species, both sexes and at multiple sites. The DHHS has derived a health-based MCL of 13 ug/L to protect against potential excess lifetime cancer risk level of one in a million.

The DHHS-BHRA recommends a secondary MCL of 20 ppb for MTBE to help ensure consumer acceptance of the taste and odor of MTBE in drinking water. This secondary MCL is anticipated to protect most of the public from the unacceptable aesthetic qualities related to taste and odor.

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Exhibit 10

R-WD-19-29

New Hampshire Department of Environmental Services

Technical Background Report for the June 2019 Proposed Maximum Contaminant Levels (MCLs) and Ambient Groundwater Quality Standards (AGQSs) for Perfluorooctane sulfonic Acid (PFOS), Perfluorooctanoic Acid (PFOA), Perfluorononanoic Acid (PFNA), and Perfluorohexane sulfonic Acid (PFHxS)

June 28, 2019

STATE OF NEW HAMPSHIRE

Department of Environmental Services
Environmental Health Program
Inter-Department Communication

To: James Martin **Date:** September 3, 2019

From: Jonathan M. Ali, Ph.D. **Cc:** Clark Freise

RE: *Correction to Typo in the June 2019 PFAS MCL Technical Support Document*

It has been brought to the attention of the Permitting & Environmental Health Bureau that there is a typographical error in the description of the perfluorooctane sulfonic acid (PFOS) reference dose (RfD) derivation. Specifically, the last sentence at the bottom of page 10, the current document reads:

> "*As a result, NHDES agreed with the use of the NOAEL (2,620 ng/mL) for IgM suppression (Dong et al., 2011) instead of the lower NOAEL of 674 ng/mL (Dong et al., 2009) as a POD*."

However, on the following page, the point of departure (POD) used for the calculation of the RfD is **2,360 ng/mL** instead of the **2,620 ng/mL** described above. The sentence on page 10 should have referred to the POD as 2,360 ng/mL from Table 1 of Dong et al. (2011), not 2,620 ng/mL. This was an error in the text that was not carried into the calculation of the PFOS RfD (3.0 ng/kg-d), and therefore does not affect the final recommendation of the document for a maximum contaminant level (MCL) of 15 ng/L.

Please contact the NHDES Permitting & Environmental Health Bureau at (603) 271-1370 with any questions regarding this memo, or other issues related to the June 2019 PFAS MCL Technical Support Document.

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Abbreviations

AFFF - aqueous film forming foam

AGQS - Ambient Groundwater Quality Standard

APFO – ammonium perfluorooctanoate

ATSDR – Agency for Toxic Substances and Disease Registry

BMD – benchmark dose

BMDL – benchmark dose lower-bound confidence limit

C8 – an alternative name for perfluorooctanoic acid

CAR – constitutive androstane receptor

CAS# - Chemical Abstracts Service Registry Number

CDC – Centers for Disease Control and Prevention

CSF – cancer slope factor

d - day

DAF – dosimetric adjustment factor

IR – ingestion rate

IRIS - Integrated Risk Information System

kg - kilogram

L - liter

LHA – lifetime health advisory

Ln – natural logarithm

LOAEL – lowest observed adverse effect level

MCL – maximum contaminant level

mg - milligram

MDH – Minnesota Department of Health

MRL – minimal risk level

ng - nanogram

NHDES – New Hampshire Department of Environmental Services

NH DHHS – New Hampshire Department of Health & Human Services

NIS - National Immunization Survey

NJDWQI – New Jersey Drinking Water Quality Institute

NOAEL – no observed adverse effect level

NTP – National Toxicology Program

PFAS – perfluoroalkyl substances

PFHxS – perfluorohexane sulfonic acid

PFNA – perfluorononanoic acid

PFOA – perfluorooctanoic acid

PFOS – perfluorooctane sulfonic acid

POD – point of departure

PPAR - peroxisome proliferator-activated receptor

ppb –parts-per-billion

ppt – parts-per-trillion

RME – reasonable maximum exposure

RSC – relative source contribution

$t_{1/2}$ – half-life

UF – uncertainty factor

USEPA – U.S. Environmental Protection Agency

V_d – volume of distribution

WHO – World Health Organization

α – alpha, used to denote specific subtypes of biological molecules (i.e., proteins)

β – beta, used to denote specific subtypes of biological molecules (i.e., proteins)

γ - gamma, used to denote specific subtypes of biological molecules (i.e., proteins)

Acknowledgements

New Hampshire Department of Environmental Services would like to thank the numerous New Hampshire stakeholders and residents who provided valuable technical commentary on the initially proposed MCLs for PFOA, PFOS, PFNA and PFHxS. This includes New Hampshire's residents, academic institutions, community advocacy groups, representatives for the business community and municipalities. The science followed in deriving the currently proposed maximum contaminant levels was enacted in part as a result of their contributions. Additionally, NHDES is grateful for insights and information shared by professionals from other state agencies, interstate collaborative working groups and professional societies.

Section I. Executive Summary

The objective of the health-based risk assessment was identifying drinking water concentrations of perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA) and perfluorohexane sulfonic acid (PFHxS) that provide adequate protection of human health at all life stages, including but not limited to pre-natal development. This document provides the technical basis for the proposed maximum contaminant levels (MCLs,) which by law become Ambient Groundwater Quality Standards (AGQSs), following evaluation of technical comments submitted up to April 12th, 2019, public comment deadline, as well as peer-reviewed scientific literature published since January 1st, 2019, and external review by Dr. Stephen Roberts at the University of Florida. As a result of this process, NHDES is proposing the following maximum contaminant levels (MCLs):

- **12 ng/L for Perfluorooctanoic acid, or perfluorooctanoate (PFOA)**
- **15 ng/L for Perfluorooctane sulfonic acid, or perfluorooctane sulfonate (PFOS)**
- **11 ng/L for Perfluorononanoic acid, or perfluorononanoate (PFNA)**
- **18 ng/L for Perfluorohexane sulfonic acid, or perfluorohexane sulfonate (PFHxS)**

These health-based values are intended as health-protective limits against the chronic health effects for a through-life exposure. The primary associated health outcomes are hepatotoxicity and changes in lipid metabolism (PFOA and PFNA), suppressed immune response to vaccines (PFOS) and impaired female fertility (PFHxS). Secondary associated health effects that are expected to be less sensitive are changes in thyroid and sex hormone levels, early-life growth delays, changes in cholesterol levels and biomarkers of liver function, neurobehavioral effects, and a possible risk for certain cancers (i.e., testicular and kidney cancer).

These proposed MCLs are lower than those proposed in January 2019 (NHDES 2019) as a result of new studies and models that indicate the standards need to be lower to be adequately protective of health at all life stages. Specifically, a peer reviewed toxicokinetic model was published by the Minnesota Department of Health (Goeden et al., 2019) that predicts blood serum levels across a lifetime. Using similar studies as those from the initial proposal and those suggested in technical comments submitted by April 12th, 2019, this model indicates lower standards are necessary to avoid unacceptable elevations in the serum levels of breastfed infants and children who were breastfed as infants.

The technical basis for the proposed MCLs is detailed in Sections III and IV, and the modeling results and conclusions are presented in Section V. Briefly, this risk assessment utilized upper value, "conservative" estimates regarding: daily water consumption rates throughout life, breastmilk consumption rates through infancy, the duration of exclusive breastfeeding (12 months), relative source contribution, absorption efficiency and consideration of breastmilk transfer. Central tendency, or less conservative, assumptions included: use of uncertainty factors, human half-life estimates, placental and breastmilk transfer efficiencies of PFAS, and the recommendation of individual MCLs instead of assuming toxicological equivalency among the four PFAS evaluated.

The health effects of PFAS is an evolving area of research and it is expected that future research will improve our understanding of the quantitative risks associated with PFAS. This may result in higher or lower recommendations for these and other PFAS in the future. NHDES is committed to reviewing new scientific information on PFAS to improve the understanding of this large group of chemicals and making future recommendations for evidence-based health protective drinking water standards.

Section II. Introduction

Perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), and perfluorohexanesulfonic acid (PFHxS) are individual compounds in a large class of chemicals known as perfluorinated compounds (PFCs) and more broadly as per- and polyfluoroalkyl substances (PFAS). They have been widely used since the 1940s in commercial, industrial, and household products and applications, including production of water, grease, and stain-resistant materials, fire suppression foams, non-stick cookware, wax removers, etc. (ATSDR 2018b).

All four compounds have been detected in New Hampshire's groundwater and surface water. Their widespread use, persistence and mobility in the environment and bioaccumulative properties has resulted in the detection of PFAS in blood serum in humans and animals worldwide. This has led to considerable research into their toxicity and health effects. The health effects associated with PFAS exposure are currently being researched extensively by toxicologists and epidemiologists worldwide, resulting in numerous publications being released on a continuous basis.

According to the Agency for Toxic Substances and Disease Registry (ATSDR)(ATSDR 2018b) the following health impacts may be associated with PFAS (specific compounds as noted by ATSDR):

- Hepatotoxicity - changes in certain liver enzymes in serum (PFOA, PFOS, PFHxS)
- Increases in total and LDL cholesterol levels (PFOA, PFOS, PFNA)
- Small decreases in birth weight (PFOA, PFOS)
- Endocrine system effects (PFOA, PFOS)
- Reproductive toxicity - decreased fertility (PFOA, PFOS)
- Immunotoxicity - decreased vaccine response (PFOA, PFOS, PFHxS)
- Suggestive evidence of carcinogenicity, specifically testicular and kidney cancer (PFOA, PFOS)
- Suggestive evidence of association with pregnancy-induced hypertension and/or pre-eclampsia (PFOA, PFOS)

For additional information on the toxicity and health effects of these compounds, please visit the ATSDR webpage at: https://www.atsdr.cdc.gov/pfas/health-effects.html

In addition to the ATSDR draft toxicological profile on perfluoroalkyls, several other state (NJDWQI 2017, 2018ab; MDH 2018, 2019ab; MI PFAS Science Advisory Panel 2018), federal (EPA 2016ab; NTP 2016) and international agencies (IARC 2016; Health Canada 2016ab; EFSA 2018) have reviewed the toxicological data related to PFAS and identified similar associated health impacts.

This document presents the health-based risk assessment that derived the proposed MCLs and Ambient Groundwater Quality Standards (AGQS) for these four compounds. In January 2019, NHDES released its initially proposed MCLs along with a supporting document that explained the rationale used and scientific literature reviewed to arrive at its recommendation (NHDES, 2019). The current report is not an exhaustive review of all existing studies that reference PFOA, PFOS, PFNA, PFHxS or other PFAS; rather, it is an update to the previous assessment after evaluation of newer studies and technical comments since the initial MCL proposal in January 2019 (NHDES, 2019).

Section III. Reference Dose Derivation

The U.S. EPA (2002) defines a reference dose (RfD) as:

> "An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime."

For PFAS, a RfD can be expressed in units of nanograms of specified PFAS (ng), per kilogram of a person's body weight (kg), per day (ng/kg-d). This allows for estimation of chemical-specific daily doses that are readily scaled to persons of differing sizes. A RfD is not the same as the minimal risk levels (MRLs) developed and used by ATSDR in that 1) MRLs are not developed with the same considerations as RfDs, and 2) MRLs are not used to define action or clean up levels for chemical contaminants (EPA 2002; ATSDR 2018a). NHDES derived RfDs for PFOA, PFOS, PFNA and PFHxS (Table 1). *Additionally, it is important to note that a RfD is a population-level value and its associated blood concentration is <u>not considered a clinically-relevant value for individuals</u>.*

Table 1. Summary of RfDs and MCLs.

Compound	Reference dose (RfD)	Exposure Assumptions	Maximum Contaminant Level (MCL)
Perfluorooctanoic acid (PFOA)	6.1 ng/kg-d	See Section IV	12 ng/L
Perfluorooctanesulfonic acid (PFOS)	3.0 ng/kg-d	See Section IV	15 ng/L
Perfluorononanoic acid (PFNA)	4.3 ng/kg-d	See Section IV	11 ng/L
Perfluorohexanesulfonic acid (PFHxS)	4.0 ng/kg-d	See Section IV	18 ng/L

Derivation of a RfD requires selection of three components (Equation 2): a point of departure (POD), uncertainty factors (UF) and, where appropriate, a dosimetric adjustment factor (DAF). The POD is based on a sensitive and human-relevant critical health effect from either animal or human studies. For PFAS, this is typically a blood concentration of a certain compound at which there is no observable adverse effect in animals (e.g. rodents). As rodents are not humans, the UF is applied to be protective by reducing the animal POD to a lower and acceptable human target serum level. The DAF then converts, by estimation, the blood concentration (ng/mL) to a body weight-adjusted (kg) amount of the chemical (ng) external to the body that would need to be ingested on a daily basis to reach the human target serum level.

$$\text{Reference dose (ng/kg/d)} = \frac{\text{Point of departure (ng/mL)}}{\text{Total uncertainty factors (unitless)}} \times \text{Dosimetric adjustment factor (mL/kg/d)}$$

As the EPA RfDs for PFOA and PFOS were deemed insufficiently protective, and there are no values for PFNA or PFHxS in the EPA Integrated Risk Information System (IRIS) database, NHDES evaluated the RfDs proposed by other agencies and derived its own values. The remainder of Section III describes how RfDs for PFOA, PFOS, PFNA and PFHxS were derived following evaluation of relevant studies and technical comments submitted to NHDES by April 12th, 2019, as well as scientific uncertainties specific to the RfDs.

Perfluorooctanoic acid or perfluorooctanoate (PFOA), CAS# 335-67-1

Principal study & consideration of health effects

For the derivation of a RfD and MCL for PFOA, NHDES recommends the critical health effect of increased relative liver weight (Loveless et al., 2006; NJDWQI 2017) as an indicator for the onset of hepatotoxicity. This is the same critical health effect previously selected in the initial MCL proposal (NHDES 2019), and based on review of the literature and technical comments received, NHDES remains confident in this recommendation.

Since the initial MCL proposal by NHDES at the start of January 2019, additional studies have been published related to associations between PFOA and human health impacts along with studies demonstrating toxicity in rodent models. Relative to the critical effect proposed by NHDES, there are three new studies that merit acknowledgment with regard to relative liver toxicity. This includes two studies from highly-exposed populations (Bassler et al., 2019; Nian et al., 2019) and evaluation of background exposure levels from the 2011-2014 NHANES dataset (Jain and Ducatman 2019). Bassler and colleagues (2019) reported associations between non-clinical biomarkers of hepatocyte apoptosis (cell death) as well as altered inflammatory disease of the liver with exposure to PFOA and other PFAS within a subset of subjects from the C8 Cohort (mean PFOA serum level 94.6 ng/mL). In the C8 Health Study of China (n = 1,605 participants, median PFOA serum level of 6.19 ng/mL), liver enzyme markers such as ALT and AST showed significant increases with natural log (ln)-unit changes of PFOA, other PFAS and their isomers (Nian et al., 2019). Analysis of the 2011-2014 NHANES data (n=2,883 subjects) detected consistent associations between PFAS, including PFOA, and increased ALT and GGT in obese individuals. It is noted that the cross-sectional design of certain studies and the lack of adjustments for false discovery following multiple comparisons underscore typical challenges of relying on epidemiological studies to demonstrate causal relationships, or their utility for determining the POD in RfD development. Qualitatively, these studies reinforce NHDES consideration of altered liver function and hypertrophy in rodents as a critical health effect for the basis of its PFOA RfD.

Studies published prior to 2019 were considered as a part of the initial PFAS MCL proposal put forward by NHDES (2019). This included evaluation of peer-reviewed evidence for:

- associated immunotoxicity as summarized by the National Toxicology Program (NTP 2016), ATSDR (2018b), DeWitt et al., (2012), Kirk et al., (2018) and Chang et al., (2016),
- developmental toxicity in animal models (Butenhoff et al., 2004; Lau et al., 2006; White et al., 2007; Wolf et al., 2007; Hu et al., 2010; Onishchenko et al., 2011; White et al., 2011; Albrecht et al., 2013; Cheng et al., 2013; Koustas et al., 2014; Quist et al., 2015ab; Koskela et al., 2016), associated fetal and neonatal growth impacts in humans (reviewed by Verner et al., 2015; Negri et al., 2017; Rappazzo et al., 2017; Liew et al., 2018 and ATSDR 2018b) and consideration of developmental outcomes evaluated in the U.S. EPA LHA for PFOA of 70 ng/L (EPA 2016a),
- associated human-health outcomes based on the C8 studies (Frisbee et al., 2009, 2010; Steenland et al., 2009, 2010ab, 2013; Stein et al. 2009, 2013; Lopez-Espinosa et al., 2011, 2012ab; Gallo et al., 2012; Savitz et al., 2012ab; Steenland and Woskie 2012; Barry et al., 2013; Darrow et al., 2013; Fletcher et al., 2013; Vieira et al., 2013; Watkins et al., 2013; Winquist et al., 2013; Darrow et al., 2016),

- and delayed mammary gland development in mice (White et al., 2007, 2009, 2011; Macon et al., 2011; Tucker et al., 2015).

In its initial proposal, NHDES agreed with the assessment made by the New Jersey Drinking Water Quality Institute (NJDWQI) relative to adverse effects on the liver and NHDES maintains this position. In their 2017 document, NJDWQI summarized evidence from studies in non-human primates, various strains of rodents, including PPARα knock-out mice, as well as the existing epidemiologic studies. This lead the NJDWQI to the conclusion that there was "consistency among non-occupational studies, as well as evidence of specificity, exposure-response, strength, and biological plausibility for PFOA and ALT. These findings provide evidence supporting a causal relationship between PFOA and ALT" (NJDWQI 2017). They also acknowledge the limited epidemiologic evidence, as of 2017, to definitively prove a causal relationship with PFOA and liver disease, and the available studies did not find an association. (NJDWQI 2017). While NHDES does not agree with the application of a full database uncertainty factor (NJDWQI 2018), the arguments made for consideration of hepatic effects for human health risk assessment were deemed appropriate given the existing information on PFOA.

The ATSDR 2018 draft toxicity profile for perfluoroalkyls recognized the likely associations between PFOA and hepatotoxicity (e.g., increased serum enzyme concentrations and effects on serum bilirubin) after consideration of similar epidemiological studies and the NJDWQI 2017 report (NJDWQI 2017; ATSDR 2018b). After additional review of this same document (ATSDR 2018b), NHDES agrees there is concern for the associations between exposure to PFOA and the following human health outcomes: increases in serum lipids (i.e., total and LDL cholesterol), disruption of thyroid hormone function and transport, decreased vaccine response, decreased fertility and reduced birth weight. The scientific evidence is less clear regarding other suggested human health associations and merit further investigation to establish whether these effects are truly linked to PFOA exposure. As this relates to the RfD derived by NHDES, it was determined that the animal study selected by ATSDR was not appropriate for RfD derivation following NHDES understanding of EPA methodology (EPA 2002) and was therefore not selected for use in the initial or final MCL proposal.

Regarding carcinogenicity, NHDES derived a PFOA MCL based on non-cancer endpoints. The U.S. EPA and International Agency for Research on Cancer (IARC) determined that the current evidence indicates that PFOA is a suggestive (EPA 2016) or possible (IARC 2016) carcinogen in humans. This is specific to suggestive evidence for increased risks of kidney and testicular cancer seen in rodents and mixed associations from human studies (Barry et al., 2013). Two other agencies, the USEPA (2016a) and NJDWQI (2017), have derived cancer values for PFOA using the same principal rodent study for PFOA carcinogenicity (Butenhoff et al. 2012). The U.S. EPA (2016a) and NJDWQI (2017) arrived at possible MCL values of 500 ng/L and 14 ng/L, respectively, for a one-in-a-million risk for testicular cancer. More recently, the California Office of Environmental Health Hazard Assessment (2019) has recommended a similar value of 14 ng/L for PFOA citing concern for liver damage and cancer. This discrepancy in cancer-based MCL estimates highlights the need for better information to inform cancer risk assessment for PFOA, and is expected to be an evolving area of research in years to come. Regardless of whichever is the more accurate assessment, the proposed MCL for PFOA is lower than the more conservative of these two estimates.

Determination of a point of departure

As previously proposed by NHDES (2019), the principal study and point of departure (POD) was the same study (Loveless et al., 2006) recommended and benchmark dose modeled by the NJDWQI (2017). The critical health effect was increased relative liver weight in male mice following a 14-d oral exposure to APFO (Loveless et al., 2006). There is consistent evidence for liver toxicity across wild-type and PPARα knock-out mice (Butenhoff et al., 2004; Loveless et al., 2008; Son et al., 2008; Cui et al., 2009; Elcombe et al., 2010; Yahia et al., 2010; Tan et al., 2013; Wang et al., 2015; Rebholz et al., 2016; Li et al., 2017), as well as persistent effect on liver size and structure following gestational exposure to similar dosing regimens (Quist et al., 2015). Rat studies have suggested that this effect is an adaptive response that will dissipate following cessation of the exposure to PFOA (Butenhoff et al., 2004; Hall et al., 2012). Beyond rodent models, cynomolgus monkeys display hepatic hypertrophy, increased serum triglycerides and decreased serum T_4 following chronic exposure (26 weeks) to APFO (Butenhoff et al., 2002). As it relates to the present human health risk assessment for an MCL, these effects are not entirely adaptive as animal studies suggest persistent changes in the liver following exposure during early life stages (Quist et al., 2015a). NHDES also maintains its previous position that whether the response is adaptive is not relevant to drinking water exposures as the general population should not require recovery periods from public water. Furthermore, unlike rodents that display relatively short half-lives for PFOA and other PFAS, once humans are exposed to increased levels of PFOA they will maintain elevated serum levels on a time scale of months to years. This means that brief external exposures become chronic internal doses, especially if the external dose is relatively high. The effects on liver function are considered a chronic health outcome based on the existing body of literature.

This POD is based on the benchmark dose modeling work conducted by the NJDWQI (2017) in their technical documents for their proposed RfD and MCL of 2.0 ng/kg-d and 14 ng/L, respectively, that identified a POD for PFOA of 4,351 ng/mL based on increased liver weight. NHDES did not arrive at the same RfD due to differences in the application of uncertainty factors. Differences in the final MCL are due to NH's use of the transgenerational exposure model for breastfeeding (Goeden et al., 2019).

Application of uncertainty factors

A total uncertainty factor of 100 was applied to the POD for PFOA based on:

$$\text{Intraspecies variability (10)} \times \text{Interspecies variability (3)} \times \text{Database limitations (3)} = 100$$

For the non-risk assessor, the units of 3 and 10 are for partial (half) and full log units. So, a full log unit of 10 equals 10^1, but a half log unit of $10^{½}$ or $10^{0.5}$ is equal to 3.162. As a convention of risk assessment using EPA methodology (EPA 2002), the value of 3.162 is presented as 3. Thus, 10 × 3 × 3 is rounded to 100 from 99.982.

The full factor of 10 for intraspecies variability was deemed appropriate to protect for the poorly characterized differences in toxico-dynamics (× 3) and -kinetics (× 3) within the human population. As NHDES applied a DAF to convert the rodent serum concentration to an oral human dose, only a partial uncertainty factor (× 3) was applied for interspecies variability. As the NJDWQI (2017) derived a benchmark dose, there was no need for any additional uncertainty factors to account for lowest observed adverse effect level (LOAEL) to no observed adverse effect level (NOAEL) conversion. As the critical effect of hepatic hypertrophy is considered the onset of the adverse effect in a sensitive model species, no additional uncertainty factor was applied to account for acute-to-chronic duration of exposure.

Although NHDES agrees with the NJDWQI selection of a critical health effect and derivation of the POD for PFOA (NJDWQI 2017), NHDES concluded there is insufficient evidence supporting the application of the more conservative full database uncertainty factor (× 10). In technical comments submitted on the initially proposed MCLs, this decision was the subject of multiple critiques. On one hand, some have argued the use of a partial uncertainty factor was under-protective as the NJDWQI applied a full factor (× 10) due to concerns for observations of delayed mammary gland development in mice exposed to PFOA during perinatal development (NJDWQI 2017, and references therein). NHDES notes that the USEPA LHA (2016a) and CDC's ATSDR draft report (2018b) did not apply any database uncertainty factor with respect to the mammary gland development studies in rodents given the lack of clarity towards human health relevance (Table 3). Similar to New Hampshire, two other state agencies, Minnesota (MDH 2018) and New York (presentation, October, 2018), derived RfDs for PFOA affording only a partial uncertainty factor for this and other adverse health impacts observed in rodent and epidemiological studies. It should be noted that both of these other agencies did not use the same POD as NJDWQI or NHDES, where Minnesota utilized a higher POD and New York utilized a lower POD compared to the benchmark dose (BMD) value from Loveless et al., (2006). Thus, NHDES believes that the application of a partial database uncertainty factor (× 3) is appropriately protective without being overly conservative given the critical health effect selected and the existing toxicological and epidemiological database.

Estimation of a human equivalent oral dose

The POD represents an internal animal serum level associated with the adverse health outcome of concern. Dividing the POD by the total uncertainty factor yields a protective target serum level equivalent for the human population. *This is not a clinical or diagnostic value, nor should it be interpreted as such*.

$$\text{Target serum level for PFOA} = \frac{4{,}351\ \text{ng/mL}}{100} = 43.5\ \text{ng/mL}$$

To estimate how this internal blood level corresponds to an external oral dose of the specified compound, a dosimetric adjustment factor is applied by multiplication to identify a dose in ng of specified PFAS, per kg of individual body weight, per day (ng/kg-d). This step accounts for the highly-bioaccumulative nature and unique half-life estimates of each compound, and is consistent with prior risk assessment methods for derivation of RfDs for PFAS (USEPA 2016ab; NJDWQI 2017, 2018a; ATSDR 2018b; MDH 2018, 2019ab). The human equivalent oral dose is estimated by the following equations:

$$\text{Reference dose (RfD)} = \frac{\text{Point of departure (POD)}}{\text{Total uncertainty factors (UF)}} \times \text{Dosimetric adjustment factor (DAF)}$$

Where the DAF is equal to,

$$\mathrm{DAF} = V_d \times \left(\frac{\mathrm{Ln}(2)}{t_{1/2}}\right)$$

$$\mathrm{DAF} = 170\ \mathrm{mL/kg} \times \left(\frac{\mathrm{Ln}(2)}{840\ \mathrm{days}}\right) = 1.40\times10^{-1}\ \mathrm{mL/kg\text{-}d}$$

Consistent with the initial PFOA MCL proposal (NHDES 2019), the volume of distribution (V_d) for PFOA was 170 mL/kg (Thompson et al., 2010; EPA, 2016a). For its revised and final proposal, NHDES selected the serum half-life of 2.3 years for PFOA (Bartell et al., 2010). NHDES acknowledges that the half-life of 2.3 years is slightly less conservative than the initially proposed value for RfD derivation of 2.7 years (Li et al. 2018; NHDES 2019). This change was due, in part, to the consideration of this half-life being more appropriate given the significantly higher exposure specific to PFOA described in Bartell et al. (2010) and the larger sample size than that in Li et al. (2018).

Thus, using this chemical-specific DAF and the aforementioned point of departure and uncertainty factors, NHDES derived an oral reference dose for PFOA of 6.1 ng/kg-d.

$$\text{Reference dose (RfD)} = \frac{4{,}351\ \mathrm{ng/mL}}{100} \times 1.40\times10^{-1}\ \mathrm{mL/kg\text{-}d} = 6.1\ \mathrm{ng/kg\text{-}d}$$

Perfluorooctane sulfonic acid or perfluorooctane sulfonate (PFOS), CAS# 1763-23-1

Principal study & consideration of health effects

For the derivation of a RfD for PFOS, NHDES recommends the critical health effect of suppressed immunoglobulin M (IgM) production in male mice as proposed by the Minnesota Department of Health (Dong et al., 2011; MDH, 2019a). While NHDES previously proposed a RfD based on developmental toxicity, the review of existing and emerging evidence and technical comments suggest that the use of this immunotoxic endpoint represents a more appropriately cautious approach for the risk assessment of PFOS.

Since the initial MCL proposal by NHDES at the start of January 2019, additional studies have been published related to associations between PFOS and human health impacts along with studies demonstrating toxicity in rodent models. In the same studies that found associations between PFOA and serological markers of liver function (Nian et al., 2019; Jain and Ducatman, 2019; Bassler et al., 2019), PFOS was also associated with liver dysfunction and markers of hepatic inflammatory responses. Relative to the critical health effect selected by NHDES, one additional study on immunosuppression in humans was published since January 2019. In a prospective study of 3-month old infants from China (n = 201 participants), cord blood levels of branched isomers of PFOS were associated with reduced concentrations of antibodies towards enterovirus 71 (a causative viral agent of hand-foot-and-mouth disease; Zeng et al., 2019). Aside from hepatic and immune effects, additional studies have suggested associations between prenatal PFOS levels and early onset of puberty in girls from the Danish Birth Cohort (Ernst et al., 2019) and an estrogen-mediated relationship between cord blood levels of PFOS and birth weight (Wang et al., 2019). As with many epidemiological studies on PFAS, many of these recent studies possessed various combinations of limitations including a lack of analysis for other environmental contaminants, limited sample size and lack of analysis for the influence of breastfeeding. However, they collectively demonstrate that there is a growing body of evidence for adverse health impacts associated with PFOS.

Studies published prior to 2019 were considered as a part of the initial PFAS MCL proposal put forward by NHDES (2019). This included evaluation of peer-reviewed evidence for:

- immunotoxicity as summarized by the National Toxicology Program (NTP 2016), ATSDR (2018b) DeWitt et al., (2012) and Chang et al., (2016),
- developmental toxicity in animal models (Lau et al., 2003; Thibodeaux et al., 2003; Luebker et al., 2005ab; Yahia et al., 2008; Butenhoff et al., 2009; Onishchenko et al., 2011; Rogers et al., 2014; Wan et al., 2014), fetal and neonatal growth impacts in humans (reviewed by Verner et al., 2015; Negri et al., 2017; Rappazzo et al., 2017; Liew et al., 2018 and ATSDR 2018b) and consideration of delayed development in the U.S. EPA LHA for PFOS of 70 ng/L (EPA 2016b),
- neurobehavioral and thyroid hormone-associated effects (as reviewed by ATSDR 2018b).

NHDES acknowledges that the current understanding of the immunotoxic effects of PFOS, other PFAS and their interactions is an evolving area of research. As described by DeWitt et al. (2019), the interpretation of immunosuppression is important to consider when evaluating the relevance of associated outcomes from human studies, as well as measured responses from rodents. The current body of literature is not mature enough to clearly evaluate clinical relevance to humans, or lack thereof

(Chang et al., 2016); however, the NTP (2016) concluded that PFOS is "presumed to be an immune hazard to humans" based on animal and human data available at that time. Mouse studies indicate that PFOS impairs the T cell-dependent antibody response at low doses following sub-chronic exposure durations (Dong et al., 2009, 2011; reviewed by DeWitt et al., 2012, 2019), and was selected as the basis for a PFOS RfD by several agencies including NJDWQI (NJDWQI 2018; further detailed by Pachkowski et al. 2019), NYDOH (2018) and proposed by MDH (2019a). Although the ATSDR MRL for PFOS was based on developmental delays (Luebker et al., 2005ab), they applied an additional uncertainty factor of 10 due to the evidence for immunotoxicity (ATSDR, 2018b). Collectively, this indicates that the lower dose range at which the immunotoxic effects occur in rodents is recognized as an appropriately protective range for selection of a POD. There is a critical need for replication and use of larger study populations for understanding the immunomodulatory associations reported for PFOS and other PFAS.

NHDES derived a PFOS MCL based on non-cancer endpoints due to a lack of adequate carcinogenicity studies. IARC has not classified the carcinogenicity of PFOS at this time. The U.S. EPA determined that PFOS was a suggestive carcinogen (EPA, 2016b). This is specific to suggestive evidence for increased incidence of liver and thyroid adenomas in rats following chronic exposure. The recommendation of using non-cancer endpoints over cancer endpoints is not unique to NHDES, as other agencies have concluded that non-cancer health endpoints are adequately protective (MDH 2018; Michigan PFAS Science Advisory Panel 2018). Should additional information become available that is adequate for derivation of a cancer slope factor (CSF) for PFOS, NHDES will consider this in the framework of the MCL process.

Determination of point of departure

Following review of the technical documents deriving RfDs for PFOS based on immunosuppression in mice (NJDWQI, 2018; ATSDR 2018b; Pachkowski et al., 2019; MDH, 2019), NHDES agreed with the RfD derivation recently proposed by the Minnesota Department of Health (MDH 2019). This POD is based on serum concentrations of PFOS at the no observable adverse effect level (NOAEL) for suppressed IgM production in male mice following 60-d oral exposure (Dong et al. 2011). As summarized by MDH (2019), the critical effect reported in Dong et al. (2011) was suppressed IgM production with a NOAEL of 2,620 ng/mL (oral dose, 0.0167 mg/kg-d) and a LOAEL of 10,750 ng/mL (oral dose, 0.083 mg/kg-d). A prior study by Dong et al. (2009) reported a NOAEL of 674 ng/mL (oral dose, 0.008 mg/kg-d) for reduced plaque forming cell response to sheep red blood cells, and a similar oral LOAEL as Dong et al. (2011). However, the early work by Dong et al. (2009) did not include the intermediate dose of 0.0167 mg/kg-d that was identified as a NOAEL in their later work (Dong et al. 2011). This is further complicated as the specific effect was not replicated in both studies where plaque forming cell response was only measured in Dong et al. (2009) and IgM concentrations in the later Dong et al. (2011). As both of these metrics describe different aspects of the same immune process they do support the consideration of immunosuppression at these low doses as a POD. There remains the issue of discordance in dosing. While benchmark dose modeling of these endpoints using the original data might prove valuable to demonstrating these different metrics support a similar POD, the original data was not available for modeling and the reported data has been described as unamenable to benchmark dose modeling (NJDWQI 2018). As a result, NHDES agreed with the use of the NOAEL (2,620 ng/mL) for IgM suppression (Dong et al., 2011) instead of the lower NOAEL of 674 ng/mL (Dong et al., 2009) as a POD.

Application of uncertainty factors

A total uncertainty factor of 100 was applied to the POD for PFOS based on:

Intraspecies variability (10) × Interspecies variability (3) × Database limitations (3) = 100

For the non-risk assessor, the units of 3 and 10 are for partial (half) and full log units. So, a full log unit of 10 equals 10^1, but a half log unit of $10^{½}$ or $10^{0.5}$ is equal to 3.162. As a convention of risk assessment using EPA methodology (EPA 2002), the value of 3.162 is presented as 3. Thus, 10 × 3 × 3 is rounded to 100 from 99.982.

The full factor of 10 for intraspecies variability was deemed appropriate to protect for the poorly characterized differences in toxico-dynamics (× 3) and -kinetics (× 3) within the human population. As NHDES applied a DAF to convert the rodent serum concentration to an oral human dose, only a partial uncertainty factor (× 3) was applied for interspecies variability. The POD was based on the NOAEL described in Dong et al. (2011); thus, there was no need for additional uncertainty factors to account for LOAEL to NOAEL conversion. Dong et al. (2011) conducted a 60-day exposure so no additional uncertainty factor was applied for acute-to-chronic duration of exposure. As described by MDH (2019), an additional partial (× 3) database uncertainty factor was applied due to concerns for reports of thyroid disruption (decreased T_4) in neonatal animals and the implications of these observations in terms of neurodevelopment that has not yet been adequately studied. NHDES agreed with this consideration given the suggestive evidence for the human relevance of altered T_4 levels (reviewed by Ballesteros et al., 2017 and ATSDR, 2018b) and their potential implications for impaired neurodevelopment in humans (Grandjean and Landrigan, 2014).

Estimation of a human equivalent oral dose

The POD represents an internal animal serum level associated with the adverse health outcome of concern. Dividing the POD by the total uncertainty factor yields a protective target serum level equivalent for the human population. *This is not a clinical or diagnostic value, nor should it be interpreted as such*.

$$\text{Target serum level for PFOS} = \frac{2{,}360\ \text{ng/mL}}{100} = 23.6\ \text{ng/mL}$$

To estimate how this internal blood level corresponds to an external oral dose of the specified compound, a dosimetric adjustment factor is applied by multiplication to identify a dose in ng of specific PFAS per kg of individual body weight per day (ng/kg-d). This step accounts for the highly-bioaccumulative nature and unique half-life estimates of each compound, and is consistent with prior risk assessment methods for derivation of RfDs for PFAS (EPA, 2016ab; NJDWQI, 2017, 2018a; ATSDR, 2018b; MDH, 2018, 2019ab). The human equivalent oral dose is estimated by the following equations:

$$\text{Reference dose (RfD)} = \frac{\text{Point of departure (POD)}}{\text{Total uncertainty factors (UF)}} \times \text{Dosimetric adjustment factor (DAF)}$$

Where the DAF is equal to,

$$\text{DAF} = V_d \times \left(\frac{\text{Ln}(2)}{t_{1/2}}\right)$$

$$\text{DAF} = 230\ \text{mL/kg} \times \left(\frac{\text{Ln}(2)}{1{,}241\ \text{days}}\right) = 1.28\times10^{-1}\ \text{mL/kg-d}$$

Consistent with the initial PFOS MCL proposal (NHDES 2019), the V_d for PFOS was 230 mL/kg (Thompson et al., 2010). In its revised and final proposal, NHDES maintains its use of a 3.4-year half-life estimate based on the average across men and women, described in Li et al. (2018; NHDES 2019). NHDES considered the longer half-life values reported for retired fluorochemical workers (Olsen et al. 2007), and deemed these to be inappropriately conservative given the use of the Minnesota transgenerational model for exposure assessment which emphasizes early-life and breastfeeding exposures.

Thus, using this chemical-specific DAF and the aforementioned point of departure and uncertainty factors, NHDES derived an oral reference dose for PFOS of 3.0 ng/kg-d.

$$\text{Reference dose (RfD)} = \frac{2{,}360\ \text{ng/mL}}{100} \times 1.28\times10^{-1}\ \text{mL/kg-d} = 3.0\ \text{ng/kg-d}$$

Perfluorononanoic acid or perfluorononanoate (PFNA), CAS# 375-95-1

Principal study & consideration of health effects

For the derivation of a RfD and MCL for PFNA, NHDES recommends the critical health effect of increased relative liver weight in pregnant mice (Das et al., 2015; NJDWQI, 2018) as an indicator for the onset of hepatotoxicity. This is the same critical health effect previously selected in the initial MCL proposal (NHDES, 2019), and based on additional review of the literature NHDES remains confident in this decision.

Since the initial MCL proposal by NHDES at the start of January 2019, additional studies have been published related to associations between PFNA and associated human health impacts along with studies demonstrating toxicity in rodent models. In the same studies that found associations between PFOA and serological markers of liver function (Nian et al., 2019; Jain and Ducatman, 2019; Bassler et al., 2019), PFNA was also associated with liver dysfunction and markers of hepatic inflammatory responses. As discussed later, this co-association between multiple PFAS and the same health outcomes is acknowledged as a present challenge of epidemiological research. The same study of the Danish Birth Cohort that associated PFOS with an early onset of puberty in girls found that prenatal serum levels of PFNA were associated with delayed onset of puberty in boys (Ernst et al., 2019). Ernst and colleagues (2019) noted that these associations merit caution in their interpretation and require replication due to their novelty. Unlike PFOA and PFOS, PFNA has been the subject of relatively less research and its lower background serum concentrations compared to PFOA and PFOS present a challenge to identifying its effects in human populations.

Studies published prior to 2019 were considered as a part of the initial PFAS MCL proposal put forward by NHDES (2019). At the time, two major documents reviewed the toxicity of PFNA in humans and rodents (NJDWQI, 2018; ATSDR, 2018b). As noted in both documents, relatively little research has been conducted on PFNA despite its historical use and presence in a variety of environmental media. The NJDWQI concluded there was limited evidence associating PFNA with changes in serum ALT as a biomarker of hepatotoxicity (NJDWQI, 2018), whereas the ATSDR determined these inconsistencies in epidemiological data did not merit inclusion of hepatotoxicity as an associated health outcome for PFNA (ATSDR, 2018b). In its initial proposal, NHDES agreed with the assessment made by the NJDWQI relative to adverse effects on the liver and NHDES maintains this position. Given the limited amount of epidemiological data currently available for PFNA and its similarity in chemical structure to PFOA and biological activities in animal models, NHDES determined that the associated hepatotoxic effects were more relevant and sensitive for human health risk assessment than the developmental and endocrine effects reported in animal studies. While NHDES does not agree with the application of the database uncertainty factor or animal-to-human dose extrapolation, the arguments made for consideration of hepatotoxicity by NJDWQI (2018) were deemed appropriate given the existing information.

To date, the carcinogenicity of PFNA has not been reported in a rodent model. The human carcinogenicity of PFNA has not been classified by the U.S. EPA, IARC or CDC (ATSDR). Therefore, NHDES did not conduct a cancer-based risk assessment for PFNA. Should additional information become available that is adequate for consideration of a cancer slope factor (CSF) for PFNA, NHDES recommends consideration as to whether its development and application of such values would be more protective than the proposed MCL.

Determination of a point of departure

As previously proposed by NHDES (2019), the principal study and point of departure (POD) was the same study (Das et al., 2015) recommended and benchmark dose modeled by the NJDWQI (2018). The critical health effect was increased relative liver weight in pregnant mice following a 17-d (duration of gestation) oral exposure to PFNA (Das et al., 2015). The internal LOAEL for these mice was 12,400 ng/mL which corresponded to an oral dose of 1.0 mg/kg-d (Das et al., 2015). While no significant mortality was observed at this dose, higher oral doses (>5.0 mg/kg-d) were associated with neonatal mortality in mice. Wolf et al. (2010) demonstrated the profound effects of PFNA on mouse pups were due to PPARα activation which raises uncertainty about the qualitative and quantitative relevance of this outcome to human health. Additional studies demonstrate that rodent models display hepatotoxic responses towards PFNA (Wolf et al., 2010; Wang et al., 2015), with evidence of PPARα-independent mechanisms (Rosen et al., 2017).

This POD is based on the benchmark dose modeling work conducted by the NJDWQI (2018) in their technical documents for their proposed MCL of 13 ng/L. It should be noted that NJDWQI did not derive a RfD as a part of the MCL development, as a ratio method was used instead of a DAF with water ingestion rate to convert the target serum level to a corresponding water concentration. NHDES did not arrive at the same MCL because NHDES opted to derive a RfD consistent with the other PFAS evaluated, as well as use of the transgenerational exposure model for breastfeeding (Goeden et al., 2019; MIDHHS, 2019).

Application of uncertainty factors

A total uncertainty factor of 100 was applied to the POD for PFNA based on:

Intraspecies variability (10) × Interspecies variability (3) × Database limitations (3) = 100

For the non-risk assessor, the units of 3 and 10 are for partial (half) and full log units. So, a full log unit of 10 equals 10^1, but a half log unit of $10^{½}$ or $10^{0.5}$ is equal to 3.162. As a convention of risk assessment using EPA methodology (EPA 2002), the value of 3.162 is presented as 3. Thus, 10 × 3 × 3 is rounded to 100 from 99.982.

The full factor of 10 for intraspecies variability was deemed appropriate to protect for the poorly characterized differences in toxico-dynamics (× 3) and -kinetics (× 3) within the human population. As NHDES applied a DAF to convert the rodent serum concentration to an oral human dose, only a partial uncertainty factor (× 3) was applied for interspecies variability. As the NJDWQI (2018) derived a benchmark dose, there was no need for any additional uncertainty factors to account for LOAEL to NOAEL conversion. As with PFOA, the critical effect of hepatic hypertrophy is considered the onset of the adverse effect in a sensitive model species. Consistent with PFOA, no additional uncertainty factor was applied to account for acute-to-chronic duration of exposure. The NJDWQI applied a full LOAEL to NOAEL uncertainty factor (× 10) to account for differences between the 17-d exposure in Das et al. (2015) and longer exposures resulting in reported adverse effects (summarized in NJDWQI, 2018). As increased liver weight in mice is already considered to be a highly-sensitive critical effect in response to PFAS, NHDES determined this was overly conservative given similar uncertainty factor considerations for the similar perfluorinated carboxylic acid, PFOA.

In its original proposal, NHDES applied a full database uncertainty factor (× 10) to account for the limited existing literature on PFNA (× 3), as well as the absence of a serum-derived human half-life estimate (× 3; NHDES 2019). As a part of its revision to the proposed RfDs and subsequent MCLs, NHDES utilized the more conservative half-life of PFNA derived for men and older women. Given the application of this more conservative half-life estimate, NHDES removed the associated partial uncertainty factor for PFNA. NHDES retained the partial uncertainty factor of × 3 to account for a lack of multigenerational rodent studies using PFNA, as well as concern for potential immunotoxic impacts seen with other PFAS (NTP 2016; DeWitt et al., 2012, 2019).

Estimation of a human equivalent oral dose

The POD represents an internal animal serum level associated with the adverse health outcome of concern. Dividing the POD by the total uncertainty factor yields a protective target serum level equivalent for the human population. *This is not a clinical or diagnostic value, nor should it be interpreted as such*.

$$\text{Target serum level for PFNA} = \frac{4{,}900 \text{ ng/mL}}{100} = 49.0 \text{ ng/mL}$$

To estimate how this internal blood level corresponds to an external oral dose of the specified compound, a dosimetric adjustment factor is applied by multiplication to identify a dose in ng of specific PFAS per kg of individual body weight per day (ng/kg-d). This step accounts for the highly-bioaccumulative nature and unique half-life estimates of each compound, and is consistent with prior risk assessment methods for derivation of RfDs for PFAS (USEPA 2016ab; NJDWQI 2017, 2018a; ATSDR 2018b; MDH 2019ab). The human equivalent oral dose is estimated by the following equations:

$$\text{Reference dose (RfD)} = \frac{\text{Point of departure (POD)}}{\text{Total uncertainty factors (UF)}} \times \text{Dosimetric adjustment factor (DAF)}$$

Where the DAF is equal to,

$$\text{DAF} = V_d \times \left(\frac{\text{Ln}(2)}{t_{1/2}}\right)$$

$$\text{DAF} = 200 \text{ mL/kg} \times \left(\frac{\text{Ln}(2)}{1{,}570 \text{ days}}\right) = 8.83 \times 10^{-2} \text{ mL/kg-d}$$

Consistent with the initial PFNA MCL proposal (NHDES 2019), the V_d for PFNA was 200 mL/kg based on similar assumptions made by ATSDR (ATSDR 2018b). In this revised proposal, NHDES adjusted the half-life value from 2.5 to 4.3 years based on urinary half-lives estimated for men and older women, groups that tend to eliminate PFAS slower than younger and reproductive age women (Zhang et al., 2013; NHDES, 2019). As previously discussed in its initial proposal (NHDES, 2019), NHDES would prefer to have more reliable serum half-life estimates for PFNA instead of the urinary-derived estimates reported by Zhang and colleagues (2013). However, since the submission of the initial proposal no additional studies have been published that report a serum-based estimate for the half-life of PFNA in humans. Should additional peer-reviewed studies emerge that provide more rigorous estimates of these values, NHDES recommends consideration as to whether such data would represent and merit a significant change for the PFNA RfD.

Thus, using this chemical-specific DAF and the aforementioned point of departure and uncertainty factors, NHDES derived an oral reference dose for PFNA of 4.3 ng/kg-d.

$$\text{Reference dose (RfD)} = \frac{4{,}900 \text{ ng/mL}}{100} \times 8.83{\times}10^{-2} \text{ mL/kg-d} = 4.3 \text{ ng/kg-d}$$

Perfluorohexane sulfonic acid or perfluorohexane sulfonate (PFHxS), CAS# 355-46-4

Principal study & consideration of health effects

For the derivation of a RfD and MCL for PFHxS, NHDES recommends the critical health effect of impaired female reproduction as determined by reduced litter size initially reported in Chang et al. (2018). This RfD derivation is currently under peer-review with a scientific journal (Ali et al. *in review*). This is the same critical health effect previously proposed in the initial MCL proposal (NHDES 2019), albeit the present value is adjusted for benchmark dose modeling and selection of endpoint specific factors for dosimetric adjustment. NHDES developed the revised RfD in collaboration with external collaborators, Dr.'s Leah Stuchal and Stephen Roberts at the University of Florida, and awaits external peer-review on the soundness of its derivation. Should peer-review recommend revision and adjustment of the proposed RfD, NHDES will review the current MCL to determine if adjustments are required to be adequately protective of human health.

Since its initial proposal (NHDES, 2019), there has been a limited amount of new information generated relative to PFHxS. The Minnesota Department of Health proposed a RfD for PFHxS of 9.7 ng/kg-d based on reduced free T_4 in exposed rats using unpublished data from the NTP. At the time of writing this recommendation, the ATSDR has not released a revision to their 2018 draft MRL of 20 ng/kg-d based upon thyroid follicular cell damage in rats (ATSDR, 2018b). PFHxS showed similar associations with serological markers of liver function and inflammation as reported for PFOA, PFOS and PFNA (Nian et al., 2019; Jain and Ducatman, 2019; Bassler et al., 2019). Despite its legacy of widespread environmental occurrence associated primarily with AFFF use and growing regulatory interests, relatively little new toxicological information has emerged for PFHxS as of June 2019.

Studies published prior to 2019 were considered as a part of the initial PFAS MCL proposal put forward by NHDES (2019). This included re-evaluation of peer-reviewed evidence considered by ATSDR (2018b) including:

- thyroid toxicity including altered thyroid histology and reduced T_4 levels in rodent models (Butenhoff et al., 2008; Chang et al., 2018; Ramhøj et al., 2018), as well as epidemiology studies for altered T_4 levels (Ballesteros et al., 2017),
- immunomodulation in humans (Grandjean et al., 2012; Dong et al., 2013; Humblet et al., 2014; Okada et al., 2014; Buser and Scinicariello 2016; Stein et al., 2016; Zhu et al., 2016)
- reproductive and developmental toxicity in rodents (Butenhoff et al., 2008; Viberg et al., 2013; Chang et al., 2018; Ramhøj et al., 2018)
- hepatotoxicity or changes in lipid metabolism in rodents (Butenhoff et al., 2008; Bijland et al., 2011; Rosen et al., 2017; Chang et al., 2018; Ramhøj et al., 2018) and humans (Nelson et al., 2010; Starling et al., 2014; Mattsson et al. 2015).
- and human carcinogenicity (Hardell et al., 2010; Bonefel et al., 2014; Hurley et al., 2018).

To date, the carcinogenicity of PFHxS has not been reported in a rodent model. The human carcinogenicity of PFHxS has not been classified by the U.S. EPA, IARC or CDC (ATSDR). Therefore, NHDES did not conduct a cancer-based risk assessment for PFHxS. Should additional information become available that is adequate for consideration of a CSF for PFHxS, NHDES recommends consideration as to whether its development and application would be more protective than the proposed MCL.

Determination of a point of departure

As described in its initial MCL proposal (NHDES 2019), the principal study and point of departure (POD) was the same study (Chang et al., 2018) that has been adjusted primarily by use of benchmark dose modeling (Ali et al., *in review*). The critical health effect was reduced litter size in mice following a 14-d, prior to pregnancy, oral exposure to PFHxS (Chang et al., 2018). As mentioned above, the details and methodology for derivation of the POD for PFHxS are currently under review in Ali et al (*in review*). Benchmark dose (BMD) modeling was performed using Benchmark Dose Software (BMDS) (Version 3.1; USEPA, 2019). The critical effect endpoint was a change in the mean live litter size for adult CD-1 female mice, and due to the unavailability of litter-specific data was modeled based on PFHxS serum concentrations on study day 14 (reported in Chang et al., 2018). This resulted in a benchmark dose of 41,200 ng/mL and a 95% lower confidence limit on the benchmark dose (BMDL) of 13,900 ng/mL. NHDES determined that this is an appropriately cautious endpoint given the limited number of animal studies (reviewed in NHDES, 2019), considerably longer half-lives of PFHxS in humans when compared to other PFAS (Olsen et al., 2007; Zhang et al., 2013; Worley et al., 2017; Li et al., 2018), environmental occurrence and exposures (Daly et al., 2018), as well as suggestive associations of reproductive impacts in humans (Vélez et al., 2015; Zhou et al., 2017; Zhang et al., 2018).

Application of uncertainty factors

A total uncertainty factor of 300 was applied to the POD for PFHxS based on:

$$\text{Intraspecies variability (10)} \times \text{Interspecies variability (3)} \times \text{Duration of exposure (3)} \\ \times \text{Database limitations (3)} = 300$$

For the non-risk assessor, the units of 3 and 10 are for partial (half) and full log units. So, a full log unit of 10 equals 10^1, but a half log unit of $10^{½}$ or $10^{0.5}$ is equal to 3.162. As a convention of risk assessment using EPA methodology (EPA 2002), the value of 3.162 is presented as 3. Thus, 10 × 3 × 3 × 3 is rounded to 300 from 316.14.

The full factor of 10 for intraspecies variability was deemed appropriate to protect for the poorly characterized differences in toxico-dynamics (× 3) and -kinetics (× 3) within the human population. As NHDES applied a DAF to convert the rodent serum concentration to an oral human dose, only a partial uncertainty factor (× 3) was applied for interspecies variability. As benchmark dose modeling was used to derive a POD, detailed in Ali et al. (*in review*), there was no need for any additional uncertainty factors to account for LOAEL to NOAEL conversion. After careful evaluation of technical comments and re-assessment of the literature and principal study, an additional but partial uncertainty factor (× 3) was applied to account for acute-to-chronic duration of exposure of female mice. In Chang et al. (2018), female mice received a less than chronic exposure (14 days) to PFHxS prior to the start of pregnancy. Because of the relatively limited number of studies on PFHxS and evidence for adverse impacts following longer exposure to similar compounds (i.e., PFOS), this was determined to be appropriate without being overly conservative (e.g., a full factor of × 10).

In its original proposal, NHDES applied a full database uncertainty factor (× 10) to account for the limited existing literature on PFHxS (× 3), as well as associations with thyroid hormone and transport interference (× 3; NHDES 2019). As a part of its revision to the proposed RfD and subsequent MCL, NHDES determined the existing single-generation studies provide some basis for evaluating the reproductive and developmental toxicity of PFHxS. However, NHDES retained a partial uncertainty factor (× 3) to account for a lack of multigenerational rodent studies, as well as concern for potential immunotoxic impacts seen with other PFAS that have yet to be assessed (NTP 2016; DeWitt et al., 2019). The protracted human half-life of PFHxS relative to other PFAS underscores the need for additional research into biological impacts following chronic exposures.

Estimation of a human equivalent oral dose

The POD represents an internal animal serum level associated with the adverse health outcome of concern. Dividing the POD by the total uncertainty factor yields a protective target serum level equivalent for the human population. *This is not a clinical or diagnostic value, nor should it be interpreted as such*.

$$\text{Target serum level for PFHxS} = \frac{13{,}900\ \text{ng/mL}}{300} = 46.3\ \text{ng/mL}$$

To estimate how this internal blood level corresponds to an external oral dose of the specified compound, a dosimetric adjustment factor is applied by multiplication to identify a dose in ng of specific PFAS per kg of individual body weight per day (ng/kg-d). This step accounts for the highly-bioaccumulative nature and unique half-life estimates of each compound, and is consistent with prior risk assessment methods for derivation of RfDs for PFAS (USEPA 2016ab; NJDWQI 2017, 2018a; ATSDR 2018b; MDH 2019ab). The human equivalent oral dose is estimated by the following equations:

$$\text{Reference dose (RfD)} = \frac{\text{Point of departure (POD)}}{\text{Total uncertainty factors (UF)}} \times \text{Dosimetric adjustment factor (DAF)}$$

Where the DAF is equal to,

$$\text{DAF} = V_d \times \left(\frac{\text{Ln}(2)}{t_{1/2}}\right)$$

$$\text{DAF} = 213\ \text{mL/kg} \times \left(\frac{\text{Ln}(2)}{1{,}716\ \text{days}}\right) = 8.61\times10^{-2}\ \text{mL/kg-d}$$

In its revised MCL proposal for PFHxS, NHDES has changed both the V_d and half-life estimate for PFHxS to reflect the female-specific health impact utilized as the basis of the RfD. The V_d for PFHxS was reduced from 287 to 213 mL/kg which reflects a female-specific V_d value for PFHxS (Sundström et al., 2012). Sundström et al. (2012) reports the volume of distribution for cynomolgus monkeys, not humans, and no human V_d is currently available for PFHxS. Similar to ATSDR (ATSDR 2018b) and other agencies (MDH 2019b; MIDHHS 2019), NHDES used the non-human primate value as an estimate for the human volume of distribution. Similarly, NHDES adjusted the half-life value from 5.3 to the female-specific estimate of 4.7 years (average) based on a study of a community exposed to PFHxS through contaminated drinking water (Li et al. 2018; discussed in NHDES 2019). It is noted that use of this average half-life estimate for women is less conservative than longer average half-life estimates of 8.5 years (Olsen et al., 2007) or 7.4 years (Li et al., 2018) that rely on serum levels in men, or longer estimates of 7.7-35 years for women depending on age (Zhang et al., 2013). However, given the conservative nature and sex-specific effect selected for the POD of PFHxS, the use of a 4.7-year half-life in women was deemed appropriate without being overly-conservative.

Thus, using this chemical-specific DAF and the aforementioned point of departure and uncertainty factors, NHDES derived an oral reference dose for PFHxS of 4.0 ng/kg-d.

$$\text{Reference dose (RfD)} = \frac{13{,}900\ \text{ng/mL}}{300} \times 8.61{\times}10^{-2}\ \text{mL/kg-d} = 4.0\ \text{ng/kg-d}$$

Summary of Recommended RfDs for PFOA, PFOS, PFNA and PFHxS

Recommended RfDs

NHDES recommends the following chronic oral RfDs for PFOA, PFOS, PFNA and PFHxS:

- PFOA, 6.1 ng/kg-d
- PFOS, 3.0 ng/kg-d
- PFNA, 4.3 ng/kg-d
- PFHxS, 4.0 ng/kg-d

These RfDs are for protection from the primary health effects of liver toxicity (PFOA and PFNA), immune suppression of antibody responses (PFOS) and reduced female fertility (PFHxS) based on evidence from animal studies. In addition to these primary health outcomes, these RfDs are expected to be reasonably protective for associated and secondary (less sensitive) health outcomes that occur at similar or higher serum concentrations in rodents. Secondary health effects for these and other PFAS include disruption of thyroid and sex hormone levels and their signaling, teratogenic effects, early-life growth delays, changes in cholesterol levels, neurobehavioral effects, renal toxicity and fertility in rodent models. NHDES believes its selection of PODs, uncertainty factors and DAFs for each RfD provides adequate protection of human health from appreciable risk of these primary and secondary health effects during a lifetime.

Table 2 presents the NHDES recommended RfDs or MRLs, along with their applied uncertainty factors those selected by other agencies that have evaluated these same PFAS. The application of uncertainty factors follows EPA guidance (EPA 2002), and is dependent on the principal study selected and consideration of other available studies. However, it is not uncommon for different risk assessors and toxicologists to arrive at different applications of uncertainty factors when considering where reasonable and health-protective conservatism is being applied in the risk assessment process.

Discussion of scientific uncertainties

While the human health effects of PFAS is a rapidly growing area of scientific research, the exact nature of their associated health effects in humans remains uncertain (ATSDR, 2018b; Michigan Panel, 2018). The cross-sectional nature of most epidemiological studies precludes proof of causality between measured PFAS serum concentrations and the reported associated health outcomes. This is especially problematic as the extraordinarily long half-lives of PFAS (years) make it difficult to disentangle the associated health effects in these studies from co-exposure to other environmental contaminants with relatively shorter half-lives (days to weeks). Additionally, there is a general lack of true control groups for comparison as various combinations of PFAS are detectable in the blood of virtually all populations from around the world. There is concern for the implications of reverse causation with certain health outcomes associated to PFAS. As an evolving area of scientific research, NHDES anticipates new findings will improve the understanding of PFAS-related health effects in humans.

Due to the limitations of epidemiological studies, RfDs were derived using animal data. There are inherent uncertainties associated with RfDs derived from animal studies (EPA 2002), specifically related to considerations of human health relevance (e.g., biological plausibility) and translation of animal findings to human equivalent values (i.e., uncertainty factors and DAFs).

As a part of its initial proposal (NHDES, 2019), NHDES considered the contentious issue of peroxisome proliferator-activated receptor subtype α (PPARα) activation in rodents and its relevance to human health. The activation of PPARα is a contributing pathway for several of the reported toxic responses in rodent models evidenced by genetic knockout studies and gene expression profiling studies (reviewed by ATSDR 2018b and NHDES 2019). This is especially true for hepatotoxicity and changes in lipid metabolism in rodents following exposure to PFAS due to upregulation of rodent specific pathways leading to oxidative stress (Perkins et al., 2004; Loveless et al., 2006; Rosen et al., 2007, 2008, 2017; Das et al., 2017; reviewed by ATSDR, 2018b). *In vitro* testing demonstrates that PFAS show a stronger binding affinity for rodent PPARα when compared to human PPARα (Wolf et al., 2008). These and other studies reviewed by NHDES (2019) suggest qualitative and quantitative differences in toxicity between species for PPARα-dependent effects.

Such qualitative and quantitative differences raise concern for selection of critical health effects such as liver toxicity based on rodent studies (reviewed by Klaunig et al., 2012), and have been a major criticism of the half-lives derived by NHDES and other agencies for RfDs for PFOA, PFOS, PFNA and PFHxS. Based on existing toxicological information, NHDES contends that selected critical effects from animal studies are appropriate for the protection of human health. While the physiological roles of PPARs (i.e., PPARα, β and γ) in humans are less defined than those of the other nuclear receptors like the estrogen or androgen receptor, there is evidence that they are involved in lipid metabolism (Issemann and Green, 1990; Lee et al., 1995) and function of muscle, adipose and immune cells throughout the body (Tyagi et al., 2011). Independent of PPARα activation, there is evidence for other mechanisms for rodent toxicity (e.g. mitochondrial dysfunction) that are potentially relevant to humans and other organisms (Hagenaars et al., 2013; Cui et al., 2015; reviewed by Li et al., 2017; Li et al., 2018; NHDES, 2019). Furthermore, evidence from non-human primates further suggest that effects on the liver, cholesterol levels, thyroid hormones and the immune system are relevant to humans and not isolated to rodent studies (Griffith and Long 1980; Thomford 2001; Butenhoff et al., 2002; Seacat et al., 2002). Taken collectively, this supports the NHDES risk assessment and derivation of RfDs using the selected critical health effects.

With respect to uncertainty factors, NHDES received multiple comments regarding its application of uncertainty factors in the initially proposed MCLs (NHDES, 2019). Table 2 presents the uncertainty factors used by other state or federal agencies for the derivation of RfDs for PFOA, PFOS, PFNA or PFHxS, and demonstrates that NHDES's selections are within the norms of the professional practice. As previously explained for each compound, NHDES considered available information from human and animal studies to arrive at the total uncertainty factors applied for each RfD. Difference in principal study selection and consideration of available data results in differences in the selection and application of total uncertainty factors (EPA 2002). Given the selection of principal studies and considerations of exposure assumptions described in Section IV, NHDES remains confident that its application of uncertainty factors is appropriate without being overly conservative.

Table 2. Interagency Differences in Uncertainty Factors. Summary of uncertainty factor allocations, RfDs and MRLs by government risk assessment groups.

Specific Uncertainty Factors	ATSDR[a] (MRLs)	US EPA[b,c] (RfD)	TX CEQ[d] (RfD)	MN DOH[e-g] (RfD)	NJ DWQI[h-j] (RfD)	NH DES (RfD)	NY DOH[k] (RfD)
PFOA							
Principal Study	Koskela et al. 2016	Lau et al. 2006	Macon et al. 2011	Lau et al. 2006	Loveless et al. 2006	Loveless et al. 2006	Macon et al. 2011
Human Variability	10	10	10	10	10	10	10
Interspecies Differences	3	3	1	3	3	3	3
Duration of Exposure	1	1	1	1	1	1	1
LOAEL to NOAEL	10	10	30	1	1	1	1
Database Insufficiency	1	1	1	3	10	3	3
Total Uncertainty Factor	300	300	300	100	300	100	100
RfD (ng/kg-d)	3.0	20.0	12.0	18.0	2.0	6.1	1.5
PFOS							
Principal Study	Luebker et al. 2005	Luebker et al. 2005	Zeng et al. 2011	Dong et al. 2011	Dong et al. 2009	Dong et al. 2011	Dong et al. 2009
Human Variability	10	10	10	10	10	10	10
Interspecies Differences	3	3	1	3	3	3	3
Duration of Exposure	1	1	1	1	1	1	1
LOAEL to NOAEL	1	1	10	1	1	1	1
Database Insufficiency	10	10	1	3	1	3	1
Total Uncertainty Factor	300	300	100	100	30	100	30
RfD (ng/kg-d)	2.0	20.0	23.0	3.0	1.8	3.0	1.8
PFNA							
Principal Study	Das et al. 2015	n.a.	Fang et al. 2010	n.a.	Das et al. 2015	Das et al. 2015	n.a.
Human Variability	10	-	10	-	10	10	-
Interspecies Differences	3	-	1	-	3	3	-
Duration of Exposure	1	-	10	-	10	1	-
LOAEL to NOAEL	1	-	1	-	1	1	-
Database Insufficiency	10	-	10	-	3	3	-
Total Uncertainty Factor	300	-	1,000	-	1,000	100	-
RfD (ng/kg-d)	3.0		12.0		0.73	4.3	
PFHxS							
Principal Study	Butenhoff et al. 2009	n.a.	Hoberman & York 2003	Unpublished NTP data	n.a.	Chang et al. 2018	n.a.
Human Variability	10	-	10	10	-	10	-
Interspecies Differences	3	-	1	3	-	3	-
Duration of Exposure	1	-	1	1	-	3	-
LOAEL to NOAEL	1	-	3	1	-	1	-
Database Insufficiency	10	-	10	10	-	3	-
Total Uncertainty Factor	300	-	300	300	-	300	-
RfD (ng/kg-d)	20.0		3.8	9.7		4.0	

n.a. indicates the specific compound was not assessed or reported on by the specific agency.
[a] ATSDR, 2018b. Draft Toxicological Profile for Perfluoroalkyls
[b] U.S. EPA, 2016a. Health Effects Support Document for Perfluorooctanoic Acid (PFOA)
[c] U.S. EPA, 2016b. Health Effects Support Document for Perfluorooctane Sulfonate (PFOS)
[d] TX Commission on Environmental Quality (TXCEQ), 2016. Perfluoro Compounds (PFCs): available at: https://www.tceq.texas.gov/assets/public/implementation/tox/evaluations/pfcs.pdf
[e] Minnesota Department of Health (MDH), 2018. Toxicological Summary for: Perfluorooctanoate.
[f] Minnesota Department of Health (MDH), 2019a. Toxicological Summary for: Perfluorooctane sulfonate.
[g] Minnesota Department of Health (MDH), 2019b. Toxicological Summary for: Perfluorohexane sulfonate.

[h] New Jersey Drinking Water Quality Institute (NJDWQI), 2017. Appendix A: Health-Based Maximum Contaminant Level Support Document: Perfluorooctanoic Acid (PFOA)
[i] New Jersey Drinking Water Quality Institute (NJDWQI), 2018a. Appendix A: Health-Based Maximum Contaminant Level Support Document: Perfluorooctane Sulfonate (PFOS)
[j] New Jersey Drinking Water Quality Institute (NJDWQI), 2018b. Appendix A: Health-Based Maximum Contaminant Level Support Document: Perfluorononanoic Acid (PFNA)
[k] New York Department of Health (NYDOH), 2018 and personal communications. Presentation available at: https://www.health.ny.gov/environmental/water/drinking/dwqc/

Section IV. Drinking Water Exposure Assumptions, Modeling and Resulting MCLs

Using the reference dose (RfD) derived in Section III, the MCL considers the estimated daily intake of water from a specific source and how much drinking water contributes to the total exposure from all other sources of a specified contaminant. Specific methodologies for deriving health protective water criteria are detailed by the EPA (USEPA 1989, 2004, 2017, 2018). Although NHDES chose a different approach, the conventional method for deriving drinking water values utilizes the following equation:

$$\text{Maximum contaminant level (ng/L)} = \frac{\text{Reference dose (ng/kg-d)}}{\text{Daily water ingestion rate (L/kg-d)}} \times \text{Relative source contribution (unitless)}$$

For a simple example, a drinking water value for PFOA using the currently recommended RfD, 95th percentile ingestion rate of lactating women and a relative source contribution of 0.5 (meaning 50%) is shown below. This approach was used in the initially proposed MCL, but is not being applied following consideration of breastfeeding (Goeden et al., 2019).

$$\text{Example for PFOA (not an actual MCL recommendation by NHDES)} = \frac{\text{6.1 ng/kg-d}}{\text{0.055 L/kg-d}} \times 0.5 = \text{55 ng/L}$$

The daily water ingestion rate is a body-weight adjusted factor specific to certain age groups, to gender, and to lactation or pregnancy status. In its initial proposal, NHDES selected the water ingestion rate of the 95th percentile of lactating women, an estimated value of 0.055 L/kg-d (EPA, 2011; NHDES, 2019). While lower estimates are more reflective of the central tendencies of the general population, especially non-lactating women, they were deemed inadequately protective for the larger population. The values are selected from the Exposure Factors Handbook (EPA 2011), which was recently updated specifically for these ingestion rates (see Chapter 3 of EPA, 2019). These updated values were used by NHDES.

Instead of applying a fixed daily water ingestion rate that is assumed to be protective across a lifespan, NHDES applied the toxicokinetic model described by Goeden et al. (2019) to consider how changes in water ingestion at a given MCL are predicted to influence internal blood levels of each PFAS. This is due to the prolonged and elevated internal doses (i.e., serum levels) predicted across infancy and childhood resulting from PFAS in breastmilk. NHDES acknowledges that this is a departure from typical methodology for deriving such a standard, but the unique properties of PFAS (i.e., long half-lives) merit its application to be truly protective across all life stages for the chronic health impacts associated with these chemicals.

The relative source contribution (RSC) is an estimate of how much of the typical daily exposure will be allowed to come from drinking water. EPA recommends an RSC floor of 20% of the RfD and a ceiling of 80% of the RfD. The intention of an RSC ceiling of 80% is to ensure that total exposure from all sources does not exceed 100% of the RfD with a margin of safety for potential unknown or underestimated exposures. PFAS are present in a wide variety of environmental media (Moriwaki et al., 2003; Trudel et al., 2008; Haug 2011; Haug et al., 2011; Winkens et al., 2017, 2018) and consumer products (Haug 2011; Carpet and Textile Treatment - Washburn et al., 2005; Winkens et al. 2017; Cosmetics - Kang et al., 2016; Fast Food Packaging – Schaider et al., 2017), with an ever-growing number of potential sources identified (Boronow et al., 2019; Kim et al., 2019; Nakayama et al., 2019). Thus, for the typical person, it is unlikely that drinking water is responsible for 100% of their exposure. However, an exact profile for the proportions of exposure from various sources remains poorly characterized. The latter part of this section details how this was evaluated by NHDES to arrive at a RSC of 50% for PFOA, PFOS, PFNA and PFHxS.

Application of Goeden et al. (2019) for exposure modeling

As a part of the evaluation of published research and technical comments on the initially proposed MCLs (NHDES, 2019), NHDES has adopted the use of the transgenerational toxicokinetic model (detailed in Goeden et al., 2019), for the determination of appropriately protective health-based MCLs. This is a toxicokinetic model that predicts the serum concentration of PFAS due to drinking water exposure and consumption of breastmilk or formula across a lifespan starting at birth (Goeden et al., 2019). It does not predict an effect (health outcome) due to exposure from drinking water, only the blood concentration for an individual in a reasonable maximum exposure (RME) scenario. The tolerable blood concentration in the RME scenario, or threshold, is determined by the chemical-specific RfD and RSC. This Excel-based model is available upon request from the MN Department of Health.

After review of the model and studies on the placental transfer (Fei et al., 2007; Midasch et al., 2007; Monroy et al., 2008; Fromme et al., 2010; Beesoon et al., 2011; Kim et al., 2011; Liu et al., 2011; Needham et al., 2011; Lee et al., 2013; Porpora et al., 2013; Zhang et al., 2013; Kato et al., 2014; Cariou et al., 2015; Manzano-Salgado et al., 2015; Fisher et al., 2016; Yang et al., 2016; Chen et al., 2017; Mamsen et al., 2019) and breastmilk transfer (Karrman et al., 2007; Haug et al., 2011; Kim et al., 2011; Liu et al., 2011; Cariou et al., 2015; Gyllenhammer et al., 2018) of PFOA, PFOS, PFNA and PFHxS, NHDES determined this novel and “fit-for-purpose” tool (Goeden et al., 2019) was necessary to evaluate exposure outcomes from the proposed MCLs. Specifically, the transfer of PFAS into breastmilk combined with the relatively high breastmilk and water ingestion rates of infants results in a prolonged elevation of serum levels throughout childhood. Under RME assumptions, the serum levels are predicted to be drastically higher than background serum levels seen in the general population, which is assumed to be free of widespread PFAS contamination in drinking water. Furthermore, this elevation throughout childhood into late adolescence limits the RSC allotment for exposure to other sources of PFAS in the environment that, to date, are not regulated.

The following subsections describe the inputs selected by NHDES for RME modeling using Goeden et al. (2019). A summary of model inputs, and associated references, used by NHDES for selection of the proposed MCLs are provided in Table 3.

Human half-life and V_d assumptions

Explanations of the selected half-lives for PFOA, PFOS, PFNA and PFHxS are described in the discussions of DAFs in Section III of this report. For PFOA, an average serum-based half-life was selected from Bartell et al. (2010), which was estimated from a sample population of 200 individuals from the Mid-Ohio valley who were exposed to PFOA from their drinking water supply due to contamination from a DuPont facility. NHDES selected the half-life estimates from Li et al. (2018) for PFOS and PFHxS. These serum-derived half-life estimates were determined to be more representative of the general population, and were obtained from a Swedish community (n = 106 participants) exposed to PFAS, namely PFOS and PFHxS, from drinking water contaminated by AFFF use at a nearby airbase (Li et al., 2018). Finally, the half-life estimate for PFNA was selected from Zhang et al. (2013) which reports urine-based values from a Chinese population (n = 86 participants).

Similar to the half-life values, the volume of distribution (V_d) estimates were identical to those selected by NHDES to derive RfDs for PFOA, PFOS, PFNA and PFHxS (Section III, and references therein).

Table 3. Exposure Model Parameters. Summary of parameters utilized in the transgenerational model (Goeden et al., 2019) by NHDES for derivation of proposed MCLs.

Model Parameter	Central or Upper Tendency of Parameter	PFOA	PFOS	PFHxS	PFNA
Half-Life, years (yrs)	Central	2.3 [a]	3.4 [b]	4.7 [b]	4.3 [c]
Placental Transfer Ratio	Central	0.72 [d]	0.40 [d]	0.70 [d]	0.69 [e]
Breastmilk Transfer Ratio	Central	0.050 [d]	0.017 [d]	0.014 [d]	0.032 [e]
Volume of Distribution (V_d), L/kg	Central	0.170 [f]	0.230 [f]	0.213 [g]	0.200 [e,h]
Relative Source Contribution (RSC), %	Central	50	50	50	50
		Same for All 4 PFAS Exposure Scenario Models			
Duration of Exclusive Breastfeeding, months	Upper	12			
Water Ingestion Rates, mL/kg-d [i] (EPA Exposure Factors Handbook, 2019 Update)					
Birth to <1 mon	Upper	224			
1 to <3 mons	Upper	267			
3 to <6 mons	Upper	158			
6 to <11 mons	Upper	133			
1 to <2 yrs	Upper	57			
2 to <3 yrs	Upper	67			
3 to <6 yrs	Upper	45			
6 to <11 yrs	Upper	41			
11 to <16 yrs	Upper	31			
16 to <18 yrs	Upper	31			
18 to <21 yrs	Upper	31			
21+ yrs	Upper	44			
Lactating Woman	Upper	47			
Breastmilk Ingestion Rates, mL/kg-d (EPA Exposure Factors Handbook, 2011)					
Birth to <1 mon	Upper	220			
1 to <3 mons	Upper	190			
3 to <6 mons	Upper	150			
6 to <12 mons	Upper	130			

[a] Bartell et al., 2010; [b] Li et al., 2018; [c] Zhang et al., 2013; [d] MDH, 2018, 2019ab
[e] MIDHHS, 2019; [f] Thompson et al., 2010; [g] Sundström et al., 2012; Ali et al., *in review*
[h] ATSDR, 2018b;
[i] Body weight and age-specific adjustments to the V_d were maintained the same as described in Goeden et al., 2019.

Placental & breastmilk transfer ratios

NHDES applied previously selected placental and breastmilk transfer ratios for PFOA (MDH 2018), PFOS (MDH 2019), PFNA (MIDHHS 2019) and PFHxS (MDH 2019). In line with the MDH and MIDHHS, NHDES opted to use central tendency values for each PFAS versus the upper or 95th percentile estimate for transfer in the RME scenarios (Table 3).

The exact quantitative nature of PFAS transfer across the placenta remains an active area of research. For example, Mamsen et al. (2019) demonstrated that the accumulation of PFAS in fetal tissues begins early in pregnancy and continues throughout gestation as specific PFAS are taken up by the forming organs with slightly different efficiencies. Several studies of cord blood compared to maternal serum levels of PFAS have been used to estimate placental transfer ratios and are used in the model to predict the “at birth” serum level (Fei et al., 2007; Midasch et al., 2007; Monroy et al., 2008; Fromme et al., 2010; Beesoon et al., 2011; Kim et al., 2011; Liu et al., 2011; Needham et al., 2011; Lee et al., 2013; Porpora et al., 2013; Kato et al., 2014; Cariou et al., 2015; Manzano-Salgado et al., 2015; Fisher et al., 2016; Yang et al., 2016; Chen et al., 2017; Mamsen et al., 2019). The average maternal-to-cord blood or placenta ratios ranged from 0.20 (Mamsen et al., 2019) to 1.24 (Midasch et al., 2007) for PFOA, 0.14 (Fisher et al., 2014) to 0.60 (Midasch et al., 2007) for PFOS, 0.24 (Mamsen et al., 2019) to 1.18 (Monroy et al., 2008) for PFNA, and 0.23 (Fisher et al., 2016) to 1.25 (Monroy et al., 2008) for PFHxS. A point of caution in interpreting placental transfer ratios in these studies is the trimester of pregnancy that data are collected. Changes in blood volume over the coruse of pregnancy are expected to affect the maternal blood concentration, thereby influences cord blood to maternal blood concentration ratios for various PFAS. Collectively, these studies provide valuable and reliable information for estimating the transfer from mother to newborn. This model does not predict fetal blood or tissue concentrations of PFAS as this compartmentalization is poorly understood, although recent work, such as Mamsen et al. (2019) may lead to the development of such models.

Compared to placental transfer efficiencies that are well-documented for PFAS, a small body of literature informs our understanding of the PFAS in breastmilk. As a part of its review of the technical documents described by MDH (2018, 2019ab) and MIDHHS (2019), NHDES reviewed the source papers for the breastmilk transfer ratios (Karrman et al., 2007; Haug et al., 2011; Kim et al., 2011; Liu et al., 2011; Cariou et al., 2015; Gyllenhammer et al., 2018). These studies demonstrate that the small average percentage (0.6-11% across various PFAS) transferred from a mother’s serum, which is typically at concentrations of ng/mL or ppb, results in breastmilk at concentration ranges well above most existing drinking water advisories. Combined with relatively high ingestion rates of breastmilk relative to the infant’s body weight, this results in a spike of infant blood concentrations that the model predicts will remain high through childhood.

Duration of breastfeeding

A major assumption for the breastfeeding component of this model is the duration of exclusive breastfeeding. Consistent with the RME scenarios selected by other states (MDH, 2018, 2019ab; MIDHHS, 2019), NHDES used a 12-month duration of *exclusive breastfeeding* for all four RME scenarios. Similar to the CDC, the World Health Organization (WHO) defines exclusive breastfeeding as:

> "Exclusive breastfeeding means that the infant receives only breast milk. No other liquids or solids are given – not even water – with the exception of oral rehydration solution, or drops/syrups of vitamins, minerals or medicines." – WHO eLENA (2019)

A central tendency assumption for the duration of exclusive breastfeeding would be 6 months, but NHDES selected a more conservative modeling parameter of 12 months of exclusive breastfeeding. A 12-month exclusive breastfeeding duration is a conservative assumption because the CDC recommends 6 months of exclusive breastfeeding and some continuation through infancy given the clear benefits to an infant's health and their long-term development. After 6 months of age, the recommendation is that other food items are introduced and breastfeeding continues for up to 2 years of age.

This assumption has been argued by some to be overly conservative relative to the RME scenarios as 1) CDC recommended exclusive breastfeeding for up to 6 months of age and 2) if an infant were exclusively breastfeeding at or after 12 months of age, it is unlikely they are not ingesting other fluids or foods. NHDES contends that this is a reasonable assumption given 1) the role that the duration of exclusive breastfeeding plays in the MN model and 2) the high rates of breastfeeding in New Hampshire and breastfeeding trends across the nation.

MDH notes that the duration of breastfeeding, along with breastmilk intake rates and water concentration, are the most sensitive parameters of the model (MDH 2017). The duration of exclusive breastfeeding and breastfeeding with complimentary foods varies, but the CDC recommends up to 2 years of breastfeeding with the addition of complimentary foods. The transgenerational model does not contain parameters for apportionment of exposure from breastmilk versus complimentary foods, or formula, across the first two years of life. Given this uncertainty for mixed exposures for breastfed infants, NHDES agreed that the assumption of a 12-month exclusive breastfeeding duration was appropriate for estimate for the purpose of the model.

Results from the National Immunization Survey (NIS) indicate that, in the general U.S. population of newborns, approximately 24.9% ± 1.2 (± half 95% CI) of infants are exclusively breastfed at 6 months of age. By 12 months, 35.9% ± 1.3 of infants consume breastmilk along with complimentary foods and liquids (CDC, 2018a). New Hampshire specific estimates from this same dataset are that 30.2% ± 5.8 of infants exclusively breastfeed at 6 months of age, while 45.6% ± 6.5 breastfeed at 12 months of age in addition to complimentary foods (CDC, 2018a). Based on the historical trends, the 2018 Breastfeeding Report Card (CDC, 2018b) indicates more women nationwide are breastfeeding or want to breastfeed their children, giving weight to the consideration of breastfeeding and selecting a conservative window of 12 months.

Breastmilk and drinking water ingestion rate assumptions

This transgenerational model evaluates the impact of changing water ingestion rates across a lifespan. These ingestion rates are expressed as liters of water per kilogram of an individual's body weight per day (L/kg-d). As a person grows, their physiological demand for water changes and this is reflected by age-specific ingestion rates, or life-process specific rates in the case of pregnant and lactating women. To put this in context of historical practice, the EPA typically assumed a drinking water ingestion rate of 2 L/d for adults and 1 L/d for infants and children under 10 years of age (U.S. EPA, 2000). After adjusting for body weight, these typical rates would underestimate the water consumption of infants, children and lactating and pregnant women. Thus, consideration of these life-stage specific values is prudent for a persistent and highly-bioaccumulative class of drinking water contaminants.

To be protective of the general population including high-end water consumers, NHDES applied the 95th percentile water and breastmilk ingestion rates throughout life in the RME scenarios for PFOA, PFOS, PFHxS and PFNA. The use of the 95th percentile for water ingestion rates is consistent with the initial proposal, and this is simply an extension to other life stages. Recently updated values in 2019 Updated Chapter 3 of the Exposure Factors Handbook (EPA, 2019) were combined with estimated breastmilk ingestion rates from Chapter 15 of the 2011 Edition (EPA, 2011). As these changes were specific to water ingestion, not breastmilk, the difference between the 2011 and 2019 estimates for infants, a change of -9% to +3% for those <1 year of age, was determined to be a minor and tolerable change to the RME scenarios. The breastfed RME exposure was the driver of the MCL for all evaluated PFAS, and therefore protective of an individual in the formula-fed RME scenario.

Consideration of the Relative Source Contribution (RSC)

Exposure to PFAS is not solely due to drinking water, so in order for the MCL to be health protective NHDES needs to account for the contribution of other sources towards the reference dose (RfD). The proportion of exposure attributed to a specific source is accounted for through the relative source contribution (RSC). With respect to a MCL, the RSC is the percentage of total exposure typically accounted for by drinking water (EPA 2000). This value can be referred to as a proportion or percentage, and EPA recommends a ceiling of 80% and a floor of 20%. A smaller RSC for drinking water exposure results in a lower regulatory standard, but implies that sources other than water contribute more significantly to exposure.

Presently, there is no inventory of all relevant sources of PFAS exposure to determine what proportion each source shares in an RSC for the general population. Several studies have characterized specific media such as dust, food (Kowalczyk et al., 2013; reviewed by EFSA, 2018) and breastmilk (previously discussed) and estimated the percentages of total exposure attributable to these sources; but no single study has merged these findings to estimate the reasonable and realistic RSC for drinking water.

In the absence of such data, the EPA provides a decision tree for identifying an appropriate RSC (replicated in Figure 1; EPA 2000). Following this process, NHDES determined:

- (Box 6 to 8a) *Yes, there are significant known sources of these PFAS other than drinking water*. As a result of their dispersion into the environment and lack of adequate removal from waste streams, there are known sources of PFAS that contribute to environmental exposures. This includes release into surface water and implications for fish and shellfish consumption (Fair et al., 2019), and the impacts of PFAS contamination of soil (Filipovic et al., 2015; Scher et al., 2018), dust (Fu et al., 2015; Winkens et al., 2018) and agriculture-related exposures (Nascimento et al., 2018; reviewed by Ghisi et al., 2019).

- (Box 8a to 8c) *Yes, there is some information to make a characterization of exposure*. As mentioned above, there is some data on environmental sources to make rough characterizations. Additionally, there is blood data from the National Health and Nutrition Examination Survey (NHANES) to estimate the general exposure of the U.S. population to PFAS. The NHANES data for blood levels of PFAS is assumed to reflect general exposure to all sources in the U.S. population, and is presumed to not reflect the results of excessively high exposures, relative to the proposed MCLs, due to contaminated drinking water as seen in the communities of Southern New Hampshire Pease Tradeport and Southern New Hampshire.
- (Box 8c to 13) *NHDES performed apportionment with a 50% ceiling and 20% floor for each of the assessed PFAS*. This apportionment was achieved using the EPA subtraction method (EPA 2000).

The subtraction method (EPA 2000) estimates an apportionment of the RSC is based on assumed knowledge of the background exposure. For PFAS, the subtraction method has been mathematically applied as follows (NJDWQI 2018; MDH 2018, 2019ab):

$$\text{Relative Source Contribution} = \frac{\text{Target serum level } \left(\frac{\text{ng}}{\text{mL}}\right) \text{ - Reference or background population level } \left(\frac{\text{ng}}{\text{mL}}\right)}{\text{Target serum level } \left(\frac{\text{ng}}{\text{mL}}\right)} \times 100\%$$

The difference between the target serum level and the RfD is that the former is an internal blood concentration while the latter is the external amount of the chemical that could come from multiple sources. For each of the compounds, the target serum levels were: PFOA – 43.5 ng/mL, PFOS – 23.6 ng/mL, PFNA – 49.0 ng/mL and PFHxS – 46.3 ng/mL. The reference population serum level is meant to reflect a background level of exposure from the general population, not one that is highly exposed due to a specific environmental source such as drinking water. Using the NHANES average serum values, subtracting this background level from the target serum level (the maximum allowable level) results in a proportion that is presumably permissible for drinking water alone. Other sources including food, dust, treated consumer products (e.g., carpeting, cookware, food packaging, etc.) are assumed to be included in the reference or background population blood concentrations.

Using this approach with the NHANES 2013-2014 data for children ranging in age from 3 to 19 years (as reported in Daly et al., 2018), NHDES arrived at RSCs of 50% for PFOA, PFOS, PFNA and PFHxS. Unlike its initial proposal, NHDES selected the NHANES dataset over the use of NH-specific estimates. The NH-specific blood data was focused on communities whose primary exposure was associated with drinking water, and would therefore overestimate non-drinking water exposure sources if used to establish an RSC as initially proposed in January (NHDES, 2019). Thus, the NHANES dataset was deemed more appropriate to account for other non-drinking water sources of exposure. For an understanding of how the NHANES data compares to that collected from one of the highly-exposed communities in New Hampshire and the limitations of interpreting these findings, readers are referred to Daly et al. (2018).

Instead of using the general population (i.e., all ages), NHDES estimated RSCs based on the serum concentrations from those younger than 19 years of age (Table 4). As emphasized in several comments made to NHDES on its initial proposal, the risk assessment needs to consider current information for children. Since the phase out of certain PFAS, but not all, the national average serum levels have declined suggesting some reduction of background exposure. Given the emphasis of the RME on infancy and early childhood, NHDES determined it was appropriate to derive the RSC with specific consideration of this group. All of the values for PFOA, PFOS, PFNA and PFHxS were at or above 48.3%, therefore NHDES opted for an RSC of 50%.

NHDES acknowledges that the use of the general NHANES estimates that includes adults with historically high exposures results in similar or more restrictive RSC values; especially for PFOS. However, the RME scenarios for the proposed MCLs indicate that the predicted serum level for the 95th percentile of adult water consumers is approximately equal to or below the 20% RSC and therefore sufficiently protective after considering the context of the national dataset. Furthermore, the cap of 50% despite calculated higher RSCs for each of these accounts for the unknown and novel sources of PFAS exposure, as well as the higher serum levels of PFAS found in New Hampshire's highly-exposed communities.

Table 4. Relative Source Contribution Estimates. Various relative source contribution (RSC) values resulting from use of the EPA subtraction method (EPA 2002) in combination with available serum data for the geometric mean (GM) and 95th percentile from the NHANES 2013-2014 dataset, as reported in Daly et al. (2018).

Reference Population	Reference Serum level (ng/mL)	Target Serum Level (ng/mL)	Resulting RSC Allotment for Drinking Water (%)
PFOA			
3-5 year olds (GM)	2.00	43.5	95.4
6-11 year olds (GM)	1.89	43.5	95.7
12-19 year olds (GM)	1.66	43.5	96.2
3-5 year olds (95th percentile)	5.58	43.5	87.2
6-11 year olds (95th percentile)	3.84	43.5	91.2
12-19 year olds (95th percentile)	3.47	43.5	92.0
PFOS			
3-5 year olds (GM)	3.38	24.0	85.9
6-11 year olds (GM)	4.15	24.0	82.7
12-19 year olds (GM)	3.54	24.0	85.3
3-5 year olds (95th percentile)	8.82	24.0	63.3
6-11 year olds (95th percentile)	12.40	24.0	48.3
12-19 year olds (95th percentile)	9.30	24.0	61.3
PFNA			
3-5 year olds (GM)	0.76	49.0	98.4
6-11 year olds (GM)	0.81	49.0	98.3
12-19 year olds (GM)	0.60	49.0	98.8
3-5 year olds (95th percentile)	3.49	49.0	92.9
6-11 year olds (95th percentile)	3.19	49.0	93.5
12-19 year olds (95th percentile)	2.00	49.0	95.9
PFHxS			
3-5 year olds (GM)	0.72	46.3	98.4
6-11 year olds (GM)	0.91	46.3	98.0
12-19 year olds (GM)	1.27	46.3	97.3
3-5 year olds (95th percentile)	1.62	46.3	96.5
6-11 year olds (95th percentile)	4.14	46.3	91.1
12-19 year olds (95th percentile)	6.30	46.3	86.4

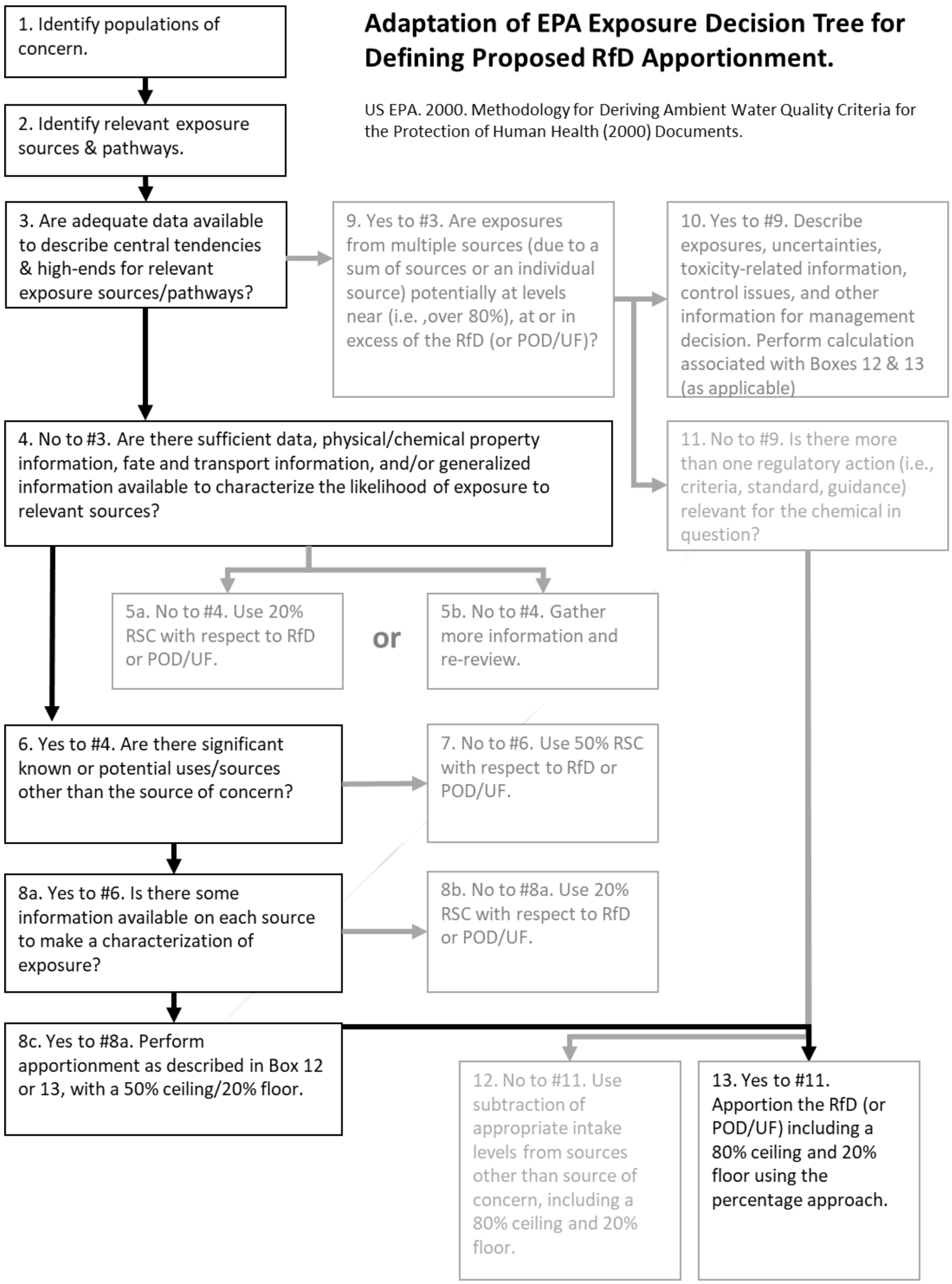

Figure 1. Adaptation of EPA decision tree (EPA, 2000) for determining the RSC. Black boxes, text and arrows outline the decision process used by NHDES to arrive at the subtraction method for PFAS with a 50% ceiling. The target serum level is a population assessment value, *not clinical*, from the derivation of the RfDs, detailed in Section III.

Section V. Discussion of the MCLs proposed by NHDES

Based on the previously described RfDs, exposure considerations and application of the transgenerational model (Figure 2), the proposed maximum contaminant levels (MCLs) are:

- **12 ng/L for Perfluorooctanoic acid, or perfluorooctanoate (PFOA)**
- **15 ng/L for Perfluorooctane sulfonic acid, or perfluorooctane sulfonate (PFOS)**
- **11 ng/L for Perfluorononanoic acid, or perfluorononanoate (PFNA)**
- **18 ng/L for Perfluorohexane sulfonic acid, or perfluorohexane sulfonate (PFHxS)**

These health-based values are intended as health-protective limits against the chronic health effects for a through-life exposure. The primary associated health outcomes are hepatotoxicity and changes in lipid metabolism (PFOA and PFNA), suppressed immune response to vaccines (PFOS) and impaired female fertility (PFHxS). Secondary associated health effects that are expected to be less sensitive are changes in thyroid and sex hormone levels, early-life growth delays, changes in cholesterol levels and biomarkers of liver function, neurobehavioral effects, and a possible risk for certain cancers (i.e., testicular and kidney).

Modeled Exposure Results

Figure 2 shows the model result for predicted serum concentrations at the proposed MCL for each PFAS. The exposure starts at birth with the assumption that the mother is at a steady-state serum level from consumption of water at the modeled drinking water concentration. The solid blue line represents the highest exposure in the RME model, showing the predicted serum level for a breastfed infant who consumes breastmilk and water at the 95th percentile ingestion rates throughout life and is born to and breastfeeds from a mother with a similar water consumption rate. The solid green line represents the predicted serum level for a formula-fed infant who consumes formula (reconstituted with water at the MCL) and water at the 95th percentile ingestion rates throughout life and is born to a mother with a similar water consumption rate. The dashed lines represent the predicted serum concentrations for individuals at the central tendency or average breastmilk, formula and water ingestion rates.

There is a clear spike in predicted serum levels of breastfed infants due to the aforementioned transfer efficiencies of PFAS into breastmilk. For infants, this is concerning due to the potential for hand-to-mouth behaviors in later infancy that have been shown to contribute to PFAS exposure in children of this age (Trudel et al., 2008). Because of these potential exposures and the suspected health impacts on early development, NHDES selected an MCL value that does not allow the predicted infant serum level to exceed the 50% RSC of the RfD or target serum level. It is true that the central tendency consumers fall well below this threshold. However, it has been shown that when considering variants on the RME scenarios the use of the 95th percentile ingestion rate is adequately protective for other factors (e.g., higher breastmilk transfer efficiencies or longer half-life estimates) (Goeden et al., 2019).

The long half-lives of these compounds result in significantly elevated serum levels peaking at the cessation of breastfeeding and continuing through the remainder of childhood. While the predicted steady-state concentrations for adults or formula-fed infants would allow less restrictive MCLs, breastfed children could potentially exceed the RfD due to other sources such as dust (Winkens et al., 2018) or foods and food packaging (D’eon et al., 2009; reviewed by EFSA, 2018). This point further emphasizes the appropriateness of the 50% cap on the RSC as selected by NHDES.

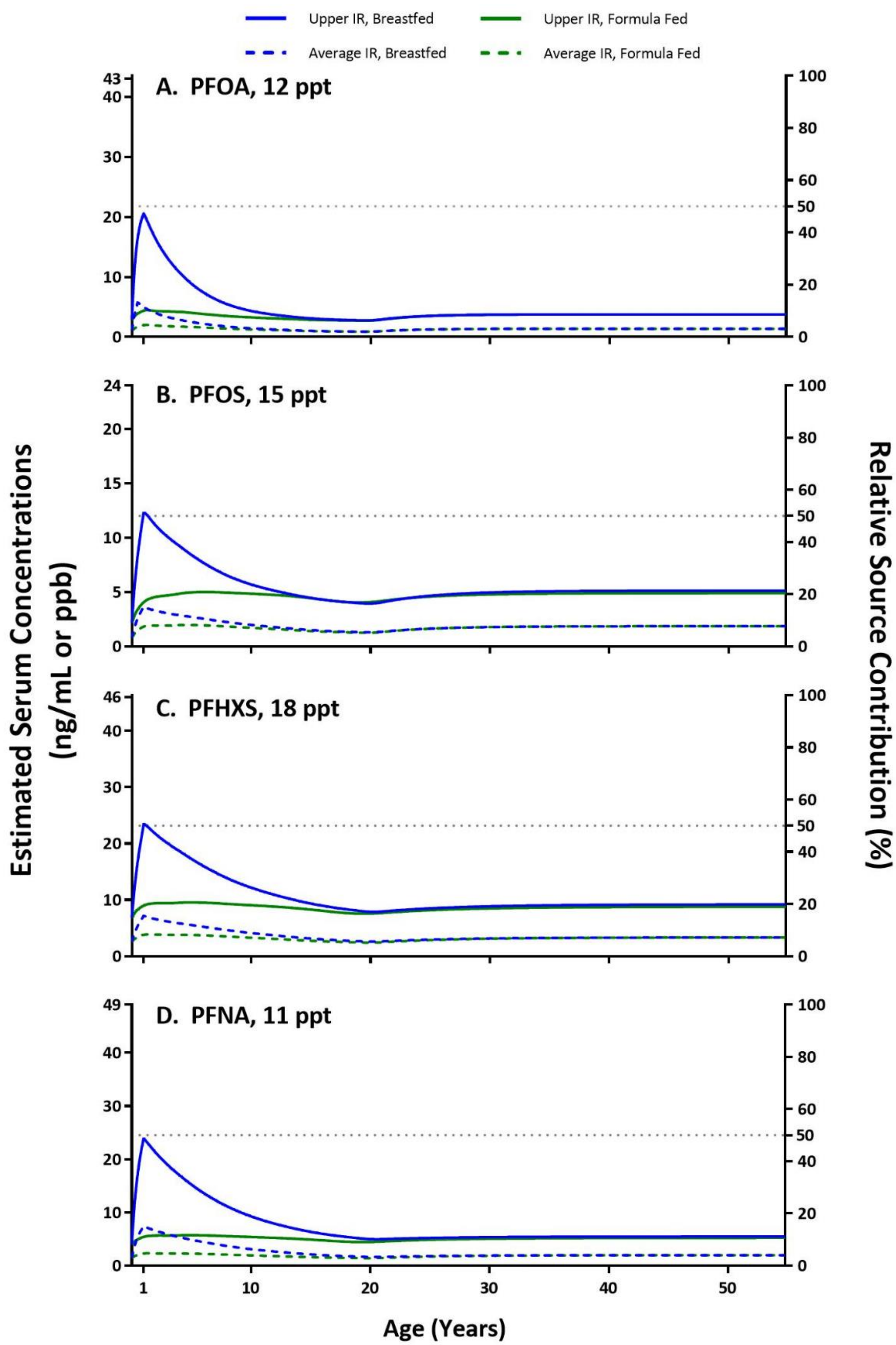

Figure 2. Predicted serum PFAS concentrations in response to upper (95th percentile) and average (mean) water ingestion rates (IR) at the proposed MCLs. Blue lines indicate results for breastfed infants with 12 months exclusive breastfeeding, and green lines indicate results for formula-fed infants. Solid lines represent upper IRs and dashed lines indicate average (mean) IRs. Estimates made using the model described in Goeden et al. (2019).

Using the proposed MCL values for each compound, serum concentrations attributable to drinking water can be estimated for an individual across various life stages (adapted from Figure 2). For newborns (at birth), the estimated drinking water contribution to serum concentrations for the 95th percentile consumer would be: 2.9 ng/mL for PFOA, 2.2 ng/mL for PFOS, 4.0 ng/mL for PFNA and 6.9 ng/mL for PFHxS. The model does not predict fetal tissue concentrations, so the predicted at-birth values represent the aforementioned placental transfer efficiencies. The predicted drinking water contribution to serum concentrations for the 95th percentile breastmilk consumer (at the end of 1 year of exclusive breastfeeding) would be: 20.6 ng/mL for PFOA, 12.4 ng/mL for PFOS, 25.1 ng/mL for PFNA and 23.5 ng/mL for PFHxS. Adults at steady state following constant water consumption at the 95th percentile are predicted to have drinking water contributions of PFAS equal to or less than: 3.8 ng/mL for PFOA, 5.1 ng/mL for PFOS, 5.7 ng/mL for PFNA and 9.2 ng/mL for PFHxS.

As a point of caution in interpretation, the previously described results assume no fluctuation from the 95th percentile drinking water consumption rate across an individual lifespan. That is to say, the 95th percentile consumer remains the 95th percentile consumer every day. These estimates include several conservative and protective assumptions, such as the use of the 95th percentile of drinking water ingestion rates (adjusted for body weight) throughout life, not the average water consumer or fluctuations between these tendencies. Additionally, the modeled outputs may not reflect individual variations in biology throughout life (Fàbrega et al., 2014; Worley et al., 2017) and are intended for population-level exposure assessment. However, as described by Goeden et al. (2019), this fit-for-purpose tool provides important insight into exposures during critical life stages of development. Further development and refinement of multi-compartment models will certainly prove useful for future risk assessments of these and other PFAS.

The proposed MCLs are predicted to result in a modest increase of serum concentrations due to drinking water levels; but, as argued by Post et al. (2017), such increases relative to background are preferred over the significantly larger serum levels that are predicted for the previously proposed MCLs (NHDES, 2019) or the EPA lifetime health advisories (EPA, 2016ab). Based on current evidence, this level of exposure is expected to be sufficiently health protective relative to current background levels reported in populations of concern, such as children and adolescents (Table 4).

Limitations and uncertainties

As with any risk assessment, this process was subject to uncertainty and limitations. Limitations included recommendation of individual versus group-based MCLs for PFAS, and consideration of background exposure using the RME scenarios described in Section IV. A major uncertainty was quantifying the exact risks of disease incidence for each compound, which is also a significant challenge for quantifying, or monetizing, the benefits of the proposed MCLs.

A limitation to the present assessment is that the transgenerational model's RME scenarios focus on the predicted impact of drinking water exposure, not other background sources of exposure. In general, there is a downward trend for the background levels of most measured PFAS based on the NHANES data. NHDES considered this with its use of the NHANES data to derive and apply a 50% RSC for each compound. Although PFOA and PFOS were recently phased out by most U.S. manufacturers, there remains potential for exposure to these and other PFAS from imported products or the degradation of precursors into PFOA or PFOS in the environment. Nevertheless, the appropriate level of conservatism applied in the assumptions of drinking water ingestion rates and RSC provide reasonable protection.

At this time, NHDES is not recommending a class-based approach to regulation of these compounds. This is a limitation of the present risk assessment given the considerable number of PFAS detected in the environment and used in commerce. However, individual assessment of each compound found each one to have relatively unique toxico-dynamic and –kinetic properties based on consideration of existing animal toxicity and human data. Despite similarity in the range of the proposed MCLs for these 4 PFAS, it is likely that future individual assessments, using current EPA methodology, of shorter carbon chain PFAS will result in higher drinking water values for shorter carbon chain compounds as a result of shorter half-lives. Given these considerations, it was determined that a class based approach was not advisable at this time. Should other state agencies or the U.S. EPA identify science-based methods for group regulation that account for some of the unique properties of these compounds, NHDES will consider this approach.

Currently, there is uncertainty to quantifying the health risks associated with exposure to PFOA, PFOS, PFNA, PFHxS and other PFAS. A growing number of epidemiological and animal toxicity studies are adding to the body of evidence for the biological activity and health outcomes associated with these contaminants. However, the exact nature of PFAS-related health hazards remains elusive due to a variety of factors including, but not limited to: a limited understanding of the toxicological mechanism of action, their occurrence world-wide and lack of control (i.e., PFAS-free) populations to compare health outcomes against, lack of long-term studies despite decades of use, and co-exposure with other PFAS and other environmental contaminants. Additional research is critically needed to address this issue and better characterize and quantify the risks associated with PFAS.

Conclusions

The lower MCLs proposed in this report are primarily due to consideration of the elevated serum levels predicted for infants and young children under a reasonable maximum exposure scenario. At the initially proposed values, these spikes in infant blood levels of PFAS would result in unacceptable reductions in the margin of exposure from infancy through childhood due to the unique properties of PFAS. Their capacity to transfer through breastmilk combined with relatively long half-lives of each compound merits the use of novel methods (i.e., Goeden et al., 2019) to provide a more accurate assessment of exposure. This is not a recommendation against breastfeeding for women who are currently breastfeeding or plan to breastfeed as the benefits of breastfeeding are very well-defined relative to the potential risk associated with PFAS. NHDES recommends these MCLs to afford adequate long-term health protection of the population based on its assessment of these four PFAS.

The human health impacts of PFAS is a continuously evolving area of scientific research, and is expected to continue changing in the future. The assessments made by NHDES are based on currently available information but recognizes that science is a process, not an outcome. Future assessments of these and other PFAS compounds may result in higher or lower health protective values based on the best available science at the time. NHDES will continue to review emerging information as a part of its ongoing efforts to understand the impacts of PFAS contamination across New Hampshire.

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