STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY

REPORT OF PROCEEDINGS TO THE NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION FOR PROPOSED REVISIONS TO THE 15A NCAC 02L .0202 GROUNDWATER QUALITY STANDARDS RULES

PUBLIC HEARING

Date: February 2, 2021, 6:00 PM

Location: Online Public Hearing, accessible through WebEx

NC Register: Publication of Notice of Environmental Management Commission intention to amend the 15A NCAC 02L .0202 rule given in accordance with G.S. 150B-21.2.
Volume 35, Issue 14, Pages 1524-1610, January 15, 2021

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I. INTRODUCTION

This report is the official record of the proceedings related to the North Carolina Department of Environmental Quality Division of Water Resources' and the Environmental Management Commission's proposal to revise the Groundwater Quality Standards in 15A NCAC 02L .0202. This report includes oral and written comments received during the public hearing and public comment period, relevant attachments, and the final recommendation of the Hearing Officer as to the proposed revisions to the Groundwater Quality Standard Rules for consideration by the North Carolina Environmental Management Commission.

Table of Abbreviations and Acronyms

The abbreviations and acronyms used in this report are defined as follows:

Abbreviation	Meaning
02L .0202	15A NCAC 02L .0202 Groundwater Quality Standards
APA	Administrative Procedures Act
ATSDR	Agency for Toxic Substances and Disease Registry
CASRN	Chemical Abstracts Service Registry Numbers
Department	Department of Environmental Quality
DEQ	Department of Environmental Quality
Director	Director of the Division of Water Resources
Division	Division of Water Resources
DWR	Division of Water Resources
EMC	Environmental Management Commission
EPA	U.S. Environmental Protection Agency
GWWMC	Groundwater and Waste Management Committee
IMAC	Interim Maximum Allowable Concentration
IRIS	U.S. EPA Integrated Risk Information System
µg/L	Micrograms per liter
ng/L	Nanograms per liter
NC	North Carolina
NCAC	North Carolina Administrative Code
NCGS	North Carolina General Statutes
NPDES	National Pollution Discharge Elimination System
OSBM	Office of State Budget and Management
PFAS	The family of per- and poly-fluorinated substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
ppb	parts per billion
ppt	parts per trillion
PQL	Practical Quantitation Limit
RfD	Reference Dose
RIA	Regulatory Impact Analysis
RSC	Relative Source Contribution
SSAB	NC Secretaries' Science Advisory Board
Staff	Staff of the Division of Water Resources

II. BACKGROUND

Groundwater Quality Standards for the protection of groundwaters of the state are established by 15A NCAC 02L .0202. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage as an existing or potential source of drinking water supply for humans. Every three years the State is required by 15A NCAC 02L .0202(g) to review its groundwater water quality standards and interim maximum allowable concentrations to determine if changes are needed and, if necessary, to make those changes. Revision of these standards is needed to ensure that they contain the most recent health and toxicological information.

15A NCAC 02L .0202(c) states that any person may petition the Director of the Division of Water Resources to establish an Interim Maximum Allowable Concentration (IMAC) for a substance for which a standard has not been established under the rule. The last periodic review performed by Division staff focused on the IMACs that have been established under 02L .0202(c). Staff reviewed the toxicological research and literature in accordance with 15A NCAC 02L .0202 to account for new information, new data, or reexaminations of existing data.

Current regulations establish groundwater quality standards as the least of the six criteria contained in 15A NCAC 02L .0202(d) (1) – (6):

1. Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (0.10 for inorganics; 0.20 for organics)]/[2liters/day (avg. water consumption)];
2. Concentration which corresponds to an incremental lifetime cancer risk of 1x 10-6;
3. Taste threshold limit value;
4. Odor threshold limit value;
5. Maximum contaminant level; or
6. National secondary drinking water standard.

Further, Paragraph 15A NCAC 02L .0202(e) requires that the following references, in order of preference, be used in establishing concentrations of substances which correspond to levels described in Paragraph (d) above:

1. U.S. EPA Integrated Risk Information System (IRIS).
2. Health Advisories (U.S. EPA Office of Water).
3. Other health risk assessment data published by U.S. EPA.
4. Other relevant, published health risk assessment data and scientifically valid peer-reviewed published toxicological data.

Staff considered appropriate modifications in accordance with 15A NCAC 02L .0202(d) and (e) and prepared reports which were reviewed by internal staff and then submitted to toxicology staff at both the Division of Waste Management and the Occupational and Environmental Epidemiology Branch within the NC Department Health and Human Services for secondary review. Staff then proposed amendments to 15A NCAC 02L .0202 in order to incorporate a number of these IMACs into groundwater quality standards.

As part of the two-year process to develop the materials for the Groundwater and Waste Management Committee (GWWMC) of the EMC, there was a series of presentations staff made leading up to the rulemaking action item. An information item was presented to the GWWMC in July 2018 by DWR staff. This information item provided an overview of the groundwater quality standards, the IMAC review process that staff had completed, and a summary of the recommendations that DWR intended to make to the GWWMC as an action item. The GWWMC was also informed that staff had begun working on the Regulatory Impact Analysis. Staff returned to the GWWMC in September 2019 and January 2020 to request approval of the proposed amendments to the rule to proceed to the EMC. At the request of the GWWMC, staff returned in May and July of 2020 with additional information items which provided detailed descriptions of the proposed groundwater standards for each IMAC that was reviewed. On September 9, 2020, an action item was presented to the GWWMC requesting approval of the proposed amendments to the rule text to proceed to the EMC. This request was approved by the GWWMC.

The EMC approved taking the proposed rule amendments and the Regulatory Impact Analysis out to public comment and hearing at their November 19, 2020 meeting. Information presented and other meeting materials are available on the EMC's website and the November 2020 agenda (Agenda Item 20-31).

III. SUMMARY OF PROPOSALS

The proposed changes to the 15A NCAC 02L .0202 Groundwater Quality Standards that were presented at the public hearing are summarized below:

- The adoption of a groundwater quality standard for 44 substances with established IMACs, some with revisions,
- the addition of a groundwater quality standard for three substances (2,6-dinitrotoluene, strontium, and total PFOA and PFOS) without established IMACs,
- the organization of the groundwater standards into a table,
- the addition of CASRNs for the groundwater standards,
- the removal of synonyms,
- a change in some units of measure to parts per billion or µg/L, when appropriate,
- the addition of rule text to 15A NCAC 02L .0202(c) to add a notification process for the establishment of an IMAC, and
- the addition of rule text to 15A NCAC 02L .0202(g) to clarify the triennial review process.

IV. REGULATORY IMPACT ANALYSIS

A Regulatory Impact Analysis was prepared as required by the Administrative Procedure Act (NCGS 150B-21-4) and is included as Attachment B in this report. The RIA was approved by the Office of State Budget and Management on August 30, 2019. It was included as an attachment for the item presented at the EMC's November 2020 meeting (Agenda Item 20-31,

Attachment B) and can also be found on the OSBM website at: https://files.nc.gov/ncosbm/documents/files/DEQ_2019-08-30b.pdf.

The current version of 15A NCAC 02L .0202 and the practical quantitation limit (PQL) for each substance served as the regulatory baseline for comparison to understand what the costs and benefits of the proposed rule changes would be to impacted and regulated parties. The PQL is a technology-based value and not based on health effects data; as such, it was not compared to a groundwater standard for purposes of determining human health impacts. The only proposed changes to the regulatory baseline were the proposed adoption of groundwater standards for 47 compounds.

In preparation of the RIA, multiple regulatory programs that use the groundwater quality standards were contacted. These include the NC DEQ Division of Waste Management Brownfields, Underground Storage Tanks, Superfund, Solid Waste, and Hazardous Waste programs and the NC Department of Transportation Asphalt Testing Program. The Non-Discharge Branch and the Groundwater Protection (now Groundwater Resources) Section within DWR were also contacted.

Due to the high degree of variability among sites, variability in driver contaminants for cleanup, the degree of contamination, the scale and complexity of remediation required to meet groundwater standards, the protracted length of time required to remediate groundwater, the age of some sites, and the lack of data, quantifying all of the potential costs and benefits was not possible for the RIA. Qualitative descriptions of expected costs and benefits were provided for all programs and quantitative data was provided when available with assumptions made.

Summary of Costs and Benefits Associated with Proposed Rule Changes: The approved RIA concludes that a net direct benefit to regulated entities and state government can be expected as groundwater standards that are numerically higher than the regulatory baseline would be adopted for a majority of the compounds. For those compounds with proposed groundwater standards that are numerically the same or less than the regulatory baseline, no quantifiable impact can be expected because the PQL would remain the regulatory value. A zero to net positive indirect benefit for well water consumers and the environment can be expected.

V. PUBLIC HEARING PROCESS

The EMC approved the request to proceed to public hearing with the proposed revisions to 15A NCAC 02L .0202 and the RIA at their November 19, 2020 meeting (Agenda Item 20-31). EMC member Yvonne Bailey was appointed to serve as the Hearing Officer.

In the abundance of caution, and to address protective measures to help prevent the spread of COVID-19, the Division held an online public hearing regarding the proposed revisions and regulatory impact analysis on February 2, 2021 at 6:00 pm. The announcement of the hearing and a WebEx link, password, and call-in number were published in the January 15, 2021 edition of the North Carolina Register (https://files.nc.gov/ncoah/documents/files/Volume-35-Issue-14-January-15-2021.pdf). The public hearing announcement is included in Attachment C.

Additionally, the announcement of the public comment period and the public hearing and background information was made available on the following websites:
DEQ Upcoming events: https://deq.nc.gov/news/events
DEQ Public notices and hearings: https://deq.nc.gov/news/events/public-notices-hearings
DEQ Proposed rules: https://deq.nc.gov/permits-regulations/rules-regulations/proposed-rules
DEQ Press releases: https://deq.nc.gov/news/press-releases/2021/01/15/deq-hold-public-hearing-proposed-changes-state%E2%80%99s-groundwater-quality
DWR, Classifications and Standards, Rules Review Branch: https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-standards

The notice in the North Carolina Public Register also included information on how to submit comments. The sixty-day comment period for the proposed rule revisions began on January 15, 2021 and ended on March 16, 2021.

VI. SUMMARY OF ORAL AND WRITTEN COMMENTS AND RESPONSES TO COMMENTS

The proposed rule changes were presented at the online public hearing on February 2, 2021. The Hearing Officer's remarks and DWR staff presentation is included in Attachment D and Attachment E, respectively. 57 people registered to attend the public hearing, and 20 people registered to speak. A list of those registered to attend the hearing and a list of those who elected to speak are included in Attachment F and Attachment G, respectively. A recording of the hearing is available on the Division's website.

A total of 769 individual written comments were received prior to the close of the comment period on March 16, 2021. These written comments were all received by email, with the exception of one received in the mail. Attachment H includes all received written comments.

The following is a summary of all relevant oral comments that were presented at the public hearing and a summary of all relevant written comments received, along with staff responses.

1. Total PFOA and PFOS Standard

The majority of comments received addressed the proposed groundwater standard for total perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) and the regulation of per- and polyfluoroalkyl substances (PFAS) compounds as a whole. Several of the comments received identified similar points of concern and can be grouped based on a few specific topics: Different Values, Regulate PFAS as a Class, Current PFOA IMAC, and Other PFAS Comments. A summary of relevant comments and staff responses are below.

Background Information:

Proposed total PFOA and PFOS Standard:	0.07 µg/L (70 ppt)
Current PFOA IMAC:	2,000 µg/L

Current PFOS IMAC: none, regulated at the PQL per 15A NCAC 02L .0202(c)

Comments received from:

Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Haw River Assembly, League of Women Voters of North Carolina, League of Women Voters - Lower Cape Fear, League of Women Voters - Wake County, NC Child, NC Coastal Federation, NC Conservation Network, NC League of Conservation Voters, NC Sierra Club, Toxic Free NC, White Oak-New Riverkeeper Alliance, Winyah Rivers Alliance (these 14 environmental advocacy groups submitted their comments jointly with representatives from NC Conservation Network and Toxic Free NC serving as the main contacts; hereafter in the report, this joint submittal will be referred to as "representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups"), 3M, Clean Cape Fear, Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Democracy Green, North Carolina Manufacturer's Association, Environment North Carolina, City of Southport Board of Alderman, National Resources Defense Council (including 622 public comments from members), and about 757 template comments (representing private citizens)

Comment Topics:

Different Values:

A number of comments received requested a groundwater quality standard for total PFOA and PFOS at a different value than the proposed 70 ppt value. These comments are summarized and grouped by the suggested revised value below:

1. *Comment: A groundwater quality standard for a total concentration of all PFAS compounds should be set at 1 ppt. (Clean Cape Fear, 221 comments including template comments from citizens)*

   Response: In accordance with 15A NCAC 02L .0202(d), groundwater quality standards are established as the least of the following: (1) the systemic threshold concentration; (2) the concentration which corresponds to an incremental lifetime cancer risk of $1x10^{-6}$; (3) the taste threshold limit value, (4) the odor threshold limit value; (5) the maximum contaminant level; (6) or the national secondary drinking water standard. 15A NCAC 02L .0202(e) also lists the references in order of preference that must be used to establish these values in order of preference: (1) EPA's Integrated Risk Information System (IRIS); (2) EPA's Office of Drinking Water Health Advisories; (3) other health risk assessment data published by EPA; and (4) other relevant, published health risk assessment data, and scientifically valid peer-reviewed published toxicological data. In the absence of an EPA IRIS assessment for PFOA or PFOS, the proposed groundwater standard for total PFOA and PFOS is based on the EPA's Office of Drinking Water Health Advisories for PFOA and PFOS from 2016.

   Staff acknowledges that more research is needed regarding immunotoxicity effects of PFAS compounds, particularly using human data, as discussed in the Grandjean and Budtz-

Jorgensen (2013) paper which was included in the comments from Clean Cape Fear. This study was the first to present benchmark dose results for human PFAS exposures. The main conclusion that the authors appeared to make in the context of this study was that EPA's limits for PFOA and PFOS in drinking water at the time were too high. EPA's provisional health advisories at that time were 0.4 µg/L or 400 ppt for PFOA and 0.2 µg/L or 200 ppt for PFOS.

This study, however, only approximated exposure limits for drinking water for PFOA, as there was no data available to correlate concentrations in drinking water with the serum concentrations for PFOS or other PFAS. It would be inappropriate to establish a standard for all PFAS at 1 ppt based on this study.

At this time, there is not enough evidence available that will allow the Division to propose a groundwater standard for all PFAS compounds as a class. Please see below for a further response.

2. *Comment: A groundwater quality standard should be set at 10 ppt for any individual PFAS compound and at 70 ppt for a total concentration of all PFAS compounds. (21 comments from citizens, Jeannie Ambrose- resident of Chatham County, The City of Southport Board of Aldermen)*

   and

   Comment: The Commission should set a standard that reflects the values in the Chemours Consent Order (10 ppt for individual compounds and 70 ppt for all PFAS compounds) so as not to undermine that level of protection. (Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups)

   Response: Division staff recognize that the Chemours Consent Order requires Chemours to provide replacement water supplies for any party whose private drinking water well tested above 10 ppt for individual PFAS compounds defined in the Consent Order and 70 ppt for combined PFAS compounds defined in the Consent Order. These values were chosen based on the PQL for GenX at the time and the EPA's 2016 Drinking Water Health Advisories for PFOA and PFOS, respectively. When calculating groundwater standards, the Division must follow the procedures in 15A NCAC 02L .0202.

   Establishing a health-based groundwater standard for total PFOA and PFOS will not remove this protection for these parties as Chemours is held to the requirements in the agreed upon Consent Order. A health-based value for PFOA and PFOS would only apply to certain private wells surrounding the facility if Chemours "demonstrates to the reasonable satisfaction of DEQ that the PFAS in a given well did not originate from the Facility" (Attachment C of the Consent Order).

3. *Comment: A groundwater quality standard should be set at 20 ppt for any individual PFAS compound and for a total concentration of all PFAS compounds. (Environment North Carolina, Representatives from Haw River Assembly, Catawba Riverkeeper Foundation,*

Yadkin Riverkeeper, Winyah Rivers Alliance, and 141 comments including template comments from citizens)

and

Comment: Cape Fear River Watch recommended that EMC set a groundwater standard of 20 ppt or lower, combined for PFOA, PFOS, plus a set of 5 indicator PFAS chosen by the Commission with support of NC Collaboratory researchers.

and

Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups stated that recent studies show flaws in the EPA Health Advisories for PFOA and PFOS. They encouraged the Commission to adopt the same RfD as that recommended by Wisconsin, which they state uses more accurate pharmacokinetic modeling than that used by EPA. The state of Wisconsin is considering a combined standard of 20 ppt for the sum of PFOA and PFOS.

and

Comment: North Carolina should follow the model developed by the Minnesota Department of Health (Goeden et al., 2019) rather than the model used by the EPA when developing the Drinking Water Health Advisories for PFOA and PFOS. (Representatives from Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Clean Cape Fear, Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Democracy Green, Haw River Assembly, White Oak-New River Assembly, and Winyah Rivers Alliance).

Response: The Division recognizes that the pharmacokinetic model used by the EPA has limitations, including not accounting for potential infant exposures. However, at this time, vertical transmissions models that incorporate infant exposures via placental transfer and breastfeeding are lacking. The studies cited in the comments from these groups (Kieskamp et al., 2018 and Goeden et al., 2019) do attempt to account for these exposure pathways. However, these studies also have uncertainties and limitations and have not been appropriately validated.

The Kieskamp et al. study was used by the Wisconsin Department of Health Services (DHS) in the selection of a human equivalent dose that was then used to determine a groundwater standard for PFOA of 20 ppt. This value was calculated using exposure parameters (body weight, drinking water intake rate, and RSC) that differ from those defined in 15A NCAC 02L .0202(d)(1).

At this time, the Division supports the use of the validated Wambaugh et al. (2013) pharmacokinetic model. EPA's National Center for Environmental Assessment and National Center for Computational Toxicology are in the process of preparing a toxicokinetic model for pregnancy and gestation that is expected to be an improvement compared to currently available pharmacokinetic models. A manuscript detailing this new model is expected soon

as discussed by Kapraun et al., 2019 (available at this link). DEQ will continue to evaluate newly published data and information, including this forthcoming maternal transfer model.

At this time, there is not enough evidence available that will allow the Division to propose a groundwater standard for all PFAS compounds as a class. Please see below for a further response.

4. *Comment: General opposition to the proposed 70 ppt groundwater quality standard for total PFOA and PFOS, with the request to set a lower unspecified value. (354 comments including template comments from citizens)*

   Response: Staff appreciates these comments. DEQ continues to evaluate newly published data and information regarding PFAS compounds so that any proposed regulatory value provides appropriate protection for human health based on the data available at that time.

5. *Comment: The Commission should set a groundwater standard of 0.1 ppt for PFOA and 0.4 ppt for PFOS as California's Office of Environmental Health Hazard Assessment recommended in 2019. (Natural Resources Defense Council, Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups)*

   Response: These values were recommended by California's Office of Environmental Health Hazard Assessment (OEHHA) by deriving a cancer slope factor calculated using animal bioassay data reported in summary tables by the National Toxicology Program in 2018. Of note, these recommended values by OEHHA were below the limit of quantitation of current analytical methods. Therefore, the State Water Resources Control Board's Division of Drinking Water (DDW) set the Notification Levels at the lowest levels that can be reliably detected using available technologies (5.1 ppt for PFOA and 6.5 ppt for PFOS). Notification Levels in California are health-based advisory levels that are nonregulatory, precautionary health-based measure for concentrations in drinking water that warrant notification and further monitoring and assessment. These are not regulatory standards.

   Staff agrees that any potential carcinogenetic effects are concerning. In their 2016 Drinking Water Health Advisory, EPA did evaluate PFOA for cancer risk and found that the lifetime Health Advisory derived from noncancer endpoints was also protective of cancer endpoints. EPA found the data too limited to support a quantitative assessment for cancer risk for PFOS at that time. The Division will continue to monitor the data regarding cancer risk for these compounds.

6. *Comment: PFOS should be regulated at the PQL.*

   and

   Comment: All PFAS compounds should be regulated at the PQL or the reporting limit.

   Response: The PQL is a laboratory value that can change with updated analytical capabilities and may vary across different laboratories. This provides uncertainty and potential variations in regulatory actions. When there is enough data available to establish a health-based standard, it is not appropriate to regulate compounds at the PQL.

The Secretaries' Science Advisory Board heard about this issue at their December 2019 meeting and provided a written statement in response (provided as an attachment at the November 2020 EMC meeting- Agenda Item 20-31, Attachment D, and included as Attachment A in this report). The SSAB included in their statement their recommendation that a health-based value for PFOA and PFOS should be established rather than the PQL. They do state that data for other PFAS compounds is lacking, therefore regulating them at the PQL is an appropriate approach.

7. *Comment:* O*ther states and agencies have developed or established different values for PFAS guidelines, advisories, and regulations.*

   Response: It is worth noting that every state develops and uses health-based values in varying ways within different programs. Groundwater quality standards in North Carolina must be developed using the procedures stated in 15A NCAC 02L .0202. In addition to different procedures for calculating health-based values, states and agencies also have differing interpretations of the data surrounding PFAS.

   States and agencies in the U.S. and other countries have recommended and established standards, guidance, and screening values for PFOA and PFOS in groundwater, drinking water, and surface water in the range of 0.0051 µg/L to 0.667 µg/L or 5.1 ppt to 667 ppt (Interstate Technology and Regulatory Council PFAS Water and Soil Values Table Fact Sheet). For total PFOA and PFOS, Alaska, Colorado, Delaware, Maine, New Mexico, and Ohio base their regulations on the EPA 2016 Drinking Water Health Advisories for PFOA and PFOS. States such as Minnesota, Michigan, New Hampshire, and Vermont have calculated different values for PFOA and PFOS with procedures that do not follow the procedures required in 15A NCAC 02L .0202. Staff continues to monitor for newly published data and information regarding PFAS compounds.

Regulate PFAS as a Class:

1. *Comment: PFAS should be regulated as a class or a subclass. (Environment North Carolina, Natural Resources Defense Council, Haw River Assembly, Catawba Riverkeeper Foundation, Yadkin Riverkeeper, Winyah Rivers Alliance, Jeannie Ambrose- resident of Chatham County, Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Clean Cape Fear, Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Democracy Green, White Oak-New River Assembly, template comments from citizens)*

   and

   Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups urged the Commission to consider that PFAS rarely travel alone. They stated that a standard that is set for PFOS and PFOA alone and does not assume concurrent exposures to other PFAS is unlikely to address the actual risk to water users posed by PFAS contamination in groundwater.

   and

Comment: *Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups recommended that the Commission should establish a class or subclass standard for PFAS based on studies of a handful of class members and enforce it as the sum of PFAS measured under EPA Method 537.1. They further suggested that the Commission should allow a party the ability to bring evidence that a specific PFAS has lower toxicity than the class standard to the Commission or Director and ask for a separate standard (or IMAC) for that compound. Natural Resources Defense Council made a similar comment, while recommending the use of the 537-modified (537-M) method and a subclass including at least the compounds PFOA, PFOS, PFNA, PFHxS, GenX, PFBS, PFBA, PFPeA, PFHxA, PFDA, PFUnA, PFDoA, PFTA, PFTrDA, PFDS, and PFOSA.*

Response: As stated above, at this time, there is not enough evidence available that will allow the Division to propose a groundwater standard for all PFAS compounds as a class in accordance with 15A NCAC 02L .0202. These compounds vary in physiochemical, environmental, and toxicological properties which makes grouping them difficult and complex. The rule language in 15A NCAC 02L .0202 does not allow for staff to calculate groundwater standards for a group of compounds which vary in toxicological endpoints and values. While there have been arguments posed for regulating these chemicals as a class (Kwiatkowski et al., 2020, Massachusetts DEP), a definitive system for grouping has not been decided upon by the scientific community.

The Division acknowledges that regulating PFAS compounds on an individual basis may not be technologically or fiscally feasible in the long run. However, in order to calculate a health-based groundwater standard in accordance with 15A NCAC 02L .0202(d), either a reference dose or a cancer slope factor is needed. Toxicological data available for a number of known PFAS compounds are lacking, which means the Division is unable to calculate a health-based groundwater standard for the majority of these compounds.

In the absence of toxicological or health-based information for individual PFAS compounds, these compounds are not permitted in concentrations above the PQL in groundwater. The PQL value is the lowest concentration of a given material that can be reliably achieved among laboratories within specified limits of precision and accuracy by a given analytical method during routine laboratory analysis. The PQL values for certain compounds are often more stringent than calculated health-based values. At this time, because the Division is unable to propose a class based PFAS groundwater quality standard, the majority of PFAS compounds will not be allowed in groundwater in concentrations above their PQL value.

2. *Comment:* *Regulation of PFAS should follow the Toxic Equivalency Factor (TEF) model used in PCDD, PCDFs, and PCBs. (George Pauly- resident of Chatham County)*

   Response: Thank you for your comments. The Toxic Equivalency Factor method is a useful approach in risk assessment for mixtures or groups of related chemicals that produce similar hazardous effects through the same mechanism. TEF is currently used in risk assessments for polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs),

and polychlorinated biphenyls (PCBs) as these compounds are chemically and toxicologically related and their mechanisms of actions are known. For PFAS compounds, however, there is limited information on the mechanisms of toxicities for the majority of the diverse individual compounds and it is unknown if these compounds have the same or similar critical effect. At this time, the Division does not believe that the TEF method is an appropriate approach to assessing or regulating PFAS compounds as a group.

3. *Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups stated that the Commission should add a new subsection providing for adoption of appropriate class-based groundwater standards.*

   and

   Comment: Representatives from Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Clean Cape Fear, Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Democracy Green, Haw River Assembly, White Oak-New River Assembly, and Winyah Rivers Alliance stated that the Commission should consider a change in rule language to accommodate a class approach to groundwater standards.

   Response: Please see section "2. Additional Comments: Proposed Additions and Changes" below for response to these comments.

Current PFOA IMAC:

1. *Comment: The current PFOA IMAC of 2,000 ppt needs to be repealed (Clean Cape Fear, and Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups).*

   and

   Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups further commented that they recognize that the Commission may decide it wants or needs to explore policy implications in greater depth before setting a standard. If the Commission decides that further study of PFAS compounds would be advisable, they urged that at a minimum, the 2006 IMAC for PFOA is repealed now.

   Response: North Carolina was one of first states to set a regulatory value for PFOA when the IMAC was established in 2006. The Division acknowledges that the current IMAC value of 2,000 ppt for PFOA is outdated and needs to be updated in accordance with the scientific literature that has been published since that time. The Division recognizes that it is a priority to either rescind this IMAC or to update this value.

Other PFAS Comments:

1. *Comment: 3M encouraged DEQ to clarify how the EPA's Drinking Water Lifetime Health Advisory was chosen over the criteria in 15A NCAC 02L .0202(d) for the proposed total PFOA and PFOS standard.*

   Response: In accordance with 15A NCAC 02L .0202(e)(2), and in the absence of an EPA IRIS assessment for PFOA or PFOS, the 2016 EPA Drinking Water Health Advisories were chosen as the reference used to establish a proposed groundwater quality standard for total PFOA and PFOS. The 2016 EPA Drinking Water Health Advisories for PFOA and PFOS are calculated using the same formula as the systemic threshold concentration defined in 15A NCAC 02L .0202(d)(1), with the exception of the exposure factors. The exposure factors used by the EPA to calculate the PFOA and PFOS Health Advisories are specific to lactating women as they are considered to be the most sensitive population and therefore the protection offered by the lifetime Health Advisory would be broadly protective of public health. EPA considers lactating women to be the most sensitive population due to the potential increased susceptibility during the time period of pregnancy and lactation and due to the increased water intake rate of lactating women in relation to body weight. In order to protect the sensitive subpopulation, the Division based the proposed PFOA and PFOS groundwater quality standard on the lifetime Health Advisories calculated by EPA. DEQ continues to evaluate newly published data and information regarding PFAS compounds.

2. *Comment: 3M stated that the EPA's health advisory levels for PFOA and PFOS do not reflect the determination in the latest EPA Exposure Factors Handbook (2019) that the current 90th percentile consumers-only estimated community water ingestion for lactating women is 0.047 L/kg (direct and indirect combined).*

   Response: EPA individually released the update for the Chapter 3 Ingestion of Water and Other Select Liquids of the Exposure Factor's Handbook in 2019 during the rulemaking process for this proposed rulemaking package.

   The average adult Recommended Values for Drinking Water Ingestion Rates and the Recommended Values for Water Ingestion Rates of Community Water for Pregnant and Lactating Women were both updated. The value for the combined direct and indirect community water ingestion for lactating women changed from the 90th percentile consumers only estimate of 0.054 L/kg-day to the 95th percentile consumers only estimate of 0.047 L/kg-day. Due to the timing of this chapter release, staff will consider the updated Exposure Factor's Handbook Ingestion Rate values during the next triennial review and update all Groundwater Quality Standards as appropriate.

3. *Comment: 3M provided technical comments on pages 142-145 of the Groundwater Quality Standards Supporting Documents included as an attachment at the November 19, 2020 EMC meeting (Agenda Item 20-31, Attachment C).*

Response: Staff thanks 3M for their detailed technical comments. The PFOA and PFOS Supporting Documents have been updated to include this information as appropriate, as shown in Attachment I of this report.

4. *Comment: Clean Cape Fear requested that PFAS measured via EPA method 537.1 should be included in the Division of Waste Management's Inactive Hazardous Site program's Guidelines for Assessment and Cleanup of Contaminated Sites protocol.*

   Response: Staff appreciates this suggestion and has passed them on the to the Division of Waste Management's Inactive Hazardous Site Branch.

5. *Comment: Clean Cape Fear requested that the state set the lowest possible standard for PFOA and PFOS, rather than regulate them at the PQL.*

   Response: Staff understands the request to establish groundwater standards based on health endpoints rather than rely on the PQL. When there is enough data available to establish a health-based standard, it is not appropriate to regulate compounds at the PQL. There is enough toxicological information available for PFOA and PFOS that allows the Division to propose a health-based groundwater standard for these compounds in accordance with 15A NCAC 02L .0202.

   The Secretaries' Science Advisory Board heard about this issue at their December 2019 meeting and provided a written statement in response (included as Attachment A in this report). The SSAB included in their statement their recommendation that a health-based value for PFOA and PFOS should be established rather than the PQL. They do state that data for other PFAS compounds is lacking, therefore regulating them at the PQL is an appropriate approach.

6. *Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups request that if the Commission chooses to set a standard for PFOS and PFOA alone, that it issues clear policy guidance that groundwater sampling must test for a suite of PFAS, not just PFOS and PFOA.*

   Response: Staff thanks these groups for their comment and has shared this request with relevant groups within the Division of Waste Management, including the Solid Waste and Hazardous Waste programs.

   The Division of Water Resources' Groundwater Management Branch within the Groundwater Resources Section collects monitoring groundwater well data throughout the state. Currently, a suite of PFAS compounds is tested in groundwater wells that are sampled within the DWR Monitoring Well Network. More information about the Monitoring Well Network and the current sampling efforts can be found on the Branch's Groundwater Quality website and results obtained to date can be viewed at this link.

7. *Comment: Representatives from Haw River Assembly, Catawba Riverkeeper Foundation, Yakin Riverkeeper, and Winyah Rivers Alliance stated that setting a groundwater standard to address only the legacy PFOA and PFOS compounds does not address the contaminants still in production processes that fill construction and demolition landfills and municipal landfills.*

   Response: Landfill operations in the state of North Carolina must comply with groundwater quality standards or IMAC levels established under 15A NCAC 02L (see 15A NCAC Subchapter 13B). In accordance with 15A NCAC 02L .0202(c), in the absence of a standard or IMAC, substances shall not be permitted in groundwater in concentrations at or above the PQL. The majority of PFAS compounds are not allowed in groundwater at concentrations above their PQL value and this will continue if a groundwater standard for PFOA and PFOS is established.

8. *Comment: North Carolina needs to establish fish consumption advisories due to PFAS contamination. (Representatives from Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Clean Cape Fear, Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Democracy Green, Haw River Assembly, White Oak-New River Assembly, and Winyah Rivers Alliance).*

   Response: This comment has been shared with the NC Division of Public Health within the Department of Health and Human Services as this group issues fish consumption advisories in North Carolina.

9. *Comment: The Commission's actions to designate groundwater standards or surface water standards are necessary to control pollution already in drinking water supplies, but they should not preclude DEQ from adhering to federal law and requiring industrial dischargers reduce PFAS effluent to the level attainable by current and readily available technology, the level of which has been shown to be, for most PFAS, lower than the detection limit. (Representatives from Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Clean Cape Fear, Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Democracy Green, Haw River Assembly, White Oak-New River Assembly, and Winyah Rivers Alliance).*

   Response: Staff thanks these groups for their comments. This comment has been shared with programs within the Division that are responsible for NPDES permitting.

2. Additional Comments

Support of Proposed Changes:

1. *Comment: Support use of Chemical Abstract Service Registry Numbers to reduce ambiguity. (Representative from Clean Water for North Carolina)*

   Response: Thank you for the comment.

2. *Comment: Support the Division's proposal for a combined standard for two types of PFAS. (Natural Resources Defense Council).*

   Response: Thank you for the comment.

3. *Comment: Support adoption of proposed groundwater standards, with the exception of PFOA and PFOS. (Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups)*

   Response: Thank you for the comment.

4. *Comment: Support decision to prioritize IMACs in this review since those have not previously received a public review. (Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups)*

   Response: Thank you for the comment.

5. *Comment: Support proposed changes to the 02L .0202(c) rule language to strengthen process by which the Division issues IMACs as they believe that the proposed requirement for public notice will increase transparency. Support proposed rule language that requires IMACs be developed the same as groundwater standards. (The City of Southport Board of Aldermen, Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups)*

   Response: Thank you for the comment.

6. *Comment: Support proposed changes to the 02L .0202(g) rule language that an IMAC will be reviewed in a public process at the next triennial review. (The City of Southport Board of Aldermen, Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups)*

   Response: Thank you for the comment.

Proposed Additions and Changes:

1. *Comment: The requirement that interim standards and all relevant data are reviewed and adjusted as data suggests, every three years needs to be strengthened. If more consistent funding and staffing is necessary to meet the obligations under .0202(g), recommend that this is called for by the hearing officers. (Representatives from Cape Fear River Watch, Advance Carolina, Center for Environmental Health, Clean Cape Fear, Coastal Carolina Riverwatch, Crystal Coast Waterkeeper, Democracy Green, Haw River Assembly, White Oak-New River Assembly, and Winyah Rivers Alliance).*

Response: Division staff thanks these groups for their comments. Staff believes that the proposed revisions to 15A NCAC 02L .0202(g) do strengthen the IMAC review process and provide more guidance and transparency regarding how IMACs are reviewed.

2. *Comment: North Carolina Manufacturer's Association commented that the proposed amendments are an improvement as they address the need for public review of a proposed IMAC prior to its adoption, but further language should be added that requires the Director to consider the public comments received during the public notice period prior to establishing an IMAC.*

   Response: Staff appreciates this comment and request. The proposed rule language does add a public involvement process by requiring the Division to publish a notice in the North Carolina Register at least 30 days prior to the establishment of an IMAC. Information published in the public notice must include the request for the establishment of the IMAC, the level of the proposed IMAC, and the basis upon which the Division relied upon in development of the proposed IMAC. A mailing address and email address will also be provided in the public notice for further questions and if any member of the public wishes to provide comments on the intended action. At the end of the 30-day period, any comments received will be provided to the Director.

3. *Comment: North Carolina Manufacturer's Association commented that under the proposed rule, there is no time frame within which a decision on an IMAC petition must be rendered. The EMC should resolve this issue and ensure timely action on such petitions by adding a sentence at the end of 02L .0202(c) that reads: "The Director shall issue or deny a petition for an IMAC within 180 days of receipt of the petition."*

   Response: The requests that the Division receives to establish IMACs for substances are unique and vary greatly on factors such as the strength and availability of data. Some requests are complicated and take time to gather and examine appropriate toxicological data. Often further communication is needed with the requestor and/or with the EPA. Also, an external review is conducted with both the Division of Waste Management and the Occupational and Environmental Epidemiology Branch of the Department of Health and Human Services.

   While it is understood that the requestor wants timely action, requiring a deadline to either issue or deny an IMAC would limit the Division's ability to work with the requester and other agencies during the IMAC establishment process. If the deadline passes and the necessary discussions and review are not completed or the appropriate data and information have not been received or located, the IMAC request must be returned and resubmitted. This may cause further work for both the Division and the requestor. If the requestor wishes to establish a health-based standard for a compound in groundwater outside of the IMAC process, there is still a formal petition process available to them.

4. *Comment: North Carolina Manufacturer's Association commented that although the proposed rule does require notice by the Director to the EMC that an IMAC has been established, there is no provision that compels either the Director or the Commission to initiate rulemaking to formally adopt an IMAC in a manner consistent with the current requirements of the Administrative Procedures Act found in NCGS 150B.*

   Response: The Division believes that the proposed rule language provides more transparency regarding the IMAC establishment and review procedures. The proposed rule language continues to require a review of all IMACs and groundwater quality standards on a triennial basis and adds language that defines the options that the Director shall take during the review of an IMAC. This includes codifying the IMAC as a groundwater quality standard, which would initiate the formal rulemaking process.

   It is understood that regulated entities and the public may want an established IMAC to be subject to the formal rulemaking requirements set out in the APA including public involvement provisions. The formal rulemaking process is available for this.

5. *Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups recommended that the EMC broaden the language in .0202(c) to allow third parties to request that the Director revisit an existing IMAC on the basis of new scientific information of the types described in .0202(d) and (e). They stated the concern that under the existing and proposed rule language, a petitioner can propose an IMAC, but a citizen cannot ask the Director to revisit it as the only option available to them is to file a full rulemaking petition with the EMC.*

   Response: Staff thanks these groups for their comments. Staff recommends revising the language in 15A NCAC 02L .0202(c) to address this concern as shown below in highlighted text and in Attachment J of this report:

   > (c) Except for tracers used in concentrations which have been determined by the Division of Public Health to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit in Class GA or Class GSA groundwaters. Any person may ~~petition~~request the Director of the Division of Water Resources to ~~establish~~establish, update, or remove an ~~interim maximum allowable concentration~~ Interim Maximum Allowable Concentration (IMAC) for a substance for which a standard has not been established under this Rule. In response to the request, the Director of the Division of Water Resources may establish, update, or remove an IMAC. The ~~petitioner~~requester shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with ~~Paragraph~~Paragraphs (d) and (e) of this Rule. ~~Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.~~If the information submitted is not in accordance with Paragraphs (d) and (e) of this Rule, the ~~Director of the~~ Division of Water

Resources shall request additional information from the ~~petitioner~~requester. If the ~~petitioner~~requester does not provide the additional information necessary to be in accordance with Paragraphs (d) and (e) of this Rule, the Director of the Division of Water Resources shall ~~deny~~return the ~~petition~~request. At least 30 days prior to establishing, updating, or removing an IMAC for any substance, the Division of Water Resources shall provide public notice that an IMAC has been requested to be established, updated, or removed. The public notice shall include the ~~petition~~request ~~requesting~~for the establishment, update, or removal of the IMAC for a substance, the level of the proposed IMAC, if applicable the level of the existing IMAC, and the basis upon which the Division of Water Resources has relied in development of the proposed IMAC establishment, update, or removal. This notice shall be published in the North Carolina Register and posted on the Division of Water Resources's website: https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-imacs. If the Director of the Division of Water Resources establishes or updates an IMAC, the IMAC shall be posted on the Division of Water Resources's website, and the Commission shall be notified in writing within 30 calendar days that a new IMAC has been established or an existing IMAC has been updated or removed.

6. *Comment: Natural Resources Defense Council stated that the default values for relative source contribution and drinking water ingestion rate are not protective of the most vulnerable populations, particularly to PFAS exposures.*

   and

   Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups stated that the Commission should add new language to .0202 allowing for consideration of salient factors in risk assessment that the existing rule language does not acknowledge. The following revision to 02L .0202(d) was proposed:

   (d) Except as provided in Paragraph (f) of this Rule, groundwater quality standards for substances in Class GA and5 Class GSA groundwaters are established as the least of:

      (1) Systemic threshold concentration ~~calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (0.10 for inorganics; 0.20 for organics)] / [2 liters/day (avg. water consumption)];~~, derived from an appropriate toxicokinetic model, or by a risk assessment formula with Reference Dose, Body Weight, and Relative Source Contribution that reflect the most vulnerable population exposed to the substance;

   The following subsection was also proposed:

   (d1) In calculating the factors under (d), the Commission, or in the case of an IMAC the Director, may account for historic or baseline exposures and may apply a peer-reviewed

model that accounts for groundwater exposure pathways as a component of total life exposure to a substance.

Response: Staff appreciates this suggestion and request. Defining the procedure to calculate the systemic threshold concentration in rule can be beneficial as it provides consistency in establishing groundwater quality standards. However, staff acknowledges that risk assessment may not always have a "one size fits all" solution for every substance. This subject will likely attract interest from the broader public who would like to comment on potential changes to the rule language.

The Division will consider this suggestion during the next triennial review and consider getting specific public comments on this subject in the next rulemaking.

7. *Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups stated that the Commission should add a new subsection providing for adoption of appropriate class-based groundwater standards. The following subsection was proposed:*

   (d2) Where substances in a class or subclass share exposure pathways, structural similarities, or suspected health effects or mechanisms of harm, the Commission, or in the case of an IMAC, the Director, may set standard for the class or subclass based on data in (d) pertaining to one or more substances in the class. Any person who believes a substance in a class exhibits substantially different toxicological characteristics and should not be regulated as a member of that class may petition the Director under (c) to establish an IMAC for that substance. If the IMAC or a separate standard is established for that substance, it shall not also be regulated as a member of the class.

   and

   Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups suggested options to approach a class-based standard, including (1) setting a standard based on a member of the class and measuring compliance as the cumulative concentration of class members; (2) setting a standard based on multiple class members, measured as the cumulative concentration of class members known to be toxic; and (3) setting a standard based on one member of the class, and demonstrating compliance through direct measurement of the total concentration of the class.

   Response: Staff appreciates these comments. Use of the "class" and "subclass" terms in the proposed language may be problematic if included in the rule language for groundwater standards. Substances could be classified based on their physical properties, structural similarities, uses, or various other factors. Defining classes and subclasses for particular substances may not be possible or may vary considerably based on differing scientific interpretations. Including the language "exposure pathways, structural similarities, or suspected health effects or mechanisms of harm" does not exclusively define a class or

subclass of substances. Without clarifying how to specifically define a class or subclass of substances, this rule language could be considered ambiguous.

Staff thanks these groups for their thorough and detailed comments and suggestions on potential approaches to regulate substances as a class. Staff believes that this subject will attract public interest by parties who would like to comment on any proposed change in rule language regarding allowing regulations of chemicals by class. The Division will consider these suggestions during the next triennial review and will consider soliciting comments on this particular subject at that time.

Regulatory Impact Analysis:

1. *Comment: 3M stated that while DEQ admittedly faced several challenges to quantifying the costs and benefits of the Proposed Regulations, the inability of DEQ to quantify costs and benefits is a result of the lack of pre-regulatory sampling. For example, without data on current levels of PFOA and PFOS at non-discharge sites, or an estimate of how many sites would exceed the practical quantitation limit, DEQ was unable to monetize the potential economic impact to non-discharge permittees.*

   Response: Staff agrees that additional data, particularly for PFOA and PFOS, would have enabled us to perform a more in-depth analysis. However, staff believes the depth of analysis was appropriate given the available data, and that it was proportional to the nature and complexity of the rule changes, especially when considering the true regulatory impact as compared to the existing IMACs.

2. *Comment: 3M stated that DEQ focused on the practical quantitation limit as the baseline standard for PFOA and other substances, even though the interim maximum allowable concentrations serve as the regulatory requirement for those substances in practice.*

   Response: The North Carolina OSBM policy did not allow the IMACs to be used as the regulatory baseline for purposes of the RIA as the IMACs were considered a temporary requirement that had not been subject to the permanent rulemaking process. Staff did include in the RIA some qualitative information on the impacts as compared to the IMACs to address what the Division recognized as the true regulatory impact. Staff have subsequently initiated more robust data and information gathering processes for requested IMACs that will better enable the Division to quantify impacts in future rulemakings.

3. *Comment: 3M stated that DEQ prepared a single RIA for the 47 contaminants for which groundwater standards have been proposed and DEQ did not explicitly evaluate the costs and benefits of the level of each proposed groundwater standard. This could, for example, disguise if the costs of a particular standard outweigh the benefits of that standard.*

   Response: NC OSBM requires that impacts be considered on a rule-by-rule basis; as such, it was necessary to present the impacts together in one RIA. Information for some contaminants were combined and impacts generalized, when appropriate, to streamline the document without losing any significant detail. Each contaminant was evaluated on its own, however, within the context of each regulatory program. Further discussion was included for

those few contaminants that were identified as driver contaminants. If a contaminant is not considered a driver contaminant, it is very unlikely that its adoption would result in additional costs or benefits that would warrant an extensive separate analysis.

4. *Comment: 3M stated that DEQ has proposed a combined standard for PFOA and PFOS but did not fully assess how the combined nature of the standard would affect the related costs and benefits of regulating each substance, despite the fact that there is an IMAC already in place for PFOA and not for PFOS and the PFOA cleanup goal is changing by a larger order of magnitude than the PFOS cleanup goal.*

   Response: Staff acknowledges that a more robust analysis of the combined PFOA and PFOS standard relative to the regulatory baseline would be informative. However, there was not yet a pool of data with which to perform a meaningful quantitative analysis, and many uncertainties remained as to its ubiquity in different industries; as such, we were limited to a qualitative discussion of potential impacts.

Other Comments:

1. *Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups encouraged the Division to review existing standards in .0202(h) and .202(i) as part of the next triennial review. They also urged the Commission to not put off protective decisions to future review cycles.*

   Response: Division staff thanks these groups for their comments.

2. *Comment: Representatives from NC Conservation Network, Toxic Free NC, and 12 additional environmental advocacy groups recommended and encouraged the Department to digitize the state's data on groundwater contamination and organize it in a database that allows searches by chemical in order to provide information to members of the public on the spatial distribution of specific contaminants. They also encouraged that this information be placed into data layers and added to the Department's community mapping tool, to support searches for contamination not just by regulatory program, but also by the contaminants known to be present at sites. They suggested that this will help the Commission and staff prioritize attention in future cycles to the most widespread contaminants or those posing the greatest practical risk to public health.*

   Response: Division staff appreciate these suggestions and agree that spatial information regarding the use of groundwater standards would be useful for staff, the Commission, and the public. These comments have been shared with relevant groups within DEQ, including DWR and the Division of Waste Management.

3. *Comment: Since groundwater and surface water are physically interconnected resources, groundwater standards should be considered applicable to surface water standards as well. (Jeannie Ambrose, resident of Chatham County).*

   Response: Staff recognizes that groundwater and surface water interactions are an area of study that needs more research, especially in regard to risk assessments and the development

of water quality standards. North Carolina surface waters are protected by the federal Clean Water Act and have their own standards developed under 15A NCAC 02B. Staff in DWR's Classifications, Standards and Rules Review Branch do communicate amongst themselves when groundwater standards and surface water standards are developed and reviewed. This communication is to coordinate for particular substances in terms of which data and resources are reviewed and how calculations are performed.

4. *Comment: A representative from the Ethylene Glycols Panel of the American Chemistry Council requested documentation for the 15A NCAC 02L .0202 Groundwater Quality Standard for ethylene glycol.*

   Response: Staff reached out to the commentor with information and available documentation regarding the ethylene glycol groundwater standard. This groundwater standard was not addressed during this rulemaking period as the current review focused on existing IMACs. The commentor followed up with acknowledgment about the anticipated timeline for the review for the ethylene glycol groundwater standard. The commentor also provided additional written comments addressing the ethylene glycol groundwater standard which will be examined and considered during the next triennial review.

5. *Comment: A representative from Clean Haw River commented that 1,4-dioxane is at a high level and needs to be kept at the lowest level possible.*

   Response: The Division continues to sample and monitor for 1,4-dioxane within the Cape Fear River Basin in order to determine and assess potential sources of this compound and to gather data to develop a regulatory strategy. More information is available on the Division's Cape Fear River Basin 1,4-Dioxane Study website. Additional information, including information on in-stream target values for 1,4-dioxane in surface waters, is also available on DEQ's Managing Emerging Compounds in Water website. The existing groundwater standard for 1,4-dioxane was not addressed during this rulemaking period as the current triennial review focused on existing IMACs.

VII. RECOMMENDATIONS

The Division and the Environmental Management Commission-appointed Hearing Officer, Yvonne Bailey, recommend that the proposed and public-noticed revisions to 15A NCAC 02L .0202 be approved by the EMC, except as follows:

1. the proposed total PFOA and PFOS groundwater standard not be adopted, as shown in the attached recommended rule text (Attachment J), and

2. with modifications to 15A NCAC 02L .0202 (c) and (g) as noted below and shown in the attached recommended rule text (Attachment J).

In taking this action, the following rules will show that the Environmental Management Commission has made revisions since these rules were public noticed as noted by the highlighted text below:

(c) Except for tracers used in concentrations which have been determined by the Division of Public Health to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit in Class GA or Class GSA groundwaters. Any person may ~~petition~~request the Director of the Division of Water Resources to ~~establish~~establish, update, or remove an ~~interim maximum allowable concentration~~ Interim Maximum Allowable Concentration (IMAC) for a substance for which a standard has not been established under this Rule. In response to the request, the Director of the Division of Water Resources may establish, update, or remove an IMAC. The ~~petitioner~~requester shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with ~~Paragraph~~Paragraphs (d) and (e) of this Rule. ~~Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.~~If the information submitted is not in accordance with Paragraphs (d) and (e) of this Rule, the ~~Director of the~~ Division of Water Resources shall request additional information from the ~~petitioner~~requester. If the ~~petitioner~~requester does not provide the additional information necessary to be in accordance with Paragraphs (d) and (e) of this Rule, the Director of the Division of Water Resources shall ~~deny~~return the ~~petition~~request. At least 30 days prior to establishing, updating, or removing an IMAC for any substance, the Division of Water Resources shall provide public notice that an IMAC has been requested to be established, updated, or removed. The public notice shall include the ~~petition~~request ~~requesting~~for the establishment, update, or removal of the IMAC for a substance, the level of the proposed IMAC, if applicable the level of the existing IMAC, and the basis upon which the Division of Water Resources has relied in development of the proposed IMAC establishment, update, or removal. This notice shall be published in the North Carolina Register and posted on the Division of Water Resources's website: https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-imacs. If the Director of the Division of Water Resources establishes or updates an IMAC, the IMAC shall be posted on the Division of Water Resources's website and the Commission shall be notified in writing within 30 calendar days that a new IMAC has been established or an existing IMAC has been updated or removed.

(g) Groundwater quality standards specified in Paragraphs (h) and (i) of this Rule and ~~interim maximum allowable concentrations~~IMACs established pursuant to Paragraph (c) of this Rule shall be reviewed by the ~~Director~~Division of Water Resources on a triennial ~~basis.~~basis and reported to the Commission. The Director of the Division of Water Resources shall ~~consider~~take any of the following actions during the review of an established IMAC:

Based on the comments received as well as the Division's ability to consider new information to establish and revise IMACs, the Hearing Officer recommends that the Commission not adopt the proposed groundwater quality standard for total PFOA and PFOS that went out to notice. The science on PFAS chemicals is developing and many studies are ongoing. The Division continues to evaluate newly published data and expected forthcoming information on these compounds that may change the proposed health-based values that went out to notice. This information includes the improved pharmacokinetic model that EPA is developing, as discussed in the Kapraun et al., 2019 study, and further scientific review by EPA leading to the establishment of Maximum Contaminant Levels for PFOA and PFOS. The Division will consider this additional information to pursue establishing IMAC values for PFOA and PFOS.

Attachment A

Secretaries' Science Advisory Board
Summary statement on use of EPA's 2016 Drinking Water Health Advisory values for PFOA and PFOS as a Groundwater Quality Standard

Note: At the Dec 2, 2019 meeting, the Secretaries' Science Advisory Board (SSAB) provided a lot of feedback on the charge to "review and comment on the Division of Water Resources' recommendation to use the 2016 EPA Drinking Water Health Advisory values for PFOA and PFOS as a Groundwater Quality Standard." The SSAB was asked at the meeting for a more formal summary statement; the members crafted it orally, and a draft was subsequently circulated for review. This is the summary statement from that review.

The SSAB reviewed the information provided by the DEQ regarding the development of a draft rule for establishing a groundwater standard for PFOA and PFOS as referred for consideration by the Environmental Management Commission's Groundwater/Waste Management Committee. The SSAB reviewed the 2016 EPA technical support documents for PFOA and PFOS and reviewed the technical basis for PFOA and PFOS standards in other states and other countries. At its December 2nd meeting, the SSAB heard overviews of studies conducted by researchers in North Carolina and elsewhere since the EPA 2016 Drinking Water Health Advisory values were established for 70 ng/L (ppt) for each chemical individually and their additive value.

It was acknowledged that EPA's Health Advisory work was developed with rigorous scientific peer review and remains relatively current. The only concerns expressed were: 1) the value of reviewing mammalian toxicology studies published since those available during EPA's review (which used scientific literature through December 2015), 2) the value of examining the points of departure used in other entities' PFOA and PFOS hazard assessments, and 3) there are many other PFAS chemicals to which people may be exposed that would remain unaddressed in setting a 70 ng/L standard for just two PFAS chemicals (however, it was acknowledged that there are not health advisory levels for all of the relevant PFAS chemicals and there is not consensus on which could be grouped based on similar toxicity mechanism(s) that would lend to having their concentrations added to PFOA and PFOS for a standard based on their values in total).

The SSAB members present voiced consensus on the establishment of a toxicological science-based standard for PFOA and PFOS in preference to a Practical Quantitation Level value*. A majority of members present indicated using the EPA 2016 Drinking Water Health Advisory level was a reasonable step to improve the current situation of having a much higher IMAC for PFOA of 2,000 ng/L and no standard for PFOS. Members strongly voiced a recommendation for DEQ to continue to evaluate research (with an emphasis on mammalian toxicity studies and epidemiological data published after 2015) during the anticipated yearlong rulemaking process to determine if a lower value is warranted, and to make these chemicals a high priority for revisiting their standard(s) by monitoring the work being done by other states in addition to EPA, using a shorter timeframe than the normal triennial evaluation.

*For other PFAS compounds, for which such data are lacking, the PQL is an appropriate approach.

Attachment B

Regulatory Impact Analysis

Rule Citation: 15A NCAC 02L .0202

Rule Title: Groundwater Quality Standards

DEQ Division: Division of Water Resources (DWR)

Staff Contacts: Bridget Flaherty, Groundwater Standards Coordinator, DWR
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Impact Summary:

State government:	Yes
NC DOT:	Yes
Local government:	Yes
Federal government:	Yes
Private entities:	Yes
Substantial Impact:	Unknown; net benefit expected

1. Necessity for Rule Change

North Carolina is required by N.C. General Statute 143-214.1 and N.C. Administrative Code Subchapter 15A NCAC 02L to adopt groundwater quality standards to protect the use of groundwater as a source of drinking water. Further, the Division of Water Resources (DWR) is required by Rule 15A NCAC 02L .0202(g) to evaluate and revise, as necessary, these standards every three years. This process is known as the "triennial review." The 2016 triennial review has been completed, and DWR has identified 47 contaminants for which standards should be adopted such that the rule will reflect the most recent health and toxicological information. As research supporting our understanding of the human health effects of contaminants found in groundwater advances, updating the groundwater standards ensures that cleanup requirements are set at a level that minimizes the risk that private well water consumers (including sensitive subgroups) will experience adverse health effects over a lifetime of exposure without being unduly burdensome for site owners.

2. Purpose of Rule

In accordance with Rule 15A NCAC 02L .0103(a), the purpose of the rules established in Subchapter 15A NCAC 02L is to "maintain and preserve the quality of the groundwaters, prevent and abate pollution and contamination of the waters of the State, protect public health and permit management of the groundwaters for their best usage by the citizens of North Carolina." Historically, the North Carolina Environmental Management Commission (EMC) has considered the best usage of groundwaters of the State to be as a source of drinking water.

The groundwater quality standards (hereafter referred to as "the standards" or "groundwater standards") for the protection of the groundwaters of the State are codified in subject Rule 15A NCAC 02L .0202. These standards represent the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the State that may be tolerated without creating a threat to human health or that would otherwise render the groundwater unsuitable for its intended best usage. The standards are used by various State regulatory programs to protect groundwater as a source of drinking water. The standards should not be confused with "maximum contaminant levels" (MCLs) which are established as part of the federal Safe Drinking Water Act and apply only to the treated drinking water supplied by public drinking water systems.

The EMC is proposing to adopt groundwater quality standards for 47 contaminants. The proposed standards are based on the most current available toxicological information and other relevant health risk assessment data in accordance with the criteria for establishing groundwater standards found in 15A NCAC 02L .0202(d), (e), and (f).

2.1 Regulatory Programs that use the Groundwater Standards

The groundwater standards are used primarily by the following State regulatory programs to establish target cleanup levels:

- Brownfields (NC DEQ-DWM)
  - reuse of abandoned or underutilized contaminated property;
- Underground Storage Tanks (NC DEQ-DWM)
  - regulates USTs that store petroleum or certain hazardous substances;
  - closure activities and corrective actions to address spills and releases from USTs;
- Superfund (NC DEQ-DWM)
  - monitoring and remediation of hazardous substance and waste disposal sites;
  - includes the Inactive Hazardous Sites program, which addresses contamination at more than 1,900 chemical spill or disposal sites and about 700 landfills that operated prior to 1982;
  - includes the Dry-cleaning Solvent Cleanup program, which addresses contamination at dry cleaner sites;
- Solid Waste (NC DEQ-DWM)
  - permitting and compliance of solid waste facilities that include municipal solid waste landfills, industrial waste landfills, and construction/demolition waste landfills;
- Hazardous Waste (NC DEQ-DWM)
  - prevention of hazardous substance release;
  - groundwater monitoring to determine extent of contamination;
  - cleanup of contaminated sites;
- Non-Discharge (NC DEQ-DWR)
  - permitting of wastewater treatment and disposal/reuse systems while avoiding discharge to surface waters;
  - includes wastewater irrigation, high-rate infiltration, residuals management;
- Groundwater Protection (NC DEQ-DWR)
  - permitting and monitoring of injection, remediation, and recovery wells as well as some high capacity drinking water wells.

- Asphalt Testing Program (NC DOT)
    - under the Roadside Environmental Unit, perform on-site testing of asphalt for Department construction activities.

3. Regulatory Baseline

As part of the permanent rulemaking process, North Carolina General Statute 150B-19.1 requires agencies to quantify to the "greatest extent possible" the costs and benefits to affected parties of a proposed rule. To understand what the costs and benefits of the proposed rule changes would be to regulated parties, it is necessary to establish a regulatory baseline for comparison. For the purpose of this fiscal note, the following items are considered to comprise the baseline:

- the current version of Rule 15A NCAC 02L .0202 (effective March 6, 2018);

- the Practical Quantitation Limit for each contaminant (Table 1). This is consistent with 15A NCAC 02L .0202(c) which states that "substances which are **not naturally occurring** and for which **no standard is specified** shall not be permitted in concentrations at or above the practical quantitation limit. . . ."

    Practical Quantitation Limit -- or "PQL" -- is defined in 15A NCAC 02L .0201 as "the lowest concentration of a given material that can be reliably achieved among laboratories within specified limits of precision and accuracy by a given analytical method during routine laboratory analysis."

    Rule 15A NCAC 02L .0202 (b)(3) further clarifies: "Where naturally occurring substances exceed the established standard, the standard shall be the naturally occurring concentration as determined by the Director." Of the 40 organic contaminants in this rulemaking, none are considered "naturally occurring" and none have a standard already adopted; therefore, the PQL is the regulatory baseline for the 40 organic contaminants. Of the seven metal/inorganic contaminants, all seven can be found in their elemental form in the environment. Where these metals are found in groundwater at levels above natural background concentration, it is typically the result of anthropogenic inputs such as from industrial processes. For this reason, it is assumed that none of these metals will be found at natural background concentrations greater than their corresponding PQL. As such, the PQL will also be considered the regulatory baseline for all seven inorganic/metal contaminants.

    The majority of PQLs used as the baseline in this analysis were established by either the DEQ Water Sciences Laboratory[1] or by commercial laboratories that have been certified by DEQ. PQLs were sought from commercial laboratories only for those contaminants for which a PQL was not available from the DEQ Water Sciences Laboratory.

    PQLs can vary from laboratory to laboratory as well as within a laboratory based upon equipment used or other factors such as matrix effects and dilution; for this reason, we compared PQLs from several of the larger commercial laboratories certified by DEQ. In most

[1] *For PQL values:* NCDEQ Chemistry Laboratory "QA/QC Limits PQLs"
https://files.nc.gov/ncdeq/Water+Quality/Chemistry+Lab/Operations/Quality+Assurance/NCDENR_DWR_WSS_LAB_PQLs.pdf

cases, the PQLs reported by commercial laboratories for a given contaminant were uniformly higher or lower than our proposed standard; in those cases, we concluded that the selection of a PQL from a particular laboratory over another would have no effect on the impact of the proposed rule.

For a handful of contaminants, there was more variability between PQLs reported by different commercial laboratories. In the case of acetic acid, for example, one lab reported a PQL of 1,000 µg/L and another reported a PQL of 10,000 µg/L. In these cases, we considered the lowest reported PQLs as the regulatory baseline from which to compare the potential effects of our proposed standards. We reasoned that the lowest PQL best represented the capability of commercial laboratories and would be more typical of current regulatory requirements.

There were three contaminants for which a PQL was not available from either the DEQ Water Sciences Laboratory or a DEQ-certified commercial laboratory. For 1,4-dibromobenzene, we used a PQL from the DEQ Water Sciences Laboratory for the chemically-similar contaminant bromobenzene[2]. For acetochlor ESA and acetochlor OXA, we substituted the Lowest Concentration Minimum Reporting Level (LCMRL) as reported in EPA Method 535[3] for the PQL. As described in EPA 815-R-11-001 the LCMRL "represents an estimate of the lowest concentration of a compound that can be quantitatively measured by members of a group of experienced drinking water laboratories."

It is important to note that Interim Maximum Allowable Concentrations (IMAC) have been established, per Rule 15A NCAC 02L .0202, for 44 of the 47 contaminants proposed for adoption; however, because IMACs are established on a temporary basis by the Director of DWR -- and not through the permanent rulemaking process -- they are not considered the regulatory baseline. The estimated fiscal impact of the proposed rulemaking would likely be considerably reduced in most cases if this analysis were to take into account the 44 existing IMACs when these health-based values are higher than the PQL. The contaminants for which there is not an existing IMAC are: 2,6-dinitrotoluene; perfluorooctane sulfonic acid (PFOS); and strontium.

There are five contaminants for which the proposed standard is lower than the IMAC: acetochlor ESA, acetochlor OXA, 2,4-dinitrotoluene, n-butanol, and perfluorooctanoic acid (PFOA). Compared to the current IMACs, these proposed standards could potentially increase remediation costs at sites for which one or more of these contaminants is the driver. The impact of the proposed standards in relationship to the IMACs for these contaminants is summarized in Section 7; however, the main focus of this analysis is the impact as compared to the PQLs. The North Carolina Office of State Budget and Management considers the PQLs to be the regulatory baseline because of the temporary nature of the IMACs and their creation outside of the rulemaking process. Generally, temporary rules are not part of the regulatory baseline because of their time-limited status and because they have not been subject to the

[2] *For identification of chemically-similar contaminant to 1,4-dibromobenzene*: U.S. EPA Chemistry Dashboard https://comptox.epa.gov/dashboard/dsstoxdb/results?search=DTXSID4024012#similar-molecules

[3] *For LCMRL values for Acetochlor ESA and OXA:* U.S. EPA Document # EPA/600/R-05/053 "Method 535. Measurement of Chloroacetanilide and other Acetamide herbicide degradates in drinking water by solid phase extraction and liquid chromoatography/tandem mass spectrometry (LC/MS/MS)" Version 1.1, April 2005, J.A. Shoemaker, M.V. Bassett

permanent rulemaking process, particularly economic analysis, public comment, and external review.

4. Proposed Changes to the Baseline

The only proposed changes to the subject rule are the adoption of standards for the 47 contaminants listed in Table 1. No changes are proposed to the existing standards already in rule. Of these 47 contaminants, 7 are metals/inorganics and 40 are organics. They include pesticides/herbicides, petroleum products/fuels, and chemical manufacturing/industrial solvents. Most have multiple uses that cross industries and regulatory programs.

Table 1: Groundwater Standards Proposed for Adoption

Contaminant	Proposed Standard µg/L (ppb)	PQL all reported in µg/L (ppb)							Is the proposed standard ≤ PQL?
		State Lab	Certified Commercial Lab					Based on LCMRL	
			#1	#2	#3	#4	#5		
Metals/Inorganics									
antimony and compounds	1	**10**							Yes
beryllium and compounds	4	**5.0**							Yes
cobalt and compounds	1	**50**							Yes
strontium and compounds	2,000	**10**							No
thallium and compounds	2	**2.0**							Yes
tin (inorganic forms)	2,000	**10**							No
vanadium and compounds	7	**10**							Yes
Organics									
acetic acid	5,000			**1,000**		10,000			No
acetochlor	100			**4.0**					No
acetochlor ESA	500							**0.4**	No
acetochlor OXA	500							**0.5**	No
acetophenone	700		4	10	10	**2**	10		No
acrolein	4		**5**	20	10	100	10		Yes
alachlor	2			**4**		6			Yes
aldrin	0.002	**0.03**							Yes
benzyl alcohol	700	**30**							No
bromomethane	10	**2**							No
n-butanol	590			**50**		250	**50**		No
sec-butanol	10,000		5,000	5,000			**250**		No

Contaminant	Proposed Standard µg/L (ppb)	PQL all reported in µg/L (ppb)							Is the proposed standard ≤ PQL?
		State Lab	Certified Commercial Lab					Based on LCMRL	
			#1	#2	#3	#4	#5		
4-chlorotoluene	24	**1**							No
dalapon	200		5	5.0		**4**			No
1,4-dibromobenzene	70	**1**[+]							No
dichloroacetic acid	0.7			**1.0**	**1**				Yes
p,p'-DDE	0.1	**0.03**							No
2,4-dichlorophenol	0.98	**10**							Yes
2,4-dinitrotoluene	0.05	**10**							Yes
2,6-dinitrotoluene	0.05	**10**							Yes
dinoseb	7	**0.6**							No
diphenyl ether	180		10	10	10	**2**			No
diquat	20			**2.0**					No
endosulfan sulfate	40	**0.03**							No
endothall	100			**10**		20			No
alpha-hexachlorocyclohexane	0.006		0.04	**0.0013**		0.01	0.02		No
beta-hexachlorocyclohexane	0.02		0.04	**0.0013**		0.01	0.02		No
2-hexanone	40		10	10	**5**	10	10		No
4-isopropyltoluene	25	**1**							No
methyl isobutyl ketone	100		**10**	**10**		**10**	**10**		No
methyl methacrylate	25		5	**2.0**	2	5	10		No
1-methylnapthalene	1		1.6	0.8	10	**0.5**	1		No
2-methylphenol	400	**10**							No
perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) (Total)	0.07		**0.002**	**0.002**		2	**0.002**		No
Propylene glycol	100,000		50,000	**10,000**		**10,000**	**10,000**		No
1,2,4,5-tetrachlorobenzene	2		5	10	10	**2**	10		Yes
1,1,1,2-tetrachloroethane	1	**1**							Yes
1,1,2-trichloroethane	0.6	**1**							Yes
2,4,5-trichlorophenol	63	**10**							No
2,4,6-trichlorophenol	4	**10**							Yes

[+] PQL for chemically-similar compound bromobenzene;
Values shown in **bold** indicate regulatory baseline for purposes of this fiscal analysis, as described in Section 3.

5. Human Health Outcomes and the Environment

The contaminants for which we are proposing standards are encountered in the environment at a wide range of sites. These sites can include chemical industry, furniture industry, abandoned hazardous waste, landfills, metalworking, wood treating, printing, plating, asphalt testing, and military facilities. We encounter solvents at furniture manufacturing and restoration, textile, wood treating, landfill and paint and printing sites. We encounter pesticides, herbicides, intermediates and solvent carriers at sites where agricultural chemicals have been stored, disposed or spilt during mixing. Metals are frequently found in groundwater at metal working, finishing, and plating sites. In addition to direct releases, some contaminants change the chemistry of the subsurface and mobilize naturally-occurring metals.

One tool we use to help protect groundwater from this ubiquitous usage and potential discharge of chemicals is the set of groundwater standards codified in Rule 15A NCAC 02L .0202. These standards are adopted to prevent chemical contamination of the groundwaters of the state so that they can be suitable for use as a source of drinking water.

Because the standards are established for the protection of waters that may be used for human consumption, it is critical to consider how the proposed standards could affect public health outcomes. The population that is potentially most directly affected by a change to the standards are the over three million North Carolina residents who use self-supported domestic water (i.e., wells)[4]. The residents who rely on public groundwater supplies are not covered by this analysis because the North Carolina groundwater standards are not applicable to these systems. Public drinking water systems are regulated under separate federal "maximum contaminant levels" (MCLs).

All of the groundwater standards proposed in this rulemaking are supported by the most recent health effects data or odor and taste thresholds published by the U.S. Environmental Protection Agency (EPA) or other relevant peer-reviewed, published data. For example, when developing standards, DWR often consults EPA's Integrated Risk Information System (IRIS) database. The IRIS database provides high-quality risk assessments that detail the potential human health effects of hundreds of different chemicals and provide toxicological information necessary to develop standards that are protective of human health.

The majority of this regulatory impact analysis is concerned with quantifiable and non-quantifiable costs and benefits to regulated parties and government agencies. In order to consider these economic impacts, we had to establish a regulatory baseline. Discussed in Section 3, the regulatory baseline we used is the Practical Quantitation Limit, or PQL. The PQL is a technology-based value used by laboratories to communicate their confidence in their test results. The PQL is not based on health effects data; as such, it should not be compared to a groundwater standard for purposes of determining human health impacts.

To further explain, in this analysis we compare the proposed groundwater standards to the PQLs when considering costs to regulated parties. This is because the adoption of the standard will replace the PQL as the regulatory baseline – the standard and the PQL can be compared when

[4] *For estimated number of private groundwater well users in North Carolina:* https://epi.dph.ncdhhs.gov/oee/wellwater/figures.html

looking at regulatory effects. But it would not be appropriate to compare the standards to the PQL when considering human health effects because the standard is a health- or aesthetics-based value and the PQL is not. The PQL does not inform the level of human health protection of the standard.

Some of the proposed standards in this rulemaking are numerically higher than the PQL and may therefore provide some measure of regulatory relief. Although providing regulatory relief, the higher standards will not adversely affect health outcomes of consumers of well water. This is because neither the PQLs nor the proposed standards surpass the risk management levels established in Rule 15A NCAC 02L .0202(d). For example, for p,p'-DDE (a breakdown product of commercial pesticide DDT, a known carcinogen) the PQL is 0.03 µg/L and the proposed standard is 0.1 µg/L. Although the standard is higher than the PQL, and that could provide regulatory relief, neither the PQL nor the standard surpasses the lifetime cancer risk of one in a million, as required by Rule 15A NCAC 02L .0202(d)(2). In this context, the two values can be considered equivalent as far as managing lifetime cancer risk. In another example, the PQL for dinoseb (an herbicide known to be toxic, but not classified as a carcinogen) is 0.6 µg/L and the proposed standard is 7 µg/L. For this contaminant, the PQL and the higher standard can be considered equivalent in that neither value surpasses the systemic threshold concentration as required by Rule 15A NCAC 02L .0202(d)(1). In other words, there would not be an increase in the appreciable risk of deleterious effects during a lifetime from daily exposure at either level. In both scenarios, the cleanup goals established using the technology-based PQLs provided a conservative level of protection that exceeded the point at which there would be no observable effects to the population. Therefore, setting a numerically higher standard that reflects a risk management threshold will not increase risk to public well water consumers. In short, adoption of these standards will reduce unnecessary regulatory burdens to owners of contaminated sites while maintaining at least an equivalent level of environmental, aesthetics, and human health protection.

The regulatory relief associated with this rulemaking could, in fact, provide an indirect benefit to the environment and human health. For some programs, regulatory relief will result in savings to funding sources for remediation projects. This would make funding available to more contaminated sites which would ultimately improve groundwater protections for consumers of private well water.

6. Costs and Benefits Analyses

6.1 Standards less than (or equal to) the PQL

Rule 15A NCAC 02L .0202(b)(1) states: "Where the standard for a substance is less than the practical quantitation limit, the detection of that substance at or above the practical quantitation limit constitutes a violation of the standard." Of the 47 standards proposed in this rulemaking, 16 are lower than (or equal to) the PQL (Table 2). For these 16 contaminants, the PQL will remain the regulatory baseline upon adoption of the standards, and the adoption of standards will neither increase nor decrease regulatory requirements.

As discussed in Section 5 of this document, the adoption of these standards will not change the level of environmental or public health protection already in effect.

For these reasons, the adoption of the 16 standards in Table 2 should have no quantifiable impact on regulated persons, at least for the foreseeable future, and no impact on public health outcomes.

Table 2: Proposed Groundwater Standards that are Less than (or equal to) the PQL

Contaminant
Metals/Inorganics
antimony and compounds
beryllium and compounds
cobalt and compounds
thallium and compounds
vanadium and compounds
Organics
acrolein
alachlor
aldrin
dichloroacetic acid
2,4-dichlorophenol
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2,4,5-tetrachlorobenzene
1,1,1,2-tetrachloroethane
1,1,2-trichloroethane
2,4,6-trichlorophenol

It is likely that environmental chemical testing methods and technologies will improve for some or all of these 16 contaminants over time, thereby allowing laboratories to achieve lower PQLs. In the event that a PQL is achieved that is lower than the standard, the standard would replace the PQL as the regulatory baseline. At that point, the standard would provide regulatory relief which could result in cost savings for remediation, monitoring, and permitting. It is impossible, however, to predict how fast – or how much – testing technology will improve for a given contaminant, so we have not attempted to quantify this possible future impact.

6.2 Standards greater than the PQL

Of the 47 standards proposed in this rulemaking, 31 are greater than the PQL (Table 3). Unlike the 16 standards that are less than the PQL (Table 2), these 31 standards will replace the PQL as the regulatory baseline upon adoption of the rule. For purposes of this analysis, the adoption of these 31 standards will reduce unnecessary regulatory burden. As a result, there should be some economic benefit and no economic cost to regulated parties.

The proposed standards are health-based values that take into account lifetime risks to human health from consumption of a contaminant. Neither the PQLs nor the proposed standards surpass the risk management levels established in Rule 15A NCAC 02L .0202(d). As such, the proposed standards are considered at least as protective of the environment, aesthetics, and human health as the technology-based PQL values.

Table 3: Proposed Groundwater Standards that are Greater than the PQL

Contaminant
Metals/Inorganics
strontium and compounds
tin (inorganic forms)
Organics
acetic acid
acetochlor
acetochlor ESA
acetochlor OXA
acetophenone
benzyl alcohol
bromomethane
n-butanol
sec-butanol
4-chlorotoluene
dalapon
1,4-dibromobenzene
p,p'-DDE
dinoseb
diphenyl ether
diquat
endosulfan sulfate
endothall
alpha-hexachlorocyclohexane
beta-hexachlorocyclohexane
2-hexanone
4-isopropyltoluene
methyl isobutyl ketone
methyl methacrylate
1-methylnapthalene
2-methylphenol

Contaminant
perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) (Total)
propylene glycol
2,4,5-trichlorophenol

For contaminants in Table 3, there should be some economic benefit to regulated parties from having the regulatory threshold lowered. This benefit would be realized by those regulated parties for whom one (or more) of the contaminants listed in Table 3 is a main driver for their site remediation. For purpose of this analysis, driver contaminants are contaminants that are either potentially widespread or have the greatest economic cost in cleanup of sites.

As mentioned earlier, there are Interim Maximum Allowable Concentrations (IMACs) already in effect for 44 of the 47 contaminants. This includes all but two of the contaminants in Table 3: Strontium and compounds and PFOS. In practice, the regulatory requirement (i.e., cleanup goal) for contaminants with an approved IMAC is the IMAC; however, because we are considering the PQL – not the IMAC – as the baseline for this analysis, we must compare the economic impact of the proposed standard against the PQL.

At the same time, we recognize that because there are existing IMACs, the bulk of the benefit we report should be considered an *ongoing* benefit rather than a benefit that will begin at some point in the future. In other words, we are attempting to quantify the ongoing benefit to the regulated parties from the adoption of the standard as compared to the PQL, absent the IMAC.

Many of the regulatory programs that are subject to the groundwater standards use the standards in similar ways. It makes sense, then, that those programs for which one or more of the contaminants in Table 3 are the driver contaminants might benefit in similar ways. Monetizing these benefits was challenging for many of these programs, though, due to the degree of variability between sites, unpredictability of future contaminant levels, lack of available data, and the complex nature of groundwater remediation. We quantified impacts when possible, but more often, we described the impacts in qualitative terms.

6.2.1 Benefits, in general

During preparation of this document, it became evident that a number of our regulatory programs would potentially benefit (or are already benefiting) in similar ways from the proposed standards. Benefits that can be generalized to multiple programs are listed below. Additional benefits (or lack thereof) specific to each regulatory program are discussed in greater detail under the programs' respective headings.

If a cleanup goal for a contaminant is relaxed (i.e., standard > PQL), and that contaminant is a driver for either monitoring or cleanup requirements, then the

responsible party for a regulated site may benefit in one of more of the following ways:

- Reduced frequency of monitoring: cost savings would include the labor costs to sample monitoring wells, analytical costs, and the costs of mapping and reporting results to DEQ. Decisions to allow reduced frequency of monitoring will be made by regulatory staff on a case-by-case basis.
- Reduced number of contaminants being monitored: costs saved include the cost to analyze the samples. Analytical costs vary widely by contaminant and laboratory.
- Reduced number of groundwater wells being monitored: costs saved include the cost to sample the well (labor costs). The cost savings realized by ceasing monitoring at a well will be somewhat reduced in the short term by the one-time costs associated with closing the well. Sites such as landfills, inactive hazardous waste sites, and USTs will incur these well closure costs at some point in time, regardless of the standard. But a numerically-higher standard may result in those costs being incurred years earlier.
- Reduced cleanup time: cost savings from completing groundwater remediation in a shorter period of time would largely be from spending less on operation and maintenance of the cleanup technology. These costs can be substantial and would likely make up the largest portion of cost savings realized from the proposed standards.
- Use of a more cost efficient cleanup technology: the type of technology used to reduce contaminant levels to the groundwater standard is site specific and depends on factors such as number and types of contaminants, contaminant properties, extent of contamination, hydrogeologic properties (soil and rock type), and cleanup goals. These factors, including the type of cleanup technology used at a site, will affect the time and cost to clean up groundwater.

The State agencies responsible for providing oversight of these regulatory programs could also realize potential benefits by freeing up staff capacity or funding resources that will be reinvested to address currently unmet needs:

- Regulated sites that achieve compliance with groundwater standards earlier – perhaps years earlier -- will require significantly less staff time in terms of oversight over the long term. This will reduce staff time spent on reviewing reports, analyzing data, and preparing correspondence per site. It will also result in the need for less travel to perform each site visit, which will save on fuel and vehicle maintenance costs. However, any savings to staff time and resources due to one project's early completion will be immediately reinvested to address the large backlog of other sites in need of staff attention across the state. For this reason, we did not expect any direct budgetary savings.

6.2.2 Brownfields

None of the contaminants in Table 3 are known drivers for cleanup of Brownfields sites. As such, the proposed standards would not have any economic impact on parties regulated under this program.

6.2.3 Hazardous Waste

The primary purpose of the Hazardous Waste Section of DEQ is to prevent and reduce releases of hazardous waste and to clean up contaminated sites. Sources of hazardous waste can include, but are not limited to, industrial or manufacturing processes such as wood preservation, chemicals manufacturing, petroleum refining, pesticides manufacturing, iron and steel production, and explosives manufacturing. Hazardous waste can also come from discarded common household products such as batteries, fluorescent lightbulbs, cathode ray tubes, paint thinners, herbicides, and adhesives.

In North Carolina, sites with groundwater contaminated by hazardous waste are required to cleanup to the groundwater standard or, in the absence of a standard, to the PQL. Of the contaminants in Table 3, the Hazardous Waste Section identified only one proposed groundwater standard that could potentially result in a cost impact to regulated hazardous waste sites: perfluorooctane sulfonic acid (PFOS) + perfluorooctanoic acid (PFOA) (Total). PFOS and PFOA are commonly-used man-made chemicals that have been used in manufacturing of fabrics, food packaging, carpet, and cookware. They are also present in aqueous film-forming foam (AFFF) which is used as a fire suppressant at military bases, fire training facilities, and airports and as a chemical fume suppressant at some types of industrial facilities.

The proposed standard for PFOS and PFOA is based on U.S. EPA drinking water health advisories[5] for PFOS and PFOA. These advisories considered the best available peer-reviewed laboratory studies of the health effects of these contaminants on rats and mice and also incorporated information from epidemiological studies from incidents of human exposure to these contaminants. Due to similarities in adverse effects that were observed following exposures to PFOS and PFOA and numerically-identical toxicity values, U.S. EPA recommends comparing the combined concentrations of PFOS and PFOA to the published health advisories. Therefore, the proposed groundwater standard for PFOS and PFOA will apply whether these contaminants are found individually or in combination.

For purposes of this analysis -- which relies on the PQL being the regulatory baseline in the absence of a standard – the proposed groundwater standard for PFOS + PFOA (Total) could provide some economic relief to regulated parties for which one or both of these contaminants is the driver for cleanup. The Hazardous Waste Section identified only one site -- a privately-owned chemical manufacturer -- at which PFOS or PFOA is driving groundwater cleanup. Two other sites are

[5] *For determination of combined PFOS/PFOA groundwater standard:* U.S. EPA drinking water health advisory https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos

currently required to sample for PFOS and PFOA – another privately-owned chemical manufacturer and a municipal-owned fire training facility; however, cleanup at these sites is not driven by the presence of PFOS or PFOA, so they are not expected to be impacted by the numerically higher standard.

Estimates of potential cost savings from the numerically higher standard were not provided for the one chemical manufacturing site. In the absence of quantifiable data for the one hazardous waste site, the general benefits summarized in Section 6.2.1 are applicable. The Hazardous Waste Section stated, though, that they do not expect an appreciable economic impact from adopting the proposed standard.

If we were to take into consideration the existing IMAC for PFOA, the potential regulatory benefit from the proposed combined standard would be reduced, eliminated, or possibly reversed. The size of the effect would depend, in part, on which of the contaminants -- PFOA or PFOS – is the driver contaminant. The IMAC for PFOA, which serves as the cleanup goal *in practice,* is 2 µg/L. For PFOS, there is no IMAC so the cleanup goal is the PQL, which is 0.002 µg/L. The proposed combined groundwater standard for PFOS + PFOA (Total) is 0.07 µg/L, which falls between the current cleanup goals for the two constituents. Because the cleanup goals for these two constituents are being combined into one standard -- and that standard is higher for one contaminant and lower for the other -- the Hazardous Waste Section expects potential benefits from the higher PFOS standard to be offset by the potential costs from the lower PFOA standard. With that being said, we do not have enough information to predict whether the costs and benefits would be offset equally or whether there could be some net costs or net benefits. That would depend on factors that will vary from site to site such as whether one or both contaminants are being monitored, their relative concentrations, the scale and complexity of the remediation, and the available remediation technology.

We also considered whether there could be an outsized regulatory effect due to the fact that the PFOA cleanup goal is changing by a larger order of magnitude than the PFOS cleanup goal. We concluded that assumptions based on differences in order of magnitude would be overly speculative because of the variability between sites, unpredictability of future contaminant levels, lack of available data, and the complex nature of groundwater remediation. Data was not available to monetize these various cost and benefit scenarios.

6.2.4 Superfund

The potential impacts on parties regulated under Superfund are as follows:

6.2.4.1 Dry Cleaning Solvent Cleanup

None of the contaminants in Table 3 are known drivers for cleanup of dry cleaning solvent sites. As such, the proposed standards would not have any economic impact on parties regulated under this program.

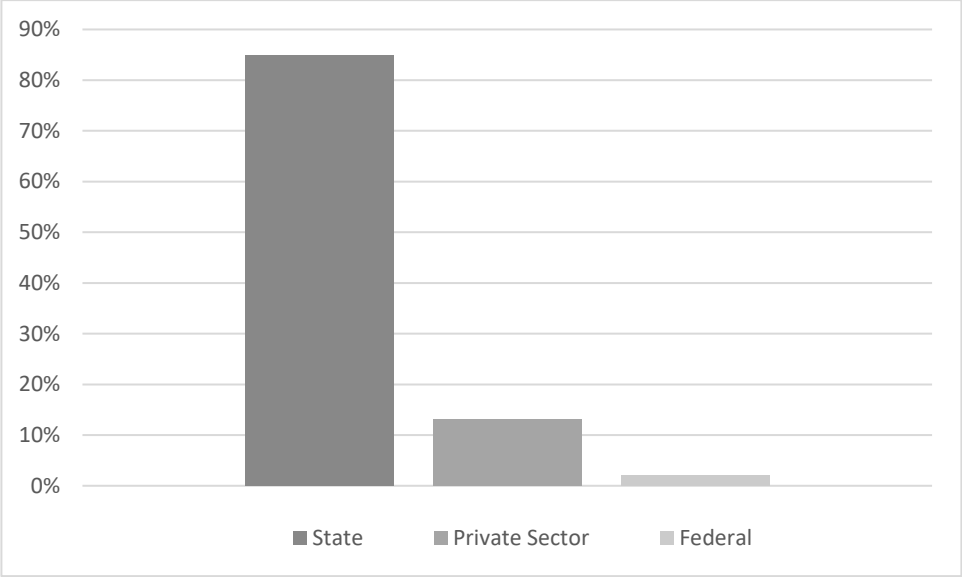
Inactive Hazardous Waste

The Inactive Hazardous Sites Program addresses sites contaminated with hazardous substances not related to permitted discharges. These are referred to as "inactive" sites because the original industries at the sites are generally no longer operating. Releases from these sites occurred before there were regulations prohibiting such releases. Some are the result of newer product spills. Most of these sites have since gone out of business or reorganized, making it difficult or impossible to find financially-viable responsible parties to do remediation. Compounding the complexity of remediating these sites is the lack of documentation regarding how, where, and when the release or releases occurred.

The Inactive Hazardous Sites Branch (IHSB) reported that, as of June 2019, there were 2,561 open IHSB cases. Of these, 666 were old landfills that received hazardous wastes before there were any regulations. The other 1,895 are non-landfill sites. IHSB estimated that about 80% of the non-landfill sites are orphaned, which means they are left to the State to manage and pay for remediation, as funding allows. Of the 2,561 open cases, only about 13% are being remediated using private funds.

In addition to the State-funded and privately-funded sites, there are 75 inactive hazardous sites for which the federal government (EPA and Department of Defense) has responsibility under the Superfund Program. These are the sites on the National Priority List which are considered the most hazardous waste sites.

Figure 1: Responsible Parties for Inactive Hazardous Waste Sites



Remediation of hazardous waste sites is costly, some sites costing in the millions of dollars. For the landfills, DEQ receives funding from the

statewide solid waste disposal tax. For the remaining orphaned sites, DEQ receives only $400,000 per year. Because of this large funding shortfall for orphaned sites, many of them are uncontrolled and have multiple hazards with limited investigation completed.

Table 4 lists the chemicals (from the subset in Table 3) that IHSB reported are commonly found at inactive hazardous waste sites, and for which the proposed standards would potentially provide some cost savings.

Table 4: Contaminants found at Inactive Hazardous Waste Sites

4-chlorotoluene	2-methylphenol
endosulfan	2,4,5-trichlorophenol
methylnaphthalene	p,p'-DDE

Staff stated that 4-chlorotoluene would probably have the highest impact in terms of reducing remediation costs as that can be one of the driver contaminants. Every site is different in terms of which contaminants are present, the degree of contamination, and the scale and complexity of remediation required to meet groundwater standards. It follows that the cost for remediation is extremely variable. For this reason, we did not attempt to monetize the potential cost savings of the proposed standards. It is reasonable, however, to assume that sites with a driver contaminant such as 4-chlorotoluene could see a significant cost savings over the life of the remediation, which typically spans decades.

It is assumed that all types of inactive hazardous waste sites for which the State has responsibility, including landfills, have the potential to realize some amount of cost savings:

- Cost savings for cleanup of non-landfill orphaned sites and landfills would be realized by both DEQ as the regulator and by the taxpayer. DEQ would see cost savings from reduced staff time and resources needed for oversight of the sites' cleanup. This includes savings from performing fewer site visits and spending less time reviewing reports and preparing correspondence. This ultimately benefits the state taxpayer.
- Cost savings to landfills will translate into savings to the statewide solid waste disposal tax fund, leaving more funding available for remediation at landfills.
- The private sector could realize a direct benefit from cost savings on their own sites.
- Sites for which the federal government has responsibility will likely realize a lesser benefit than State-managed sites. The reason for this is that the federal government manages sites involving the most

hazardous contaminants, none of which are part of this proposed rulemaking.

In the absence of quantifiable data, the general benefits summarized in Section 6.2.1 are applicable to all parties responsible for inactive hazardous waste sites.

6.2.5 Solid Waste Program

Within the Solid Waste Program, the parties that might be impacted are the following types of landfills:

- **Municipal Solid Waste (MSW) landfills -** nonhazardous waste from household, commercial, and institutional sources;
- **Construction and Demolition Debris (C&D) landfills –** solid waste from the construction, remodeling, repair, or demolition operations on pavement and buildings or structures; and
- **Industrial Waste (IW) landfills –** solid waste from manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of RCRA. Includes waste resulting from manufacturing processes such as electric power generation, fertilizer/agricultural chemicals, iron and steel manufacturing, organic chemicals, transportation equipment, etc. Does not include mining waste or oil and gas waste.

MSW and C&D landfills are required to perform groundwater monitoring for a suite of contaminants set by federal and state regulation. Which contaminants they monitor for depend primarily on the age of the landfill. Older landfills -- permitted before Oct 9, 1993 -- monitor groundwater for contaminants listed in 40 CFR Part 258 "Criteria for Municipal Solid Waste Landfills" Appendix I "Constituents for Detection Monitoring" (typically referred to as "Appendix I")[6]. Newer landfills -- permitted on or after Oct 9, 1993 -- also monitor groundwater for Appendix I contaminants; however, if they have exceedances, they are required to do additional monitoring of contaminants in the "List of Hazardous Inorganic and Organic Constituents" ("Appendix II"). If a contaminant is not listed on Appendix I or II, it is generally not required to be monitored at MSW or C&D landfills, although there are occasional exceptions based on waste stream.

IW landfills operate under a somewhat different groundwater monitoring scheme. In addition to monitoring for Appendix I contaminants, IW landfills also monitor for contaminants depending on the makeup of their specific waste stream. This results in greater variability between individual IW landfill facilities.

[6] *For determination of which contaminants are monitored at landfills:* Appendix I and II referenced from NC Solid Waste Section Environmental Monitoring List, Oct 15, 2018 https://edocs.deq.nc.gov/WasteManagement/0/edoc/1257181/SWS_EnviroMonitoring_Constituents_List.pdf

Table 4 summarizes the numbers and types of landfills at which each of the proposed contaminants have been or are currently being monitored. It also states whether the contaminant is listed in Appendix I or II. About two thirds of the proposed contaminants have been tested for in groundwater at one or more of the three types of landfills. According to DWM Solid Waste Section staff, changing waste streams and other variables at landfills make it difficult to identify when one contaminant over another is the main driver for assessment or cleanup of contaminated groundwater. This means that even if a proposed contaminant was detected at a level above the PQL, we cannot claim that the adoption of a standard that is numerically higher has or has not benefited these landfills. For this reason, we have not attempted to monetize the ongoing fiscal impact of the proposed standards on landfills.

Table 4: Proposed Contaminants Monitored at NC Solid Waste Landfills

Contaminant	Listed in 40 CFR Part 258 Appendix I or II?	Type & Number of Landfills at which Contaminant has been Monitored
Metals/Inorganics		
strontium and compounds	-	IW -1 MSW - 2
tin (inorganic forms)	Appendix II	MSW-28 C&D-9
Organics		
acetochlor ESA	-	none
acetochlor OXA	-	none
acetophenone	Appendix II	MSW-2 C&D-2
benzyl alcohol	Appendix II	MSW-3
bromomethane	Appendix I	none
n-butanol	-	none
sec-butanol	-	none
4-chlorotoluene	-	IW-4
dalapon	-	none
1,4-dibromobenzene	-	none
p,p'-DDE	Appendix II	MSW-4
dinoseb	Appendix II	MSW-5
diphenyl ether	-	IW-1
diquat	-	none
endosulfan sulfate	Appendix II	none
endothall	-	none
alpha-hexachlorocyclohexane	-	MSW-18 C&D-6
beta-hexachlorocyclohexane	-	MSW-15 C&D-4
2-hexanone	Appendix I	MSW-21

		C&D-5 IW-1
4-isopropyltoluene	-	MSW-3 IW-1
methyl isobutyl ketone	Appendix I	MSW-34 C&D-5 IW-2
methyl methacrylate	Appendix II	MSW-8
1-methylnapthalene	-	none
2-methylphenol	Appendix II	MSW-3
perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) (Total)	-	None* *Leachate from lined landfills will be tested beginning in 2019.
propylene glycol	-	none
2,4,5-trichlorophenol	Appendix II	MSW-2

Although about one third of the contaminants have not been monitored at these types of landfills, we cannot say with reasonable certainty that they will not be monitored in the future. Degradation of landfill materials over time or the development of a leak in a liner could result in the detection of a previously-undetected contaminant. It is also common for the makeup of materials collected at a landfill (waste stream) to vary over time. This could result in the introduction of additional contaminants to the groundwater and additional testing requirements. Further compounding the difficulty in monetizing a fiscal impact is that it is impossible to predict if future analytical testing will detect higher levels or lower levels of a particular contaminant. For these reasons, we have not attempted to monetize the future fiscal impact of the proposed standards on landfills.

In the absence of quantifiable data, the general benefits summarized in Section 6.2.1 are applicable to all parties responsible for regulated solid waste landfills.

It is assumed that all regulated landfills could potentially benefit from a numerically-higher groundwater standard for the reasons stated above. This benefit could be realized regardless of ownership. According to DWM, there were approximately 311 active and inactive MSW, C&D, and IW landfill facilities in North Carolina as of February 1, 2019[7]. The majority of these types of landfills are owned either by private entities or local governments, although there is a total of seven landfills owned by state and federal governments (Table 5). We do not anticipate one type of landfill or one subgroup of owner to benefit more than another.

[7] *For data on numbers of NCDWM Solid Waste permitted facilities:* https://deq.nc.gov/about/divisions/waste-management/sw/data/facility-lists

Table 5: Ownership of C&D, IW, and MSW Landfills in North Carolina

	Privately-owned	Local Govt-owned	State-owned	Federal-owned	Sub-Total
C&D	34	51	0	1	86
Industrial	40	2	0	0	42
MSW	42	135	2	4	183
				TOTAL	**311**

6.2.6 Underground Storage Tanks

The Underground Storage Tank (UST) Section of DEQ oversees programs related to the cleanup of contaminated soil and groundwater due to releases of contaminants from USTs. These sites are required to cleanup to the groundwater standard or, in the absence of a standard, to the PQL. Of the contaminants in Table 3, only those associated with petroleum products were identified by the UST Section as potential contaminants of concern at UST release sites. This subset of contaminants is listed in Table 6.

Table 6: Potential Non-Driver Contaminants at UST Sites

Benzyl alcohol	Methyl isobutyl ketone
Bromomethane	1-methylnapthalene
n-Butanol	2-methylphenol
4-chlorotoluene	Propylene glycol
2-hexanone	2,4,5-trichlorophenol
4-Isopropyltoluene	

While each of the contaminants in Table 6 has the potential to be found at UST sites, none of them are considered drivers for assessment and remediation of petroleum releases. This is because other petroleum products -- such as MTBE and benzene – are usually the drivers as they are more widespread and have substantially greater cleanup costs. The contaminants in Table 6 are found in very small amounts, as additives or incidental contamination.

Although none of the proposed standards are for driver contaminants, we still anticipate some economic benefit to various parties from adopting standards that are numerically higher than the associated PQLs. Currently, when non-driver contaminants are found at levels above the PQLs, closeout of a UST remediation site can be delayed. Under this scenario, soil excavation and groundwater cleanup (e.g., pump and treat) activities will cease, but groundwater monitoring will continue until the site is closed out. Non-driver contaminants tend to be less volatile than the driver contaminants and are therefore harder to remediate, relying more on passive remediation techniques such as natural biodegradation and time.

For example, if a site is successfully remediated for the driver contaminant (such as MTBE) by soil excavation and treatment of groundwater, but levels of another contaminant (such as 1-methylnapthalene) remain elevated above the PQL, excavation and treatment cease, but monitoring for the non-driver contaminants must continue. Adopting a standard that it numerically higher than the PQL should result in fewer instances and shorter durations of delayed closeouts.

The UST Section conservatively estimated that elevated levels of non-driver contaminants, such as those listed in Table 6, could delay closeout of UST petroleum release sites by as much as five years and affect up to 10% of active remediation sites annually. These are rough estimates based on decades of staff experience and are solely meant to provide a basis for analysis. The actual duration of closeout and number of sites affected is highly variable from site to site and year to year. Staff estimated that approximately 400 sites in a year achieve successful cleanup of the driver contaminant. It follows that the closeout of 40 sites (10%) might be delayed due to lingering presence of non-driver contaminants.

The largest portions of cleanup costs are associated with soil excavation, groundwater cleanup, and groundwater monitoring. Since soil excavation and groundwater cleanup are not factors for non-driver contaminants, those costs are not included in this analysis. The UST Section estimated that delaying closeout of one site could cost up to $10,000 per year for ongoing monitoring (sampling and laboratory analyses). This is likely an overestimate for many sites, but it should provide a reasonable basis to consider the maximum possible cost for a complex site. Costs will be highly variable between sites due to differences in site-specific conditions, monitoring frequencies, and contaminants being tested.

The responsible parties for the majority of UST sites are private commercial entities (50.84%) or private non-commercial entities (36.74%). Responsible parties can include tank owners, operators, and landowners. A total of 5.54% of sites are owned by government entities, which include federal (e.g., military bases, post offices) state (NCDOT, prisons, hospitals), or local governments. The remaining 6.88% are State-lead sites, which are sites where the State assumes responsibility for remediation when the commercial responsible party cannot or will not perform remediation as required.

Table 7: Responsible Parties of Active Storage Tank Sites in North Carolina

Responsible Party	# Active Sites	% Active Sites
Commercial	7,045	50.84%
Non-commercial	5,091	36.74%
State-lead	953	6.88%
Government-owned (state, local, federal)	768	5.54%
TOTAL	13,857	100%

Over five years, it is assumed the responsible parties would receive a cost savings proportional to the number of sites they own or operate. The one exception to that is for commercial sites. Commercial sites have access to funds from the State's UST Commercial Trust Fund dedicated to cleaning up contaminated UST sites. The net costs for commercial sites are limited to a $20,000 deductible per site, regardless of how extensive the remediation plan. After meeting the deductible, commercial sites are eligible for reimbursement from the UST Commercial Trust Fund for 100% of their expenses.

Currently, the UST Commercial Trust Fund does not have enough funds to cover all the commercial remediation projects in a given year. As such, the North Carolina General Assembly limits reimbursements to a subset of commercial UST remediation sites that are ranked as having an Intermediate risk or greater to human health and the environment. Assessment and remediation work at the remaining commercial UST sites has been suspended indefinitely. These are sites that are not receiving reimbursement either because they are lower risk and are therefore ineligible or because the UST Commercial Trust Fund has insufficient funds to reimburse all eligible projects in a given funding cycle. In the near term, the proposed rulemaking will be of little or no benefit to sites not eligible for funding (i.e., lower risk sites), but these sites may benefit in the long term as funding becomes available.

It stands to reason that the potential savings to commercial sites will be shifted to the UST Commercial Trust Fund. The UST Commercial Trust Fund will save money on current remediation sites, thereby leaving more money available for remediation of additional sites. In turn, cleanup of additional sites provides an indirect benefit to a localized subset of private well water consumers and the environment in the form of improved groundwater protection.
Aside from the subset of well water consumers who will benefit from savings to the UST Commercial Trust Fund, privately-owned *non-commercial* sites stand to benefit the most from the proposed standards as they are responsible for the vast majority of sites for which no such trust fund is available.

The UST Section Trust Fund Branch will realize cost savings due to reduced assessment, corrective action, and monitoring costs. This savings will be re-invested to address the substantial backlog of sites that need attention. Government-owned sites are not eligible for money from the State Trust Fund, so the agencies themselves will realize direct benefits from reduced monitoring costs. Data was not readily available on the proportion of federal versus state versus local government-owned sites, so we assumed each government subgroup would benefit equally.

Table 8 presents the estimated maximum savings over the next 5 years for each responsible party subgroup and the benefit to the UST Commercial Trust Fund. These amounts were estimated as follows:

Total savings for all parties over the 5 years:
40 sites per year x $10,000/year = $400,000 per year x 5 years = $2,000,000
($1,754,884 Net Present Value, using 7% discount rate)

The cost savings proportionate to each subgroup of responsible parties over 5 years was estimated as follows:
% of Active Sites x $1,754,884 / 100.

Table 8: Maximum Cost Savings for UST Responsible Parties Over Five Years in Millions of 2019 Dollars

Responsible Party	% Active Sites	Savings ($M)
UST Commercial Trust Fund	50.84%	**$0.8922**
Non-commercial	36.74%	**$0.6447**
State-lead commercial	6.88%	**$0.1207**
Government-owned (state, local, and federal)	1.85%	**$0.03246**
	1.85%	**$0.03246**
	1.85%	**$0.03246**
Commercial sites	*(see UST Trust Fund)*	**$0**
TOTAL	100%	$1.75498 *rounded to* **$1.76M NPV**

This is likely an overestimate for the reasons stated above as well as the fact that some sites might still experience some delayed closeout if contaminant levels remain higher than the new standard. The proposed standards for these contaminants were, in many cases, proposed by the UST Section in order to provide regulated parties from relief from the numerically-lower PQLs. As such, it is reasonable to expect that a majority of sites will receive some benefit from the proposed standards in the form of reduced monitoring costs. More precisely, these sites will continue to receive some *ongoing* benefit from the proposed standards since the standards are already in effect as IMACs.

6.2.7 DWR Groundwater Protection Program

6.2.7.1 Hazardous Waste Injection Wells

Administered by DWR, the Groundwater Protection Program uses the groundwater standards for remediating sites in which hazardous waste was disposed of by injecting it into underground wells, a practice that is now prohibited. There are very few of hazardous waste injection well sites still under DWR oversight.

The impact of the proposed standards on parties regulated under DWR's Groundwater Protection Program is expected to be negligible. Any potential impact will be mitigated by Rule 15A NCAC 02L .0407 which allows remediation of groundwater contamination to either the groundwater standards **or** to a level that is "as closely thereto as is economically and technologically feasible." It is unlikely, therefore, that the adoption of a groundwater standard that is higher than the technology-based PQL would provide a cost savings beyond that which is already allowed by this provision. In some cases, Rule 15A NCAC 02L .0407(c) requires remediation levels based on values other than the groundwater standards, such as IMACs, federal drinking water standards, or contaminant solubility. Because the regulatory baseline for this program is varied and not limited to the groundwater standard, we do not anticipate any economic impact on parties regulated under this program.

6.2.7.2 Non-discharge Sites

DWR is authorized under Subchapters 15A NCAC 02L (Groundwater Classification and Standards) and 15A NCAC 02T (Waste Not Discharged to Surface Waters) to issue permits that allow the discharge of waste onto land or into the subsurface under conditions outlined in a "non-discharge" permit. Infrequently, cleanup activities from these discharges may be required. Staff reported that there are no cleanup activities underway on permitted sites for any of the 31 contaminants in Table 3, and none of the 31 contaminants are part of permittees' required monitoring suite. For this reason, there is no data available to quantify how many non-discharge sites could potentially be affected. Staff indicated that of the proposed standards, only PFOS/PFOA is currently being considered for monitoring in the future. Without data on current levels of PFOS/PFOA at these sites, or an estimate on how many sites would exceed the PQL for this contaminant, staff cannot speculate on many sites might benefit from a standard that is numerically higher than the PQL. For these reasons, we have not attempted to monetize the potential economic impact to current or future non-discharge permittees.

DWR's Groundwater Protection Program anticipates no direct or indirect economic impact to their program from the proposed rule.

6.2.8 NC Department of Health and Human Services (NC DHHS)

The On-Site Water Protection Branch programs within NC DHHS provide oversight of sub-surface on-site wastewater treatment systems. They also provide consultative services related to wastewater and private drinking water wells to local health departments. They use the groundwater standards for non-regulatory purposes only. Staff confirmed that the proposed changes to the groundwater standards should have no impact on their programs.

6.2.9 Agriculture

Although some of these contaminants are products used in agriculture -- particularly pesticides (including herbicides) -- our standards will not affect the

agricultural community. Use of herbicides in agriculture is regulated by different criteria, typically lifetime Health Advisory Levels (HAL) or maximum contaminant levels (MCL). Use of other types of pesticides is subject to other federal and state regulations and is not required to comply with EMC's groundwater standards.

DWR contacted the Department of Agriculture and Consumer Services who reported no anticipated direct or indirect economic impact to the agency from the proposed rule.

6.2.10 NC Department of Transportation (NCDOT)

The program within NCDOT that will be primarily affected is the Asphalt Testing Program. The NCDOT Asphalt Testing Program performs on-site testing of asphalt for Department construction activities using ASTM Method D2172-88. This method requires the use of solvents. Solvents stored, spilled, or disposed of onsite near operating labs can result in releases of these solvents to the environment.

NCDOT identified four contaminants on our proposed standards list that have been detected in groundwater at some asphalt testing sites: acetic acid, n-butanol, sec-butanol, and methyl-isobutyl-ketone. All of these are breakdown products of solvents. In the absence of groundwater standards for these four contaminants, NCDOT states that they use background concentrations as the threshold to determine compliance of their sites with 15A NCAC 02L .0202. They reported that the proposed standards for acetic acid, n-butanol, sec-butanol, and methyl-isobutyl-ketone are slightly higher than background concentrations; as such, compliance with the proposed standards may be achieved more readily.

Because the presence and detection of contaminants at each site is highly variable and unpredictable, NCDOT could not provide estimates of the number of sites that would benefit or the likelihood of benefit from the numerically higher standards. They did state, though, that any potential benefit would likely be negligible. Further minimizing a potential benefit is the fact that a change to the standards for these four contaminants would only be realized if one of these contaminants were the main driver for remediation at a particular site. This type of data was not available for our analysis. For these reasons, we have not attempted to monetize the potential benefit.

In the absence of quantifiable data for asphalt testing sites, the general benefits summarized in Section 6.2.1 are applicable. If there are benefits to NCDOT in terms of cost savings, it would most likely be realized in the form of savings to their Highway Maintenance Fund, which funds groundwater remediation projects among many other transportation-related projects.

6.2.11 Private wells

None of the contaminants for which we are proposing standards are currently required to be analyzed for under Section 15A NCAC 18A .3800 Private Drinking

Water Well Sampling. Nor do these rules require that well water comply with our groundwater standards. The State does not use the groundwater standards to regulate the water quality of private well water. The burden to monitor water quality of private well water is on the well owners. Information relating to the groundwater standards may be provided by NC DHHS to a well owner if there is a concern about possible contamination, but the well owner would not be required to take action. For these reasons, the proposed groundwater standards should not have any economic impact on private well owners.

6.3 Interim Maximum Allowable Concentrations (IMACs)

If this analysis were to take into account existing IMACs, the estimated cost savings would likely be considerably reduced for all but five contaminants. For the five contaminants for which the proposed groundwater standard will be lower than the IMAC, there could be some remediation costs not accounted for in this analysis. Remediation costs would be limited to responsible parties for sites at which one of the following contaminants is a driver: acetochlor ESA, acetochlor OXA, 2,4-dinitrotoluene, n-butanol, and perfluorooctanoic acid (PFOA). For PFOA, potential costs would be offset by potential benefits of the higher PFOS standard (see Section 6.2.3). For n-butanol, which was identified by NCDOT as a contaminant at asphalt testing sites, the potential costs from a lower cleanup goal would likely be negligible since it is a non-driver contaminant (see Section 6.2.10). For acetochlor ESA, acetochlor OXA, and 2,4-dinitrotoluene, the costs to site owners of a lower cleanup goal would be associated with increased monitoring frequency and duration and potential use of a more expensive cleanup technology. State agencies could also incur opportunity costs from reduced staff capacity and funding resources that would have otherwise been reinvested at additional sites in need of cleanup. There are few sites at which these particular contaminants are the main drivers for cleanup, so the potential amount of costs realized is likely very low.

7. Summary

The agency anticipates that if the groundwater standards are adopted as proposed, there would be an ongoing net benefit to regulated parties from having standards that are numerically-higher than the regulatory baseline for 31 of the 47 contaminants (Table 3). For purposes of this analysis, the regulatory baseline is the Practical Quantitation Limit (PQL) and not the existing Interim Maximum Allowable Concentrations (IMACs). Because there are existing IMACs in place for all but two of the contaminants in Table 3, the bulk of the cost savings would be considered largely an ongoing benefit rather than a benefit that will begin at some point in the future.

For the other 16 contaminants (Table 2) included in this rulemaking, we concluded that the adoption of standards will neither increase nor decrease regulatory requirements because the PQL will remain the baseline. For this reason, the adoption of the 16 standards in Table 2 should have no quantifiable impact on regulated persons, at least for the foreseeable future.

Benefits associated with this rulemaking would be realized by parties regulated primarily under the agency's UST, Hazardous Waste, Inactive Hazardous Waste, and Solid Waste Landfill programs. For most programs, we provided qualitative descriptions of the potential benefits,

many of which could be generalized to all programs. We provided quantitative data when available and made assumptions based on past data and trends when appropriate.

With the exception of the UST program, we did not attempt to monetize the potential benefits. This is because of the high degree of variability among sites in terms of which contaminants are present, which contaminants are the drivers for cleanup, the degree of contamination, the scale and complexity of remediation required to meet groundwater standards, the protracted length of time required to remediate groundwater, the age of some sites (i.e., lack of data). Together with the fact that we cannot reasonably predict future levels of groundwater contamination nor the pace at which cleanup and testing technologies will advance, we were hesitant to monetize future benefits associated with the groundwater standards as this would be overly speculative.

Unquantified benefits to regulated parties include reduced frequency of monitoring, reduced number of contaminants being tested, reduced number of groundwater wells being monitored (labor costs) and reduced cleanup time. Cost savings from completing groundwater remediation in a shorter period of time would largely be from spending less on operation and maintenance of the cleanup technology. Operation and maintenance costs can be substantial and would likely make up the largest portion of cost savings realized from the proposed standards.

The only quantified cost savings were related to the UST Program. It was estimated that over a five-year period, non-commercial UST owners, the State Commercial UST Trust Fund, and federal, state and local government agencies could realize a total maximum savings of $1.76M (net present value).

Unquantified benefits to State government include savings to staff time and resources for DEQ and NCDOT due to reduced administrative oversight.

Perhaps the largest beneficiary of this rulemaking would be the state taxpayer who would potentially benefit in terms of cost savings to the following state funds that provide full or partial funding for groundwater remediation projects:

- UST Commercial Trust Fund – funds groundwater remediation at commercial UST sites;
- State Highway Maintenance Fund – funds groundwater remediation at asphalt testing program;
- Solid Waste Disposal Tax Fund – funds groundwater remediation at inactive hazardous waste landfills.

Savings to these funds in the near term would allow remediation at more sites in the long term. This should result in improved compliance with the groundwater standards, which would result in further protection of the groundwaters of the state as a resource and as a source of drinking water. This benefit would be realized by the environment and by those citizens who consume private well water.

If this analysis were to take into account existing IMACs, the estimated cost savings would likely be considerably reduced for all but five contaminants for which the proposed standard is lower than the IMAC. As summarized in Section 6.3, there could be some remediation costs associated with these contaminants which are not accounted for in this analysis. The costs to site owners of a

lower cleanup goal would be associated with increased monitoring frequency and duration and potential use of a more expensive cleanup technology. State agencies could also incur opportunity costs from reduced staff capacity and funding resources that would have otherwise been reinvested at additional sites in need of cleanup. Remediation costs would be limited to sites at which one of the five contaminants is the driver for cleanup. Only one such site was identified during this analysis; for this site, the potential costs from a lower PFOA standard would be either fully or partially offset by the potential savings from a higher PFOS standard.

The agency does not have sufficient data to reasonably predict whether the total quantified and unquantified impacts of the proposed rulemaking will meet or exceed the $1,000,000 threshold for substantial economic impact as defined in G.S. 150B-21.4. It is reasonable to expect, however, that there will be a net direct benefit to regulated entities and state government and a zero to net-positive indirect benefit for well water consumers and the environment. The amount of savings could not be determined because of the high degree of variability and unpredictability of contaminated sites and remediation methods.

Appendix I References

1. *For PQL values:* NCDEQ Chemistry Laboratory "QA/QC Limits PQLs" https://files.nc.gov/ncdeq/Water+Quality/Chemistry+Lab/Operations/Quality+Assurance/NCDENR_DWR_WSS_LAB_PQLs.pdf

2. *For identification of chemically-similar contaminant to 1,4-dibromobenzene*: U.S. EPA Chemistry Dashboard https://comptox.epa.gov/dashboard/dsstoxdb/results?search=DTXSID4024012#similar-molecules*For LCMRL values for Acetochlor ESA and OXA:* U.S. EPA Document # EPA/600/R-05/053 "Method 535. Measurement of Chloroacetanilide and other Acetamide herbicide degradates in drinking water by solid phase extraction and liquid chromoatography/tandem mass spectrometry (LC/MS/MS)" Version 1.1, April 2005, J.A. Shoemaker, M.V. Bassett

3. *For the definition of Lowest Concentration Minimum Reporting Level:* U.S. EPA Document # EPA 815-R-11-001 "Technical Basis for the Lowest Concentration Minimum Reporting Level (LCMRL) Calculator" December 2010.

4. *For estimated number of private groundwater well users in North Carolina:* https://epi.dph.ncdhhs.gov/oee/wellwater/figures.html

5. *For determination of combined PFOS/PFOA groundwater standard:* U.S. EPA drinking water health advisory https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos

6. *For data on numbers of NCDWM Solid Waste permitted facilities:* https://deq.nc.gov/about/divisions/waste-management/sw/data/facility-lists

7. *For determination of which contaminants are monitored at landfills:* Appendix I and II referenced from NC Solid Waste Section Environmental Monitoring List, Oct 15, 2018 https://edocs.deq.nc.gov/WasteManagement/0/edoc/1257181/SWS_EnviroMonitoring_Constituents_List.pdf

Attachment C: Public Hearing Announcement

TITLE 15A – DEPARTMENT OF ENVIRONMENTAL QUALITY

Notice *is hereby given in accordance with G.S. 150B-21.2 that the Environmental Management Commission intends to amend the rule cited as 15A NCAC 02L .0202.*

Link to agency website pursuant to G.S. 150B-19.1(c): *https://deq.nc.gov/news/events/public-notices-hearings*

Proposed Effective Date: *July 1, 2021*

Public Hearing:
Date: *February 2, 2021*
Time: *6:00 pm*
Location: *In the abundance of caution, and to address protective measures to help prevent the spread of COVID-19, the NC Division of Water Resources is holding an online public hearing that can be joined starting at 5:45 pm via WebEx link: https://ncdenrits.webex.com/ncdenrits/onstage/g.php?MTID=e5c544ae3124c6ca32f29b6ac45afb8ac,*
WebEx password: jPeFQgQ3n85
WebEx phone number: 1-415-655-0003
WebEx access code: 178 659 9930

To register for the hearing and provide your preference regarding speaking at the hearing, please visit: https://forms.office.com/Pages/ResponsePage.aspx?id=3IF2etC5mkSFw-zCbNftGRcM2xmuszROiks3JDQp2_RUNlJKWjlIRjlWWkhIVTRLMDFGM1gzSDRYMy4u

Or scan the following QR code with your phone:

Registration must be completed by 12:00 pm on February 2, 2021. If you have any problems registering online, please call 919-707-9011 by the registration deadline of 12:00 pm on February 2, 2021.

The Division of Water Resources highly recommends testing your computer's WebEx capabilities prior to the hearing at https://www.webex.com/test-meeting.html. For instructions about digital ways to join the public hearing, please refer to the WebEx Help Center online at https://help.webex.com/en-us/.

To comment during the hearing after your name is called as a registered speaker and/or after the hearing officer asks if any people wish to comment following the registered speakers:
*- If you join the hearing by phone, press *3 to "raise your hand," speak once called upon to do so, and press *3 again to "lower your hand."*
- If you join the hearing online, press the hand icon to "raise your hand," speak once called upon to do so, and press the hand icon again to "lower your hand."
- The Hearing Officer may limit the length of time that you may speak, so that all those who wish to speak may do so.

Reason for Proposed Action: *Groundwater Quality Standards for the protection of groundwaters of the state are established by 15A NCAC 02L .0202. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage as an existing or potential source of drinking water supply for humans. Every three years the State is required by 15A NCAC 02L .0202(g) to review its groundwater water quality standards and interim maximum allowable concentrations to determine if changes are needed and, if necessary, to make those changes. Revision of these standards is needed to ensure that they contain the most recent health and toxicological information. The last review focused on the interim maximum allowable concentrations established under 15A NCAC 02L .0202(c).*

Proposed changes to 15A NCAC 02L .0202 include:
- *The adoption of a groundwater quality standard for 44 substances with established interim maximum allowable concentrations, some with revisions,*
- *the addition of a groundwater quality standard for three substances (2,6-dinitrotoluene, strontium, and total PFOA and PFOS) without established interim maximum allowable concentrations,*
- *the organization of the groundwater standards into a table,*
- *the addition of Chemical Abstracts Service Registry Numbers (CASRNs) for the groundwater standards,*
- *the removal of synonyms,*
- *a change in some units of measure to parts per billion (µg/L), when appropriate,*
- *the addition of rule text to add a notification process for the establishment of an interim maximum allowable concentration, and*
- *the addition of rule text to clarify the triennial review process.*

Comments may be submitted to: *Bridget Shelton, NC DEQ-DWR Planning Section, 1611 Mail Service Center, Raleigh, NC 27699-1611; email GWTriRevComments@ncdenr.gov*

Comment period ends: *March 16, 2021*

Procedure for Subjecting a Proposed Rule to Legislative Review: If an objection is not resolved prior to the adoption of the rule, a person may also submit written objections to the Rules Review Commission after the adoption of the Rule. If the Rules Review Commission receives written and signed objections after the adoption of the Rule in accordance with G.S. 150B-21.3(b2) from 10 or more persons clearly requesting review by the legislature and the Rules Review Commission approves the rule, the rule will become effective as provided in G.S. 150B-21.3(b1). The Commission will receive written objections until 5:00 p.m. on the day following the day the Commission approves the rule. The Commission will receive those objections by mail, delivery service, hand delivery, or facsimile transmission. If you have any further questions concerning the submission of objections to the Commission, please call a Commission staff attorney at 919-431-3000.

Fiscal impact. Does any rule or combination of rules in this notice create an economic impact? Check all that apply.

☒ **State funds affected**
☒ **Local funds affected**
☐ **Substantial economic impact (>= $1,000,000)**
☒ **Approved by OSBM**
☐ **No fiscal note required**

CHAPTER 02 - ENVIRONMENTAL MANAGEMENT

SUBCHAPTER 02L - GROUNDWATER CLASSIFICATION AND STANDARDS

SECTION .0200 - CLASSIFICATIONS AND GROUNDWATER QUALITY STANDARDS

15A NCAC 02L .0202 GROUNDWATER QUALITY STANDARDS

(a) The groundwater quality standards for the protection of the groundwaters of the state are those specified in this Rule. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage.

(b) The groundwater quality standards for contaminants specified in Paragraphs (h) and (i) of this Rule are as listed, except that:

(1) Where the standard for a substance is less than the practical quantitation limit, the detection of that substance at or above the practical quantitation limit constitutes a violation of the standard.

(2) Where two or more substances exist in combination, the Director shall consider the effects of chemical interactions as determined by the Division of Public Health and may establish maximum concentrations at values less than those established in accordance with Paragraphs (c), (h), or (i) of this Rule. In the absence of information to the contrary, in accordance with Paragraph (d) of this Rule, the carcinogenic risks associated with carcinogens present shall be considered additive and the toxic effects associated with non-carcinogens present shall also be considered additive.

(3) Where naturally occurring substances exceed the established standard, the standard shall be the naturally occurring concentration as determined by the Director.

(4) Where the groundwater standard for a substance is greater than the Maximum Contaminant Level (MCL), the Director shall apply the MCL as the groundwater standard at any private drinking water well or public water system well that may be impacted.

(c) Except for tracers used in concentrations which have been determined by the Division of Public Health to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit in Class GA or Class GSA groundwaters. Any person may petition the Director of the Division of Water Resources to establish an ~~interim maximum allowable concentration~~ Interim Maximum Allowable Concentration (IMAC) for a substance for which a standard has not been established under this Rule. The petitioner shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with ~~Paragraph~~ Paragraphs (d) and (e) of this Rule. ~~Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.~~ If the information submitted is not in accordance with Paragraphs (d) and (e) of this Rule, the Director of the Division of Water Resources shall request additional information from the petitioner. If the petitioner does not provide the additional information necessary to be in accordance with Paragraphs (d) and (e) of this Rule, the Director of the Division of Water Resources shall deny the petition. At least 30 days prior to establishing an IMAC for any substance, the Division of Water Resources shall provide public notice that an IMAC has been requested. The public notice shall include the petition requesting the establishment of the IMAC for a substance, the level of the proposed IMAC, and the basis upon which the Division of Water Resources has relied in development of the proposed IMAC. This notice shall be published in the North Carolina Register and posted on the Division of Water Resources's website: https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-imacs. If the Director of the Division of Water Resources establishes an IMAC, the IMAC shall be posted on the Division of Water Resources's website and the Commission shall be notified in writing within 30 calendar days that a new IMAC has been established.

(d) Except as provided in Paragraph (f) of this Rule, groundwater quality standards for substances in Class GA and Class GSA groundwaters are established as the least of:

(1) Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution ~~(.10~~ (0.10 for inorganics; ~~.20~~ 0.20 for organics)] / [2 liters/day (avg. water consumption)];

(2) Concentration which corresponds to an incremental lifetime cancer risk of 1x10-6;

(3) Taste threshold limit value;

(4) Odor threshold limit value;

(5) Maximum contaminant level; or

(6) National secondary drinking water standard.

(e) The following references, in order of preference, shall be used in establishing concentrations of substances which correspond to levels described in Paragraph (d) of this Rule.

(1) Integrated Risk Information System (U.S. EPA).

(2) Health Advisories (U.S. EPA Office of Drinking Water).

(3) Other health risk assessment data published by the U.S. EPA.

(4) Other relevant, published health risk assessment data, and scientifically valid peer-reviewed published toxicological data.

(f) The Commission may establish groundwater standards less stringent than existing maximum contaminant levels or national secondary drinking water standards if it finds, after public notice and opportunity for hearing, that:

(1) more recent data published in the EPA health references listed in Paragraph (e) of this Rule results in a standard which is protective of public health, taste threshold, or odor threshold;

(2) the standard will not endanger the public health and safety, including health and environmental effects from exposure to groundwater contaminants; and

(3) compliance with a standard based on the maximum contaminant level or national secondary drinking water standard would produce serious hardship without equal or greater public benefit.

(g) Groundwater quality standards specified in Paragraphs (h) and (i) of this Rule and ~~interim maximum allowable concentrations~~ IMACs established pursuant to Paragraph (c) of this Rule shall be reviewed by the ~~Director~~ Division of Water Resources on a triennial ~~basis.~~ basis and reported to the Commission. The Director of the Division of Water Resources shall consider the following actions during the review of an established IMAC:

(1) recommend codifying the IMAC as a groundwater quality standard under this Rule;

(2) update the IMAC value based on data published or rescinded subsequent to the previous review;

(3) remove the IMAC based on data published or rescinded subsequent to the previous review; or

(4) retain the IMAC at the current value;

Any IMAC recommended under Subparagraph (g)(1) of this Rule that the Commission does not codify shall remain an established IMAC and be reviewed during the next triennial review. ~~Appropriate modifications~~ Modifications to established standards shall be ~~made~~ made, through rulemaking, in accordance with the ~~procedure~~ procedures prescribed in ~~Paragraph~~ Paragraphs (d) and (e) of this Rule where modifications are considered appropriate based on data published subsequent to the previous review.

(h) Class GA Standards. Unless otherwise indicated, the standard refers to the total concentration in micrograms per liter (µg/L) of any constituent in a dissolved, colloidal or particulate form which is mobile in groundwater. This does not apply to sediment or other particulate matter which is preserved in a groundwater sample as a result of well construction or sampling procedures. The Class GA standards are:

~~(1) Acenaphthene: 80;~~

~~(2) Acenaphthylene: 200;~~

~~(3) Acetone: 6 mg/L;~~

~~(4) Acrylamide: 0.008;~~

~~(5) Anthracene: 2 mg/L;~~

~~(6) Arsenic: 10;~~

~~(7) Atrazine and chlorotriazine metabolites: 3;~~

~~(8) Barium: 700;~~

~~(9) Benzene: 1;~~

~~(10) Benzo(a)anthracene (benz(a)anthracene): 0.05;~~

~~(11) Benzo(b)fluoranthene: 0.05;~~

~~(12) Benzo(k)fluoranthene: 0.5;~~

~~(13) Benzoic acid: 30 mg/L;~~

~~(14) Benzo(g,h,i,)perylene: 200;~~

~~(15) Benzo(a)pyrene: 0.005;~~

~~(16) Bis(chloroethyl)ether: 0.03;~~

~~(17) Bis(2-ethylhexyl) phthalate (di(2-ethylhexyl) phthalate): 3;~~

~~(18) Boron: 700;~~

~~(19) Bromodichloromethane: 0.6;~~

~~(20) Bromoform (tribromomethane): 4;~~

~~(21) n-Butylbenzene: 70;~~

~~(22) sec-Butylbenzene: 70;~~

~~(23) tert-Butylbenzene: 70;~~

~~(24) Butylbenzyl phthalate: 1 mg/L;~~

~~(25) Cadmium: 2;~~
~~(26) Caprolactam: 4 mg/L;~~
~~(27) Carbofuran: 40;~~
~~(28) Carbon disulfide: 700;~~
~~(29) Carbon tetrachloride: 0.3;~~
~~(30) Chlordane: 0.1;~~
~~(31) Chloride: 250 mg/L;~~
~~(32) Chlorobenzene: 50;~~
~~(33) Chloroethane: 3,000;~~
~~(34) Chloroform (trichloromethane): 70;~~
~~(35) Chloromethane (methyl chloride): 3;~~
~~(36) 2-Chlorophenol: 0.4;~~
~~(37) 2-Chlorotoluene (o-chlorotoluene): 100;~~
~~(38) Chromium: 10;~~
~~(39) Chrysene: 5;~~
~~(40) Coliform organisms (total): 1 per 100 mL;~~
~~(41) Color: 15 color units;~~
~~(42) Copper: 1 mg/L;~~
~~(43) Cyanide (free cyanide): 70;~~
~~(44) 2, 4-D (2,4-dichlorophenoxy acetic acid): 70;~~
~~(45) DDD: 0.1;~~
~~(46) DDT: 0.1;~~
~~(47) Dibenz(a,h)anthracene: 0.005;~~
~~(48) Dibromochloromethane: 0.4;~~
~~(49) 1,2-Dibromo-3-chloropropane: 0.04;~~
~~(50) Dibutyl (or di-n-butyl) phthalate: 700;~~
~~(51) 1,2-Dichlorobenzene (orthodichlorobenzene): 20;~~
~~(52) 1,3-Dichlorobenzene (metadichlorobenzene): 200;~~
~~(53) 1,4-Dichlorobenzene (paradichlorobenzene): 6;~~
~~(54) Dichlorodifluoromethane (Freon-12; Halon): 1 mg/L;~~
~~(55) 1,1-Dichloroethane: 6;~~
~~(56) 1,2-Dichloroethane (ethylene dichloride): 0.4;~~
~~(57) 1,2-Dichloroethene (cis): 70;~~
~~(58) 1,2-Dichloroethene (trans): 100;~~
~~(59) 1,1-Dichloroethylene (vinylidene chloride): 350;~~
~~(60) 1,2-Dichloropropane: 0.6;~~
~~(61) 1,3-Dichloropropene (cis and trans isomers): 0.4;~~
~~(62) Dieldrin: 0.002;~~
~~(63) Diethylphthalate: 6 mg/L;~~
~~(64) 2,4-Dimethylphenol (m-xylenol): 100;~~
~~(65) Di-n-octyl phthalate: 100;~~
~~(66) 1,4-Dioxane (p-dioxane): 3;~~
~~(67) Dioxin (2,3,7,8-TCDD): 0.0002 ng/L;~~
~~(68) 1,1--Diphenyl (1,1, biphenyl): 400;~~
~~(69) Dissolved solids (total): 500 mg/L;~~
~~(70) Disulfoton: 0.3;~~
~~(71) Diundecyl phthalate (Santicizer 711): 100;~~
~~(72) Endosulfan: 40;~~
~~(73) Endrin, total (includes endrin, endrin aldehyde and endrin ketone): 2;~~
~~(74) Epichlorohydrin: 4;~~
~~(75) Ethyl acetate: 3 mg/L;~~
~~(76) Ethylbenzene: 600;~~
~~(77) Ethylene dibromide (1,2-dibromoethane): 0.02;~~
~~(78) Ethylene glycol: 10 mg/L;~~
~~(79) Fluoranthene: 300;~~
~~(80) Fluorene: 300;~~
~~(81) Fluoride: 2 mg/L;~~
~~(82) Foaming agents: 500;~~
~~(83) Formaldehyde: 600;~~
~~(84) Gross alpha (adjusted) particle activity (excluding radium-226 and uranium): 15 pCi/L;~~
~~(85) Heptachlor: 0.008;~~
~~(86) Heptachlor epoxide: 0.004;~~
~~(87) Heptane: 400;~~
~~(88) Hexachlorobenzene (perchlorobenzene): 0.02;~~
~~(89) Hexachlorobutadiene: 0.4;~~

~~(90) Hexachlorocyclohexane isomers (technical grade): 0.02;~~
~~(91) n-Hexane: 400;~~
~~(92) Indeno(1,2,3-cd)pyrene: 0.05;~~
~~(93) Iron: 300;~~
~~(94) Isophorone: 40;~~
~~(95) Isopropylbenzene: 70;~~
~~(96) Isopropyl ether: 70;~~
~~(97) Lead: 15;~~
~~(98) Lindane (gamma-hexachlorocyclohexane): 0.03;~~
~~(99) Manganese: 50;~~
~~(100) Mercury: 1;~~
~~(101) Methanol: 4 mg/L;~~
~~(102) Methoxychlor: 40;~~
~~(103) Methylene chloride (dichloromethane): 5;~~
~~(104) Methyl ethyl ketone (2-butanone): 4 mg/L;~~
~~(105) 2-Methylnaphthalene: 30;~~
~~(106) 3-Methylphenol (m-cresol): 400;~~
~~(107) 4-Methylphenol (p-cresol): 40;~~
~~(108) Methyl tert-butyl ether (MTBE): 20;~~
~~(109) Naphthalene: 6;~~
~~(110) Nickel: 100;~~
~~(111) Nitrate (as N): 10 mg/L;~~
~~(112) Nitrite (as N): 1 mg/L;~~
~~(113) N-nitrosodimethylamine: 0.0007;~~
~~(114) Oxamyl: 200;~~
~~(115) Pentachlorophenol: 0.3;~~
~~(116) Petroleum aliphatic carbon fraction class (C5 - C8): 400;~~
~~(117) Petroleum aliphatic carbon fraction class (C9 - C18): 700;~~
~~(118) Petroleum aliphatic carbon fraction class (C19 - C36): 10 mg/L;~~
~~(119) Petroleum aromatics carbon fraction class (C9 - C22): 200;~~
~~(120) pH: 6.5 - 8.5;~~
~~(121) Phenanthrene: 200;~~
~~(122) Phenol: 30;~~
~~(123) Phorate: 1;~~
~~(124) n-Propylbenzene: 70;~~
~~(125) Pyrene: 200;~~
~~(126) Selenium: 20;~~
~~(127) Silver: 20;~~
~~(128) Simazine: 4;~~
~~(129) Styrene: 70;~~
~~(130) Sulfate: 250 mg/L;~~
~~(131) 1,1,2,2-Tetrachloroethane: 0.2;~~
~~(132) Tetrachloroethylene (perchloroethylene; PCE): 0.7;~~
~~(133) 2,3,4,6-Tetrachlorophenol: 200;~~
~~(134) Toluene: 600;~~
~~(135) Toxaphene: 0.03;~~
~~(136) 2,4,5-TP (Silvex): 50;~~
~~(137) 1,2,4-Trichlorobenzene: 70;~~
~~(138) 1,1,1-Trichloroethane: 200;~~
~~(139) Trichloroethylene (TCE): 3;~~
~~(140) Trichlorofluoromethane: 2 mg/L;~~
~~(141) 1,2,3-Trichloropropane: 0.005;~~
~~(142) 1,2,4-Trimethylbenzene: 400;~~
~~(143) 1,3,5-Trimethylbenzene: 400;~~
~~(144) 1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113): 200 mg/L;~~
~~(145) Vinyl chloride: 0.03;~~
~~(146) Xylenes (o-, m-, and p-): 500; and~~
~~(147) Zinc: 1 mg/L.~~

Substance	Chemical Abstracts Service (CAS) Registry Number	Standard (µg/L)
Acenaphthene	83-32-9	80
Acenaphthylene	208-96-8	200
Acetic acid	64-19-7	5,000

Acetochlor	34256-82-1	100
Acetochlor ESA	187022-11-3	500
Acetochlor OXA	184992-44-4	500
Acetone	67-64-1	6,000
Acetophenone	98-86-2	700
Acrolein	107-02-8	4
Acrylamide	79-06-1	0.008
Alachlor	15972-60-8	2
Aldrin	309-00-2	0.002
Anthracene	120-12-7	2,000
Antimony	7440-36-0	1
Arsenic	7440-38-2	10
Atrazine and chlorotriazine metabolites	1912-24-9	3
Barium	7440-39-3	700
Benzene	71-43-2	1
Benzo(a)anthracene	56-55-3	0.05
Benzo(a)pyrene	50-32-8	0.005
Benzo(b)fluoranthene	205-99-2	0.05
Benzo(g,h,i)perylene	191-24-2	200
Benzo(k)fluoranthene	207-08-9	0.5
Benzoic acid	65-85-0	30,000
Benzyl alcohol	100-51-6	700
Beryllium	7440-41-7	4
Bis(chloroethyl)ether	111-44-4	0.03
Bis(2-ethylhexyl) phthalate	117-81-7	3
Boron	7440-42-8	700
Bromodichloromethane	75-27-4	0.6
Bromoform	75-25-2	4
Bromomethane	74-839-9	10
n-Butanol	71-36-3	590
sec-Butanol	78-92-2	10,000
n-Butylbenzene	104-51-8	70
sec-Butylbenzene	135-98-8	70
tert-Butylbenzene	98-06-6	70
Butylbenzyl phthalate	85-68-7	1,000
Cadmium	7440-43-9	2
Caprolactam	105-60-2	4,000
Carbofuran	1563-66-2	40
Carbon disulfide	75-15-0	700
Carbon tetrachloride	56-23-5	0.3
Chlordane	12789-03-6	0.1
Chloride	16887-00-6	250,000
Chlorobenzene	108-90-7	50
Chloroethane	75-00-3	3,000
Chloroform	67-66-3	70
Chloromethane	74-87-3	3
2-Chlorophenol	95-57-8	0.4
2-Chlorotoluene	95-49-8	100
4-Chlorotoluene	106-43-4	24
Chromium	7440-47-3	10
Chrysene	218-01-9	5
Cobalt	7440-48-4	1
Coliform organisms (total)	No CAS Registry Number	1 per 100 mL
Color	No CAS Registry Number	15 color units
Copper	7440-50-8	1,000
Cyanide (free cyanide)	57-12-5	70
2,4-D (2,4-dichlorophenoxy acetic acid)	94-75-7	70
Dalapon	75-99-0	200
DDD	72-54-8	0.1
DDE	72-55-9	0.1
DDT	50-29-3	0.1

Dibenz(a,h)anthracene	53-70-3	0.005
1,4-Dibromobenzene	106-37-06	70
Dibromochloromethane	124-48-1	0.4
1,2-Dibromo-3-chloropropane	96-12-8	0.04
Dibutyl phthalate	84-74-2	700
Dichloroacetic acid	79-43-6	0.7
1,2-Dichlorobenzene	95-50-1	20
1,3-Dichlorobenzene	541-73-1	200
1,4-Dichlorobenzene	106-46-7	6
Dichlorodifluoromethane	75-71-8	1,000
1,1-Dichloroethane	75-34-3	6
1,2-Dichloroethane	107-06-2	0.4
1,2-Dichloroethene (cis)	156-59-2	70
1,2-Dichloroethene (trans)	156-60-5	100
1,1-Dichloroethylene	75-35-4	350
2,4-Dichlorophenol	120-83-2	0.98
1,2-Dichloropropane	78-87-5	0.6
1,3-Dichloropropene (cis and trans isomers)	542-75-6	0.4
Dieldrin	60-57-1	0.002
Diethylphthalate	84-66-2	6,000
2,4-Dimethylphenol	105-67-9	100
2,4-Dinitrotoluene	121-14-2	0.05
2,6-Dinitrotoluene	606-20-2	0.05
Di-n-octyl phthalate	117-84-0	100
Dinoseb	88-85-7	7
1,4-Dioxane	123-91-1	3
Dioxin (2,3,7,8-TCDD)	1746-01-6	0.0002 ng/L
1,1-Diphenyl	92-52-4	400
Diphenyl ether	101-84-8	180
Diquat	85-00-7	20
Dissolved solids (total)	No CAS Registry Number	500,000
Disulfoton	298-04-4	0.3
Diundecyl phthalate (Santicizer 711)	3648-20-2	100
Endosulfan	115-29-7	40
Endosulfan sulfate	115-29-7	40
Endothall	145-73-3	100
Endrin, total (includes endrin, endrin aldehyde, and endrin ketone)	72-20-8	2
Epichlorohydrin	106-89-8	4
Ethyl acetate	141-78-6	3,000
Ethylbenzene	100-41-4	600
Ethylene dibromide	106-93-4	0.02
Ethylene glycol	107-21-1	10,000
Fluoranthene	206-44-0	300
Fluorene	86-73-7	300
Fluoride	16984-48-8	2,000
Foaming agents	No CAS Registry Number	500
Formaldehyde	50-00-0	600
Gross alpha (adjusted) particle activity (excludes radium-226 and uranium)	12587-46-1	15 pCi/L
Heptachlor	76-44-8	0.008
Heptachlor epoxide	1024-57-3	0.004
Heptane	142-82-5	400
Hexachlorobenzene	118-74-1	0.02
Hexachlorobutadiene	87-68-3	0.4
Hexachlorocyclohexane isomers (technical grade)	608-73-1	0.02
alpha-Hexachlorocyclohexane	319-84-6	0.006
beta-Hexachlorocyclohexane	319-85-7	0.02
gamma-Hexachlorocyclohexane (Lindane)	58-89-9	0.03
n-Hexane	110-54-3	400
Indeno(1,2,3-cd)pyrene	193-39-5	0.05

Iron	7439-89-6	300
Isophorone	78-59-1	40
Isopropyl ether	108-20-3	70
Isopropylbenzene	98-82-8	70
4-Isopropyltoluene	99-87-6	25
Lead	7439-92-1	15
Manganese	7439-96-5	50
Mercury	7439-97-6	1
Methanol	67-56-1	4,000
Methoxychlor	72-43-5	40
Methylene chloride	75-09-2	5
Methyl butyl ketone	591-78-6	40
Methyl ethyl ketone	78-93-3	4,000
Methyl isobutyl ketone	108-10-1	100
Methyl methacrylate	80-62-6	25
1-Methylnapthalene	90-12-0	1
2-Methylnaphthalene	91-57-6	30
2-Methylphenol	95-48-7	400
3-Methylphenol	108-39-4	400
4-Methylphenol	106-44-5	40
Methyl tert-butyl ether (MTBE)	1634-04-4	20
Naphthalene	91-20-3	6
Nickel	7440-02-0	100
Nitrate (as N)	14797-55-8	10,000
Nitrite (as N)	14797-65-0	1,000
N-nitrosodimethylamine	62-75-9	0.0007
Oxamyl	23135-22-0	200
Pentachlorophenol	608-93-5	0.3
Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA), total	1763-23-1 (PFOS); 335-67-1 (PFOA)	0.07
Petroleum aliphatic carbon fraction class (C5 – C8)	No CAS Registry Number	400
Petroleum aliphatic carbon fraction class (C9 – C18)	No CAS Registry Number	700
Petroleum aliphatic carbon fraction class (C19 – C36)	No CAS Registry Number	10,000
Petroleum aromatics carbon fraction class (C9 – C22)	No CAS Registry Number	200
pH	No CAS Registry Number	6.5 - 8.5 (no unit)
Phenanthrene	85-01-8	200
Phenol	108-95-2	30
Phorate	298-02-2	1
n-Propylbenzene	103-65-1	70
Propylene glycol	57-55-6	100,000
Pyrene	129-00-0	200
Selenium	7782-49-2	20
Silver	7440-22-4	20
Simazine	122-34-9	4
Strontium	7440-24-6	2,000
Styrene	100-42-5	70
Sulfate	14808-79-8	250,000
1,2,4,5-Tetrachlorobenzene	95-94-3	2
1,1,2,2-Tetrachloroethane	79-34-5	0.2
1,1,1,2-Tetrachloroethane	630-20-6	1
Tetrachloroethylene (PCE)	127-18-4	0.7
2,3,4,6-Tetrachlorophenol	58-90-2	200
Thallium	7440-28-0	2
Tin (inorganic forms)	7440-31-5	2,000
Toluene	108-88-3	600
Toxaphene	8001-35-2	0.03
2,4,5-TP (Silvex)	93-72-1	50
1,2,4-Trichlorobenzene	120-82-1	70
1,1,1-Trichloroethane	71-55-6	200
1,1,2-Trichloroethane	79-00-5	0.6
Trichloroethylene (TCE)	79-01-6	3

Trichlorofluoromethane	75-69-4	2,000
2,4,5-Trichlorophenol	95-95-4	63
2,4,6-Trichlorophenol	88-06-2	4
1,2,3-Trichloropropane	96-18-4	0.005
1,2,4-Trimethylbenzene	95-63-6	400
1,3,5-Trimethylbenzene	108-67-8	400
Vanadium	7440-62-2	7
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	200,000
Vinyl chloride	75-01-4	0.03
Xylenes	1330-20-7	500
Zinc	7440-66-6	1,000

(i) Class GSA Standards. The standards for this class are the same as those for Class GA except as follows:
  (1) chloride: allowable increase not to exceed 100 percent of the natural quality concentration; and
  (2) dissolved solids (total): ~~1000 mg/L.~~ 1,000,000 µg/L.

(j) Class GC Standards.
  (1) The concentrations of substances that, at the time of classification, exceed the standards applicable to Class GA or GSA groundwaters shall not be caused to increase, nor shall the concentrations of other substances be caused to exceed the GA or GSA standards as a result of further disposal of contaminants to or beneath the surface of the land within the boundary of the area classified GC.
  (2) The concentrations of substances that, at the time of classification, exceed the standards applicable to GA or GSA groundwaters shall not be caused to migrate as a result of activities within the boundary of the GC classification, so as to violate the groundwater or surface water quality standards in adjoining waters of a different class.
  (3) Concentrations of specific substances, that exceed the established standard at the time of classification, are listed in Section .0300 of this Subchapter.

History Note: *Authority G.S. 143-214.1; 143B-282(a)(2);*
Eff. June 10, 1979;
Amended Eff. November 1, 1994; October 1, 1993; September 1, 1992; August 1, 1989;
Temporary Amendment Eff. June 30, 2002;
Amended Eff. August 1, 2002;
Temporary Amendment Expired February 9, 2003;
Amended Eff. April 1, 2013; January 1, 2010; April 1, 2005;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. March 6, 2018.
Amended Eff. July 1, 2021.

ONLINE PUBLIC HEARING:
Groundwater Quality Standards
February 2, 2021, 6:00 p.m.
Hearing Officer: Yvonne Bailey

Good evening. It is now 6:00 p.m. and this public hearing is officially called to order.
My name is Yvonne Bailey and I am a member of the Environmental Management Commission. I have been designated as the hearing officer for the 15A NCAC 02L .0202 Groundwater Quality Standards rulemaking effort.

If you are having technical difficulties with WebEx, you can use the chat feature in WebEx to ask questions or seek assistance. You can also view the public announcement for this hearing, which is a link on the Department of Environmental Quality's Public Notices and Hearings website, for instructions on various ways to connect to WebEx and for the WebEx phone number and access code for this hearing.

This hearing is being held under the authority of North Carolina General Statutes, Chapter 150B-21.2. In accordance with the General Statutes, a public notice of this hearing was published in the January 15, 2021 edition of the North Carolina Register. Notice to the public was also provided through the Division's website and a press release was issued by the Division of Water Resources on January 15, 2021.

The purpose of today's Hearing is to obtain public comment on the proposed amendments to the regulations governing groundwater quality standards and its fiscal analysis. In a moment, Bridget Shelton, a Division of Water Resources staff member, will review this proposal for you. There is additional information available on the Department of Environmental Quality's Public Notices and Hearings webpage that describes the proposal.

A written record of this hearing will be prepared that will include all the relevant comments, questions, and discussions. For this reason, the hearing is being recorded. Written comments received by March 16, 2021 will also be included in the record.

Based on the public comments received by March 16th and input and review of the comments by myself and the Division of Water Resources staff, I will make a recommendation to the Environmental Management Commission after the record is complete. In making the final decision, the Environmental Management Commission will consider the written record, the recommendations of Division staff, the recommendations of the Hearing Officer, and any concerns of other commission members.

The recommendation for the proposed rule may be to adopt it as proposed or to adopt a modified version of the proposal. The Environmental Management Commission may adopt the recommendation, modify it, or reject it. If the Commission wishes to adopt a rule that differs substantially from what has been published in the North Carolina Register and proposed this evening, it must first publish the text of the proposed different rule and accept comments on the new text.

Now, Bridget Shelton will present a brief overview of the proposed rule changes. After Bridget's presentation, comments from the audience will be allowed.
<*Bridget's presentation*>
Thank you, Bridget.

The Environmental Management Commission wants to hear your comments on the proposed rule. All interested and potentially affected persons or parties are encouraged to make their opinion known to the Commission, whether in favor of or opposed to any or all provisions of the proposed rule. Please know that your comments are important and will enable the Commission to act in the best interest of the public.

Please also remember that the intent of this hearing is to solicit your comments on the proposed amendments to the groundwater quality standards and associated fiscal analysis. It is important that you keep your comments concise and relevant to the proposal and fiscal analysis. It is critical that we have time to get all your comments on the proposal and its fiscal analysis and will hear them first. Then if you have other comments that you believe should be voiced to the staff or the Hearing Officer, we will try to give additional time at the end of the hearing for those comments, or you can contact staff after the hearing with those comments.

We will now accept comments on the proposed rule from the audience. I will call on speakers in the order that you registered for this hearing. If you have joined the hearing by phone, press *3 to "raise your hand," speak once called upon to do so, and press *3 again to "lower your hand." If you have joined the hearing online, press the hand icon to "raise your hand," speak once called upon to do so, and press the hand icon again to "lower your hand."

The WebEx Host will unmute each speaker when it is his or her turn to speak. I will also state the name of the next speaker in the queue so that individual can be prepared when his or her name is called to speak. Please do not start speaking until the Webex Host has indicated that your microphone has been unmuted.

If I call your name, but cannot hear you after you have been unmuted, please check to see if you are muted on the Webex screen on your computer. If you are having audio issues, try a different method of audio connection within Webex or use the "Call Me" feature to have Webex call your personal telephone line. If I still cannot hear you, I will proceed to the next registered speaker, but will call your name again at the end of the hearing.

When your name is called, please clearly and slowly state your name and any affiliation with an organization you may be representing. If you have written copies of your comments, we would appreciate receiving a copy of them. We may question speakers, if necessary, to clarify or learn more about matters as they arise. After all the registered speakers have had an opportunity to comment, any registered speaker who could not previously be heard will be called upon to speak. In addition, anyone who did not register to speak or desires additional time to speak will have the opportunity to comment. Please remember that Division of Water Resources staff can be contacted after the hearing to address any additional questions or comments that you may have.

Because a large number of people have requested to speak, it will be necessary to impose a time limit of 4 minutes. A member of the Division of Water Resources staff will be timing the comments and will state when you have one minute remaining to speak. We appreciate your cooperation with this time limit so that everyone who wishes to speak is able to do so.

I will now call on the first speaker. (*call names of speakers in the order that they registered*)
<if there is time> Are there any additional comments?

If there are no more comments, I declare the hearing closed.

<if there isn't time for additional comments> I declare this hearing closed.

The hearing record will remain open until March 16, 2021. That means that anytime between today and close of business on March 16, 2021, anyone can submit further comments on the proposed rules in writing to Ms. Shelton. Written comments received by US Mail or by e-mail during this time period will be made a part of the public record. (*the public notice announcement and the last slide of the presentation will have both addresses for you to reference*).

After the comment period has ended on March 16th, Division of Water Resources staff and I will review the comments and prepare a report of proceedings including all the comments; then we will make a recommendation to the Environmental Management Commission. The Commission will make a decision regarding the proposal after consideration of the report of proceedings and our recommendation. As I noted earlier, the Commission may not make substantial changes in the final rules without re-notice and rehearing. If the Commission adopts the proposed rules, then the expected effective date for the rules would be July 1, 2021. We thank everyone for attending this online hearing and offering your comments.

Attachment E:

Public Hearing Division of Water Resources Staff Presentation

Public Hearing on Proposed Rule Amendments and Regulatory Impact Analysis for 15A NCAC 02L .0202 Groundwater Quality Standards

February 2, 2021

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North Carolina Groundwater Quality Standards

NC Groundwater Quality Standards	
Federal Requirement	No
North Carolina Rule	15A NCAC 02L .0202
Population	Human Adults
Target use	Ingestion Household use
Standard endpoints	Noncancer Cancer Aqueous taste and odor

- Maximum allowable concentrations which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage
- Best Usage: existing or potential source of drinking water supply for humans
- Protect groundwaters of the state as a resource for human consumption
- Implemented in various programs including site clean-ups, risk assessments, and health evaluations

DEQ
NORTH CAROLINA
Department of Environmental Quality

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Interim Maximum Allowable Concentrations (IMACs)

- When a groundwater standard has not been established under the rule for a substance, any person may petition the Director to establish an interim maximum allowable concentration (IMAC).
- The petitioner must submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish an IMAC in accordance with NCAC 02L .0202 (d).
- DWR staff evaluate the submitted data and determine the appropriate protective level for the chemical of concern following procedures outlined in 15A NCAC 02L .0202.

15A NCAC 02L .0202 (c)

Periodic Review of IMACs

- 15A NCAC 02L .0202 (g): Groundwater quality standards and interim maximum allowable concentrations shall be reviewed on a triennial basis.
- DWR staff review the toxicological research and literature in accordance with 15A NCAC 02L .0202 to account for new information, new data, or reexaminations of existing data.
  - DWR staff consider appropriate modifications and prepare reports which are reviewed by internal staff
  - DWR submit prepared reports to DWM and DHHS toxicology staff for review and/or further discussion and comment

Proposed Amendments to 15A NCAC 02L .0202

- Incorporate 44 existing IMACs
  - Revisions for some compounds based on new data, recalculations, and reexamination of existing data
- Add a Groundwater Quality Standard for the following compounds:
  - 2,6-Dinitrotoluene, Strontium, PFOA and PFOS (total)

Compounds with Proposed Revised Values

- Revisions for some compounds based on new data, recalculations, and reexamination of existing data:
  - Acetochlor ESA
  - Acetochlor OXA
  - Alachlor
  - n-Butanol
  - 2,4-Dinitrotoluene
  - Diphenyl ether
  - PFOA and PFOS
  - Thallium
  - Vanadium

Proposed Amendments to 15A NCAC 02L .0202 continued

- Add Chemical Abstracts Service (CAS) Registry Numbers for existing groundwater standards and proposed incorporated IMACs
- Updates for clarification and ease of use:
  - Organize standards into table, remove synonyms, report in uniform units

Proposed Amendments to 15A NCAC 02L .0202 continued

Proposed rule text revisions:

- 15A NCAC 02L .0202 (c): rule text revisions to add IMAC notification process
- 15A NCAC 02L .0202 (g): rule text revisions to clarify triennial review process

Proposed rule text revisions to 15A NCAC 02L .0202 (c)

(c) Except for tracers used in concentrations which have been determined by the Division of Public Health to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit in Class GA or Class GSA groundwaters. Any person may petition the Director of the Division of Water Resources to establish an ~~interim maximum allowable concentration~~ Interim Maximum Allowable Concentration (IMAC) for a substance for which a standard has not been established under this Rule. The petitioner shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with Paragraphs (d) and (e) of this Rule. ~~Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.~~ If the information submitted is not in accordance with Paragraphs (d) and (e) of this Rule, the Director of the Division of Water Resources shall request additional information from the petitioner. If the petitioner does not provide the additional information necessary to be in accordance with Paragraphs (d) and (e) of this rule, the Director of the Division of Water Resources shall deny the petition.

Proposed rule text revisions to 15A NCAC 02L .0202 (c) continued

At least 30 days prior to establishing an IMAC for any substance, the Division of Water Resources shall provide public notice that an IMAC has been requested. The public notice shall include the petition requesting the establishment of the IMAC for a substance, the level of the proposed IMAC, and the basis upon which the Division of Water Resources has relied in development of the proposed IMAC. This notice shall be published in the North Carolina Register and posted on the Division of Water Resources's website: https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-imacs. If the Director of the Division of Water Resources establishes an IMAC, the IMAC shall be posted on the Division of Water Resource's website and the Commission shall be notified in writing within 30 calendar days that a new IMAC has been established.

Proposed rule text revisions to 15A NCAC 02L .0202 (g)

(g) Groundwater quality standards specified in Paragraphs (h) and (i) of this Rule and ~~interim maximum allowable concentrations~~ IMACs established pursuant to Paragraph (c) of this Rule shall be reviewed by the ~~Director~~ Division of Water Resources on a triennial basis and reported to the Commission. The Director of the Division of Water Resources shall consider the following actions during the review of an established IMAC:

(1) recommend codifying the IMAC as a groundwater quality standard under this rule;

(2) update the IMAC value based on data published or rescinded subsequent to the previous review;

(3) remove the IMAC based on data published or rescinded subsequent to the previous review;

(4) retain the IMAC at the current value;

Any IMAC recommended under Subparagraph (g)(1) of this Rule that the Commission does not codify shall remain an established IMAC and be reviewed during the next triennial review. ~~Appropriate~~ Modifications to established standards shall be made, through rulemaking, in accordance with the procedures prescribed in Paragraph (d) and (e) of this Rule where modifications are considered appropriate based on data published subsequent to the previous review.

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Fiscal Analysis

- By state law, rule changes require a Regulatory Impact Analysis to be performed on the proposed changes. The regulatory impact analysis was approved by OSBM on August 30, 2019.
- A net direct benefit to regulated entities (savings in operation and maintenance costs) and state government (staff time and resources) can be expected
- A zero to net positive indirect benefit for well water consumers and the environment (increased remediation efforts leading to improved compliance with groundwater standards) can be expected
- **Regulatory Impact Analysis report can be found here:** https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-standards

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Written comments may be mailed to:
Bridget Shelton, NC DEQ-DWR Planning Section,
1611 Mail Service Center, Raleigh, NC 27699-1611

Written comments may be emailed to:
GWTriRevComments@ncdenr.gov

Comment period ends: March 16, 2021

More information can be found at:
https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-standards

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Attachment F:

Public Hearing Registered Attendees

Public Hearing on Proposed Rule Amendments and Regulatory Impact Analysis for 15A NCAC 02L .0202 Groundwater Quality Standards
February 2, 2021

The hearing was called to order at 6:00 pm by Yvonne Bailey, the Environmental Management Commission-appointed Hearing Officer. The hearing was adjourned at 7:19 pm. Below is a list of registered attendees.

	Name:	Employer/Representing:
1	Shaun Malin	HRP Associates, Inc.
2	Chris Gilbert	Duke Energy
3	Liesel Werch	GreenStory Global Water Filtration
4	Craig Caldwell	NCDEQ
5	Dr. Sarah Cavrak	(private citizen)
6	Aniruddha Dastidar	Draper Aden Associates
7	Dacia Meng	Beveridge & Diamond PC
8	Phoebe Gooding	Toxic Free North Carolina
9	Tom Vitaglione	NC Child
10	Candace Prusiewicz	Self
11	Emily Donovan	Clean Cape Fear
12	Todd Mickleborough	The Quartz Corp
13	Emily Sutton	Haw River Assembly
14	Anna Van Der Hurd	Mother
15	Connor Kippe	Climate Action NC
16	Roberta Waddle	myself
17	Carrianne McClellan	citizen
18	Michael Watters	Grays Creek Residents United against PFAS in our Wells & Rivers
19	Elli Klein	People living in the state and surrounding areas
20	Nita Dukes	Chatham Climate Advisory Committee l
21	Terry Reilly	Retired
22	Barry	Self
23	Brian Beauregard	Self Employed
24	Kathryn	Self
25	Carrol Heiner	NA
26	Barbara Sfraga	Self
27	Edward Watson	NCDEQ- DWR-MRO
28	Dana Sargent	Cape Fear River Watch
29	Cassa Mason	NHC resident
30	Grady McCallie	NC Conservation Network
31	Suzanne Taylor	None
32	Tom Vitaglione	NC Child
33	Hope Taylor	Clean Water for North Carolina
34	Greg Barnes	NC Health News
35	Alexis Luckey	Toxic Free North Carolina
36	Jennifer Hill Carrigan	Circular Triangle
37	Lior Vered, PhD	Toxic Free North Carolina
38	Courtney Bippley	Myself
39	Rick Bolich	DWR Groundwater Section
40	Brandon Jones	Catawba Riverkeeper Foundation
41	Cori Bell	Natural Resources Defense Council
42	Manny Mayfield	Self
43	David Hill	Self
44	Lauren Eaves	UNC
45	Floyd Waddle	self
46	Sherri White-Williamson	N C Conservation Network
47	Brendan and Regina O'Donnell	not applicable
48	Claire O'Donnell	N/A
49	Brittany Johnston	HRP Associates, Inc.
50	Emily Sutton	Haw River Assembly
51	Lior Vered, Ph.D.	Toxic Free North Carolina
52	Stan Frost	Self
53	Beth Markesino	North Carolina Stop Genx in our water
54	Christopher Scott Leyhew	Self employed
55	Nita Dukes	CCAC
56	cristina sanchez	Baron & Budd
57	David Hill	Self

Attachment G:

Public Hearing Speakers

	Name:	Employer/Representing:	Registered to speak?	Spoke?
1	Emily Donovan	Clean Cape Fear	Yes	Yes
2	Emily Sutton	Haw River Assembly	Yes	Yes
3	Anna Van Der Hurd	Self	Yes	No
4	Connor Kippe	Climate Action NC	Yes	No
5	Roberta Waddle	Self	Yes	No
6	Michael Watters	Grays Creek Residents United against PFAS in our Wells & Rivers	Yes	Yes
7	Elli Klein	People living in the state and surrounding areas	Yes	No
8	Brian Beauregard	Self	Yes	No
9	Dana Sargent	Cape Fear River Watch	Yes	Yes
10	Grady McCallie	NC Conservation Network	Yes	Yes
11	Tom Vitaglione	NC Child	Yes	Yes
12	Hope Taylor	Clean Water for North Carolina	Yes	Yes
13	Jennifer Hill Carrigan	Circular Triangle	Yes	No
14	Lior Vered, PhD	Toxic Free North Carolina	Yes	Yes
15	Brandon Jones	Catawba Riverkeeper Foundation	Yes	Yes
16	Cori Bell	Natural Resources Defense Council	Yes	Yes
17	Manny Mayfield	Self	Yes	Yes
18	Floyd Waddle	Self	Yes	No
19	Brendan and Regina O'Donnell	Self	Yes	Yes
20	Claire O'Donnell	Self	Yes	Yes
21	Christopher Leyhew	Self	No	Yes
22	Beth Markasino	North Carolina Stop GenX in our Water	No	Yes
23	Manuel Fort	Self	No	Yes
24	Katie Bryant	Clean Haw River	No	Yes

Attachment H:

Written Comments Received

All written comments received can be found on the DWR Groundwater Triennial Review and Rulemaking website:

https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-standards

Attachment I

Groundwater Interim Maximum Allowable Concentration (IMAC) Summary Document

Division of Water Resources

PERFLUOROOCTANE SULFONIC ACID (CASRN 1763-23-1)

Health Effects Summary

Human health effects associated with chronic, low environmental exposures to perfluorooctane sulfonic acid (PFOS) are unknown. Perfluorooctane sulfonic acid is slowly eliminated and therefore accumulates in the human body. Its human serum biological half-life (time necessary for half of dose to be eliminated) is estimated to be approximately 2.9-5.8 years (Li et al. 2018; Olsen et al. 2007; Xu et al. 2020). The biological half-life of perfluorooctane sulfonic acid in other species, including rats and monkeys, is much smaller at 48-121 days (Chang et al. 2012).

Animals exposed to high doses of perfluorooctane sulfonic acid via ingestion exhibited decreased body weight, increased liver weight, increased liver fat, and liver histopathology. Animal reproductive and developmental studies reported decreased survival and weight of offspring. Animals exposed during gestation and lactation had offspring that exhibited higher serum glucose levels and insulin resistance as adults (U.S. EPA 2016). Epidemiological studies of workers exposed to perfluorooctane sulfonic acid via inhalation and general populations exposed via drinking water report increased total cholesterol and high-density lipoproteins (HDLs), and developmental and reproductive effects such as reduced fertility and fecundity (U.S. EPA 2016).

Data used for Groundwater IMAC

U.S. EPA's Office of Water established an oral reference dose (RfD) of 0.00002 mg/kg-day for perfluorooctane sulfonic acid based on decreased rat pup body weight in a two-generation reproductive study (https://www.epa.gov/sites/production/files/2016-05/documents/pfos_hesd_final_508.pdf).
A systemic threshold concentration of 0.14 µg/L can be calculated using the oral reference dose for perfluorooctane sulfonic acid in accordance with 15A NCAC 02L .0202(d)(1).

U.S. EPA considers perfluorooctane sulfonic acid as having "suggestive evidence of carcinogenic potential" according to its 2005 Guidelines for Carcinogen Risk Assessment. Liver tumors were reported at the highest dose tested in a long-term rat study. However, there is lack of demonstrated genotoxicity and comparable human epidemiological evidence from workers exposed to perfluorooctane sulfonic acid. The U.S. EPA Office of Water has not derived a cancer slope factor for perfluorooctane sulfonic because the weight of evidence for human carcinogenic is limited. A human exposure concentration associated with an incremental lifetime cancer risk estimate of 1×10^{-6} cannot be calculated per the requirements of 15A NCAC 02L .0202(d)(2).

No aqueous odor threshold, aqueous taste threshold, federal maximum contaminant level (MCL) or secondary drinking water standard has been established for perfluorooctane sulfonic acid.

Recommended Groundwater IMAC

U.S. EPA Office of Water issued a Health Advisory and Health Effects Support Document for Perfluorooctane Sulfonic Acid (PFOS) in 2016. The Health Advisory of 0.07 µg/L was calculated based on reduced pup body weight using the 90th percentile drinking water intake and body weight of lactating women from the 2011 U.S. EPA Exposure Factors Handbook. Alternatively, the calculation provided by the derivation of the non-cancer endpoint (0.1 ug/L) is advised.

Groundwater standards are to be the "lesser of" the criteria in 15A NCAC 02L .0202(d)(1-6).

The recommended groundwater IMAC for perfluorooctane sulfonic acid (PFOS) is 0.07 ug/L (ppb) based on the calculated noncancer systemic threshold using the 90th percentile drinking water intake and body weight of lactating women.

Uses

Perfluorooctane sulfonic acid is used as a water and oil repellent and as a surfactant in firefighting foams. It is used in carpet, upholstery, and textiles in waterproofing and stain resistance applications. It is also used in food packaging as a paper grease proofing agent. It is commonly used as the sodium or potassium form of the acid.

References

Amoore, JE and Hautala E. 1983. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatiles for 214 industrial chemicals in air and water dilution. Journal of Applied Toxicology, Volume 3. No. 6.

Chang, S.-C., P.E. Noker, G.S. Gorman, S.J. Gibson, J.A. Hart, D.J. Ehresman, and J.L. Butenhoff. 2012. Comparative pharmacokinetics of perfluorooctanesulfonate (PFOS) in rats, mice and monkeys. Reproductive Toxicology 33:428–440.

Li, Y., Fletcher, T., Mucs, D., Scott, K., Lindh, C.H., Tallving, P. and Jakobsson, K., 2018. Half-lives of PFOS, PFHxS and PFOA after end of exposure to contaminated drinking water. Occupational and environmental medicine, 75(1), pp.46-51.

Luebker, D.J., M.T. Case, R.G. York, J.A. Moore, K.J. Hansen, and J.L. Butenhoff. 2005b. Two-generation reproduction and cross-foster studies of perfluorooctanesulfonate (PFOS) in rats. Toxicology 215:126–148.

Olsen, G.W., J.M. Burris, D.J. Ehresman, J.W. Froehlich, A.M. Seacat, J.L. Butenhoff, and L.R. Zobel. 2007. Half-life of serum elimination of perfluorooctanesulfonate, perfluorohexanesulfonate and perfluorooctanoate in retired fluorochemical production workers. Environmental Health Perspectives 115:1298–1305

U.S. EPA Drinking Water Standards and Health Advisories. 2012. Office of Water (EPA 822-S-12-001) https://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf

U.S. EPA Drinking Water Health Advisory for Perfluorooctane Sulfonic Acid (PFOS). 2016. Office of Water. (EPA 822-R-16-004) https://www.epa.gov/sites/production/files/2016-05/documents/pfos_hesd_final_508.pdf

U.S. EPA Guidelines for Carcinogen Risk Assessment. 2005. (EPA/630/P-03/001B). Risk Assessment Forum, Washington, DC. (https://www.epa.gov/risk/guidelines-carcinogen-risk- assessment).

U.S. EPA Exposure Factors Handbook: 2011 Edition (Final). Office of Research and Development, National Center for Environmental Assessment. (EPA/600/R-09/052F). https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252

Xu, Y., Fletcher, T., Pineda, D., Lindh, C.H., Nilsson, C., Glynn, A., Vogs, C., Norström, K., Lilja, K., Jakobsson, K. and Li, Y., 2020. Serum half-lives for short-and long-chain perfluoroalkyl acids after ceasing exposure from drinking water contaminated by firefighting foam. Environmental health perspectives, 128(7), p.077004.

Young WF, Horth H, Crane R, Ogden T and Arnott M. 1996. Taste and odour threshold concentrations of potential potable water contaminants. Water Research, 30:2, pp. 331-340.

Groundwater Interim Maximum Allowable Concentration (IMAC) Summary Document

Division of Water Resources

PERFLUOROOCTANOIC ACID (PFOA) (CASRN 335-67-1)

Health Effects Summary

Human health effects associated with chronic, low environmental exposures to perfluorooctanoic acid (PFOA) are unknown. Perfluorooctanoic acid is slowly eliminated from humans and accumulates in the body. It has an estimated human biological half-life (time necessary for half of dose to be eliminated) of approximately 2-4 years (Bartell et al. 2010; Li et al. 2018; Olsen et al. 2007; Xu et al. 2020).

Animal studies reported liver toxicity including hypertrophy and necrosis, increased kidney weight, immune effects, developmental effects, and liver, testicular, and pancreatic cancer after oral exposures to perfluorooctanoic acid (U.S. EPA 2016). Epidemiological studies of workers exposed to perfluorooctanoic acid via inhalation and general populations exposed via drinking water report high cholesterol, increased liver enzymes, decreased vaccination response, thyroid disorders, pregnancy induced hypertension and preeclampsia, and testicular and kidney cancer (U.S. EPA 2016).

Data used for Groundwater IMAC

U.S. EPA's Office of Water established an oral reference dose (RfD) of 0.00002 mg/kg-day for perfluorooctanoic acid based on skeletal variations and accelerated puberty observed in male mice offspring (https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_hesd_final_508.pdf). A systemic threshold concentration of 0.14 µg/L can be calculated using the oral reference dose for perfluorooctanoic acid in accordance with 15A NCAC 02L .0202(d)(1).

U.S. EPA considers perfluorooctanoic acid as having "suggestive evidence of carcinogenic potential" according to its 2005 Guidelines for Carcinogen Risk Assessment. U.S. EPA Office of Water derived a cancer slope factor of 0.07 $(mg/kg\text{-}day)^{-1}$ for perfluorooctanoic acid based on testicular cancer (Leydig cells) observed in rats. A human exposure concentration of 0.50 µg/L associated with an incremental lifetime cancer risk estimate of 1×10^{-6} can be calculated per the requirements of 15A NCAC 02L .0202(d)(2).

No aqueous odor threshold, aqueous taste threshold, federal maximum contaminant level (MCL) or secondary drinking water standard has been established for perfluorooctanoic acid.

Recommended Groundwater IMAC

An interim maximum allowable concentration (IMAC) of 2 µg/L was established under 15A NCAC 02L .0202(c) for perfluorooctanoic acid in 2006. New toxicological information relevant to the derivation of a North Carolina groundwater standard is available. U.S. EPA Office of Water issued a Health Advisory and Health Effects Support Document for Perfluorooctanoic Acid (PFOA) in 2016. The Health Advisory of 0.07 µg/L was calculated based on potential adverse effects for fetuses during pregnancy and breastfed infants using the 90th percentile drinking water intake and body weight of lactating women from the 2011 U.S. EPA Exposure Factors Handbook. Alternatively, the calculation provided by the derivation of the non-cancer endpoint (0.1 µg/L) is advised.

Groundwater standards are to be the "lesser of" the criteria in 15A NCAC 02L .0202(d)(1-6).

The recommended groundwater IMAC for perfluorooctanoic acid (PFOA) is 0.07 ug/L (ppb) based on the calculated noncancer systemic threshold using the 90th percentile drinking water intake and body weight of lactating women.

Uses

Perfluorooctanoic acid is used as a water and oil repellent, a surfactant in firefighting foams, and as an intermediate in the synthesis of fluoroacrylic esters. It is used in Teflon, floor waxes and polishes, outdoor clothing and similar chemicals (known as fluorotelomers). According to the 2010/2015 EPA PFOA Stewardship Program, manufacture of PFOA was scheduled to be phased out by 2015.

References

Amoore, JE and Hautala E. 1983. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatiles for 214 industrial chemicals in air and water dilution. Journal of Applied Toxicology, Volume 3. No. 6.

Bartell, S., A. Calafat, C. Lyu, K. Kato, P.B. Ryan, and K. Steenland. 2010. Rate of decline in serum PFOA concentrations after granular activated carbon filtration at two public water systems in Ohio and West Virginia. Environmental Health Perspectives 118:222–228.

Li, Y., Fletcher, T., Mucs, D., Scott, K., Lindh, C.H., Tallving, P. and Jakobsson, K., 2018. Half-lives of PFOS, PFHxS and PFOA after end of exposure to contaminated drinking water. Occupational and environmental medicine, 75(1), pp.46-51.

Lau, C., J.R. Thibodeaux, R.G. Hanson, M.G. Narotsky, J.M. Rogers, A.B. Lindstrom, and M.J. Strynar. 2006. Effects of perfluorooctanoic acid exposure during pregnancy in the mouse. Toxicological Sciences 90:510–518.

Olsen, G.W., J.M. Burris, D.J. Ehresman, J.W. Froehlich, A.M. Seacat, J.L. Butenhoff, and L.R. Zobel. 2007. Half-life of serum elimination of perfluorooctanesulfonate, perfluorohexanesulfonate and perfluorooctanoate in retired fluorochemical production workers. Environmental Health Perspectives 115:1298–1305

U.S. EPA Drinking Water Standards and Health Advisories. 2012. Office of Water (EPA 822-S-12-001) https://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf

U.S. EPA Guidelines for Carcinogen Risk Assessment. 2005. (EPA/630/P-03/001B). Risk Assessment Forum, Washington, DC. (https://www.epa.gov/risk/guidelines-carcinogen-risk- assessment).

U.S. EPA Health Effects Support Document for Perfluorooctanoic Acid (PFOA). 2016. Office of Water. (EPA 822-R-16-003) https://www.epa.gov/sites/production/files/201605/documents/pfoa_health_advisory_final-plain.pdf

U.S. EPA Exposure Factors Handbook: 2011 Edition (Final). Office of Research and Development, National Center for Environmental Assessment. (EPA/600/R-09/052F). https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252

Young WF, Horth H, Crane R, Ogden T and Arnott M. 1996. Taste and odour threshold concentrations of potential potable water contaminants. Water Research, 30:2, pp. 331-340.

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North Carolina Groundwater Interim Maximum Allowable Concentration (IMAC) Calculation Sheet

Total Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) CASRNs 1763-23-1 and 335-67-1

North Carolina Groundwater (GW) IMAC = 0.07 µg/L*

Summary

The North Carolina GW IMAC for total perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) is based on a noncancer endpoint in accordance with selection criteria defined in 15A NCAC 02L .0202 (highlighted in yellow below). Critical health effect: Reduced pup body weight, 2-generation rat gavage study (PFOS) and reduced ossification of the forelimbs and hindlimbs and accelerated puberty in male mice pups (PFOA).

GW IMAC based on noncancer endpoint

GWQS = [(RfD x WT x RSC) / WI] * 1000

	PFOS	PFOA	
RfD = reference dose[1]	2.0E-05	2.0E-05	mg/kg/day
WT = average adult human body weight[2]	70	70	kg
RSC= relative source contribution[3]	0.2	0.2	unitless value
WI = average daily human adult water intake[4]	2	2	L/day
1000 = conversion factor	1000	1000	µg/mg
Calculated GW Standard using noncancer endpoint	**0.1**	**0.1**	**µg/L**

GW IMAC based on cancer endpoint

GWQS = [(RL x WT) / (q1* x WI)] * 1000

RL = risk level	1.0E-06	1.0E-06	
WT = average adult human body weight[2]	70	70	kg
q1* = carcinogenic potency factor (slope factor)[5]	NA	0.07	$(mg/kg/day)^{-1}$
WI = average daily human adult water intake[4]	2	2	L/day
1000 = conversion factor	1000	1000	µg/mg
Calculated GW Standard using cancer endpoint	**NA**	**0.5**	**µg/L**

GW IMAC based on published values

Taste Threshold[6]	**NA**	**NA**	**µg/L**
Odor Threshold[7]	**NA**	**NA**	**µg/L**
Maximum Contaminant Level (MCL)[8]	**NA**	**NA**	**µg/L**
Secondary Drinking Water Standard (SMCL)[9]	**NA**	**NA**	**µg/L**

Additional Information

US EPA Health Advisory for PFOA/PFOS (2016)[10]	**0.07**	**0.07**	**µg/L**
Practical Quantitation Limit (PQL)[11]	0.04	0.002	µg/L

References

[1] US EPA Drinking Water Health Advisory for Perfluorooctane sulfonic acid (PFOS). 2016. US EPA Office of Water (EPA 822-R-16-004); US EPA Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). 2016. US EPA Office of Water (EPA 822-R-16-005)

[2] Average adult body weight from 15A NCAC 02L .0202 (effective date April 1, 2013).

[3] RSC=0.1 for nonorganics, 0.2 for organics in accordance with 15A NCAC 02L .0202 (effective date April 1, 2013).

[4] Average adult water consumption from 15A NCAC 02L .0202 (effective date April 1, 2013).

[5] US EPA has not classified PFOS for carcinogenicity. A cancer slope factor is not available. US EPA Office of Water derived a cancer slope factor for PFOA based on testicular cancer observed in rats. Human epidemiological studies evaluating the carcinogenicity of PFOA are equivocal for kidney and testicular cancer.US EPA Health Effects Support Document for Perfluorooctanoic Acid. 2016. US EPA Office of Water (EPA 822-R-16-003)

[6] NA; Contact NC DEQ Groundwater Standards Coordinator for list of taste threshold resources examined.

[7] NA; Contact NC DEQ Groundwater Standards Coordinator for list of odor threshold resources examined.

[8] NA; MCL: https://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants#Organic

[9] NA; SMCL : https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals.

[10] US EPA Office of Water derived the Health Advisory for PFOS using the 90th percentile consumers-only estimate of combined direct and indirect community water ingestion for lactating women (Table 3-81 in US EPA 2011 Exposure Factors Handbook). A value of 0.054 L/kg-day was used in the calculation which equates roughly to 3.8 L of water consumed per day for a 65 Kg woman.

* EPA established equivalent Health Advisory Levels of 0.07 µg/L for PFOA and PFOS. The Health Advisory Level also applies to the sum total of both compounds if they co-occur.

[11] PQL provided for informational purposes only. PQL not established by North Carolina Water Resources Laboratory. Using EPA Method 537, Pace Analytical reports a PRL (ie- PQL) of 0.04 µg/L for PFOS and 0.002 µg/L for PFOA. (https://www.pacelabs.com/environmental-services/specialty-services/pfas-analysis.html)

Attachment J:

NC DWR and Hearing Officer's Recommended 02L .0202 Rule Text

15A NCAC 02L .0202 GROUNDWATER QUALITY STANDARDS

(a) The groundwater quality standards for the protection of the groundwaters of the state are those specified in this Rule. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage.

(b) The groundwater quality standards for contaminants specified in Paragraphs (h) and (i) of this Rule are as listed, except that:

(1) Where the standard for a substance is less than the practical quantitation limit, the detection of that substance at or above the practical quantitation limit constitutes a violation of the standard.

(2) Where two or more substances exist in combination, the Director shall consider the effects of chemical interactions as determined by the Division of Public Health and may establish maximum concentrations at values less than those established in accordance with Paragraphs (c), (h), or (i) of this Rule. In the absence of information to the contrary, in accordance with Paragraph (d) of this Rule, the carcinogenic risks associated with carcinogens present shall be considered additive and the toxic effects associated with non-carcinogens present shall also be considered additive.

(3) Where naturally occurring substances exceed the established standard, the standard shall be the naturally occurring concentration as determined by the Director.

(4) Where the groundwater standard for a substance is greater than the Maximum Contaminant Level (MCL), the Director shall apply the MCL as the groundwater standard at any private drinking water well or public water system well that may be impacted.

(c) Except for tracers used in concentrations which have been determined by the Division of Public Health to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit in Class GA or Class GSA groundwaters. Any person may ~~petition~~request the Director of the Division of Water Resources to establish, update, or remove an ~~interim maximum allowable concentration~~ Interim Maximum Allowable Concentration (IMAC) for a substance for which a standard has not been established under this Rule. In response to this request, the Director may establish, update, or remove an IMAC. The ~~petitioner~~requestor shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with Paragraphs (d) and (e) of this Rule. ~~Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.~~ If the information submitted is not in accordance with Paragraphs (d) and (e) of this Rule, the Director of the Division of Water Resources shall request additional information from the ~~petitioner~~requester. If the ~~petitioner~~requester does not provide the additional information necessary to be in accordance with Paragraphs (d) and (e) of this rule, the Director of the Division of Water Resources shall ~~deny~~return the ~~petition~~request. At least 30 days prior to establishing, updating, or removing an IMAC for any substance, the Division of Water Resources shall provide public notice that an IMAC has been requested to be established, updated, or removed. The public notice shall include the ~~petition~~request ~~requesting~~for the establishment, update, or removal of

the IMAC for a substance, the level of the proposed IMAC, if applicable the level of the existing IMAC, and the basis upon which the Division of Water Resources has relied in development of the proposed IMAC establishment, update, or removal. This notice shall be published in the North Carolina Register and posted on the Division of Water Resources's website: https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/groundwater-imacs. If the Director of the Division of Water Resources establishes or updates an IMAC, the IMAC shall be posted on the Division of Water Resource's website and the Commission shall be notified in writing within 30 calendar days that a new IMAC has been established or an existing IMAC has been updated or removed.

(d) Except as provided in Paragraph (f) of this Rule, groundwater quality standards for substances in Class GA and Class GSA groundwaters are established as the least of:

(1) Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (.10 for inorganics; .20 for organics)] / [2 liters/day (avg. water consumption)];

(2) Concentration which corresponds to an incremental lifetime cancer risk of 1x10-6;

(3) Taste threshold limit value;

(4) Odor threshold limit value;

(5) Maximum contaminant level; or

(6) National secondary drinking water standard.

(e) The following references, in order of preference, shall be used in establishing concentrations of substances which correspond to levels described in Paragraph (d) of this Rule.

(1) Integrated Risk Information System (U.S. EPA).

(2) Health Advisories (U.S. EPA Office of Drinking Water).

(3) Other health risk assessment data published by the U.S. EPA.

(4) Other relevant, published health risk assessment data, and scientifically valid peer-reviewed published toxicological data.

(f) The Commission may establish groundwater standards less stringent than existing maximum contaminant levels or national secondary drinking water standards if it finds, after public notice and opportunity for hearing, that:

(1) more recent data published in the EPA health references listed in Paragraph (e) of this Rule results in a standard which is protective of public health, taste threshold, or odor threshold;

(2) the standard will not endanger the public health and safety, including health and environmental effects from exposure to groundwater contaminants; and

(3) compliance with a standard based on the maximum contaminant level or national secondary drinking water standard would produce serious hardship without equal or greater public benefit.

(g) Groundwater quality standards specified in Paragraphs (h) and (i) of this Rule and ~~interim maximum allowable concentrations~~ IMACs established pursuant to Paragraph (c) of this Rule shall be reviewed by the ~~Director~~ Division of Water Resources on a triennial basis and reported to the Commission. The Director of the Division of Water Resources shall ~~consider~~take any of the following actions during the review of an established IMAC:

(1) recommend codifying the IMAC as a groundwater quality standard under this rule;

(2) update the IMAC value based on data published or rescinded subsequent to the previous review;

(3) remove the IMAC based on data published or rescinded subsequent to the previous review;

(4) retain the IMAC at the current value;

Any IMAC recommended under Subparagraph (g)(1) of this Rule that the Commission does not codify shall remain an established IMAC and be reviewed during the next triennial review. ~~Appropriate~~ ~~m~~Modifications to established standards shall be made, through rulemaking, in accordance with the procedures prescribed in Paragraph (d) and e of this Rule where modifications are considered appropriate based on data published subsequent to the previous review.

(h) Class GA Standards. Unless otherwise indicated, the standard refers to the total concentration in micrograms per liter (µg/L) of any constituent in a dissolved, colloidal or particulate form which is mobile in groundwater. This does not apply to sediment or other particulate matter which is preserved in a groundwater sample as a result of well construction or sampling procedures. The Class GA standards are:

~~(1) Acenaphthene: 80;~~

~~(2) Acenaphthylene: 200;~~

~~(3) Acetone: 6 mg/L;~~

~~(4) Acrylamide: 0.008;~~

~~(5) Anthracene: 2 mg/L;~~

~~(6) Arsenic: 10;~~

~~(7) Atrazine and chlorotriazine metabolites: 3;~~

~~(8) Barium: 700;~~

~~(9) Benzene: 1;~~

~~(10) Benzo(a)anthracene (benz(a)anthracene): 0.05;~~

~~(11) Benzo(b)fluoranthene: 0.05;~~

~~(12) Benzo(k)fluoranthene: 0.5;~~

~~(13) Benzoic acid: 30 mg/L;~~

~~(14) Benzo(g,h,i,)perylene: 200;~~

~~(15) Benzo(a)pyrene: 0.005;~~

~~(16) Bis(chloroethyl)ether: 0.03;~~

~~(17) Bis(2-ethylhexyl) phthalate (di(2-ethylhexyl) phthalate): 3;~~

~~(18) Boron: 700;~~

~~(19) Bromodichloromethane: 0.6;~~

~~(20) Bromoform (tribromomethane): 4;~~

~~(21) n-Butylbenzene: 70;~~

~~(22) sec-Butylbenzene: 70;~~

~~(23) tert-Butylbenzene: 70;~~

~~(24) Butylbenzyl phthalate: 1 mg/L;~~

~~(25) Cadmium: 2;~~

~~(26) Caprolactam: 4 mg/L;~~

~~(27) Carbofuran: 40;~~

~~(28) Carbon disulfide: 700;~~

~~(29) Carbon tetrachloride: 0.3;~~

~~(30) Chlordane: 0.1;~~

~~(31) Chloride: 250 mg/L;~~

~~(32) Chlorobenzene: 50;~~

~~(33) Chloroethane: 3,000;~~

~~(34) Chloroform (trichloromethane): 70;~~

~~(35) Chloromethane (methyl chloride): 3;~~

~~(36) 2-Chlorophenol: 0.4;~~

~~(37) 2-Chlorotoluene (o-chlorotoluene): 100;~~

~~(38) Chromium: 10;~~

~~(39) Chrysene: 5;~~

~~(40) Coliform organisms (total): 1 per 100 mL;~~

~~(41) Color: 15 color units;~~

~~(42) Copper: 1 mg/L;~~

~~(43) Cyanide (free cyanide): 70;~~

~~(44) 2, 4-D (2,4-dichlorophenoxy acetic acid): 70;~~

~~(45) DDD: 0.1;~~

~~(46) DDT: 0.1;~~

~~(47) Dibenz(a,h)anthracene: 0.005;~~

~~(48) Dibromochloromethane: 0.4;~~

~~(49) 1,2-Dibromo-3-chloropropane: 0.04;~~

~~(50) Dibutyl (or di-n-butyl) phthalate: 700;~~

~~(51) 1,2-Dichlorobenzene (orthodichlorobenzene): 20;~~

~~(52) 1,3-Dichlorobenzene (metadichlorobenzene): 200;~~

~~(53) 1,4-Dichlorobenzene (paradichlorobenzene): 6;~~

~~(54) Dichlorodifluoromethane (Freon-12; Halon): 1 mg/L;~~

~~(55) 1,1-Dichloroethane: 6;~~

~~(56) 1,2-Dichloroethane (ethylene dichloride): 0.4;~~

~~(57) 1,2-Dichloroethene (cis): 70;~~

~~(58) 1,2-Dichloroethene (trans): 100;~~

~~(59) 1,1-Dichloroethylene (vinylidene chloride): 350;~~

~~(60) 1,2-Dichloropropane: 0.6;~~

~~(61) 1,3-Dichloropropene (cis and trans isomers): 0.4;~~

~~(62) Dieldrin: 0.002;~~

~~(63) Diethylphthalate: 6 mg/L;~~

~~(64) 2,4-Dimethylphenol (m-xylenol): 100;~~

~~(65) Di-n-octyl phthalate: 100;~~

~~(66) 1,4-Dioxane (p-dioxane): 3;~~

~~(67) Dioxin (2,3,7,8-TCDD): 0.0002 ng/L;~~

~~(68) 1,1-Diphenyl (1,1, biphenyl): 400;~~

~~(69) Dissolved solids (total): 500 mg/L;~~

~~(70) Disulfoton: 0.3;~~

~~(71) Diundecyl phthalate (Santicizer 711): 100;~~

~~(72) Endosulfan: 40;~~

~~(73) Endrin, total (includes endrin, endrin aldehyde and endrin ketone): 2;~~

~~(74) Epichlorohydrin: 4;~~

~~(75) Ethyl acetate: 3 mg/L;~~

~~(76) Ethylbenzene: 600;~~

~~(77) Ethylene dibromide (1,2-dibromoethane): 0.02;~~

~~(78) Ethylene glycol: 10 mg/L;~~

~~(79) Fluoranthene: 300;~~

~~(80) Fluorene: 300;~~

~~(81) Fluoride: 2 mg/L;~~

~~(82) Foaming agents: 500;~~

~~(83) Formaldehyde: 600;~~

~~(84) Gross alpha (adjusted) particle activity (excluding radium-226 and uranium): 15 pCi/L;~~

~~(85) Heptachlor: 0.008;~~

~~(86) Heptachlor epoxide: 0.004;~~

~~(87) Heptane: 400;~~

~~(88) Hexachlorobenzene (perchlorobenzene): 0.02;~~

~~(89) Hexachlorobutadiene: 0.4;~~

~~(90) Hexachlorocyclohexane isomers (technical grade): 0.02;~~

~~(91) n-Hexane: 400;~~

~~(92) Indeno(1,2,3-cd)pyrene: 0.05;~~

~~(93) Iron: 300;~~

~~(94) Isophorone: 40;~~

~~(95) Isopropylbenzene: 70;~~

~~(96) Isopropyl ether: 70;~~

~~(97) Lead: 15;~~

~~(98) Lindane (gamma-hexachlorocyclohexane): 0.03;~~

~~(99) Manganese: 50;~~

~~(100) Mercury: 1;~~

~~(101) Methanol: 4 mg/L;~~

~~(102) Methoxychlor: 40;~~

~~(103) Methylene chloride (dichloromethane): 5;~~

~~(104) Methyl ethyl ketone (2-butanone): 4 mg/L;~~

~~(105) 2-Methylnaphthalene: 30;~~

~~(106) 3-Methylphenol (m-cresol): 400;~~

~~(107) 4-Methylphenol (p-cresol): 40;~~

~~(108) Methyl tert-butyl ether (MTBE): 20;~~

~~(109) Naphthalene: 6;~~

~~(110) Nickel: 100;~~

~~(111) Nitrate (as N): 10 mg/L;~~

~~(112) Nitrite (as N): 1 mg/L;~~

~~(113) N-nitrosodimethylamine: 0.0007;~~

~~(114) Oxamyl: 200;~~

~~(115) Pentachlorophenol: 0.3;~~

~~(116) Petroleum aliphatic carbon fraction class (C5 - C8): 400;~~

~~(117) Petroleum aliphatic carbon fraction class (C9 - C18): 700;~~

~~(118) Petroleum aliphatic carbon fraction class (C19 - C36): 10 mg/L;~~

~~(119) Petroleum aromatics carbon fraction class (C9 - C22): 200;~~

~~(120) pH: 6.5 - 8.5;~~

~~(121) Phenanthrene: 200;~~

~~(122) Phenol: 30;~~

~~(123) Phorate: 1;~~

~~(124) n-Propylbenzene: 70;~~

~~(125) Pyrene: 200;~~

~~(126) Selenium: 20;~~

~~(127) Silver: 20;~~

~~(128) Simazine: 4;~~

~~(129) Styrene: 70;~~

~~(130) Sulfate: 250 mg/L;~~

~~(131) 1,1,2,2-Tetrachloroethane: 0.2;~~

~~(132) Tetrachloroethylene (perchloroethylene; PCE): 0.7;~~

~~(133) 2,3,4,6-Tetrachlorophenol: 200;~~

~~(134) Toluene: 600;~~

~~(135) Toxaphene: 0.03;~~

~~(136) 2,4,5-TP (Silvex): 50;~~

~~(137) 1,2,4-Trichlorobenzene: 70;~~

~~(138) 1,1,1-Trichloroethane: 200;~~

~~(139) Trichloroethylene (TCE): 3;~~

~~(140) Trichlorofluoromethane: 2 mg/L;~~

~~(141) 1,2,3-Trichloropropane: 0.005;~~

~~(142) 1,2,4-Trimethylbenzene: 400;~~

~~(143) 1,3,5-Trimethylbenzene: 400;~~

~~(144) 1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113): 200 mg/L;~~

~~(145) Vinyl chloride: 0.03;~~

~~(146) Xylenes (o-, m-, and p-): 500; and~~

~~(147) Zinc: 1 mg/L.~~

Substance	Chemical Abstracts Service (CAS) Registry Number	Standard (µg/L)
Acenaphthene	83-32-9	80
Acenaphthylene	208-96-8	200
Acetic acid	64-19-7	5,000
Acetochlor	34256-82-1	100
Acetochlor ESA	187022-11-3	500
Acetochlor OXA	184992-44-4	500
Acetone	67-64-1	6,000
Acetophenone	98-86-2	700
Acrolein	107-02-8	4
Acrylamide	79-06-1	0.008
Alachlor	15972-60-8	2
Aldrin	309-00-2	0.002
Anthracene	120-12-7	2,000
Antimony	7440-36-0	1
Arsenic	7440-38-2	10
Atrazine and chlorotriazine metabolites	1912-24-9	3
Barium	7440-39-3	700
Benzene	71-43-2	1
Benzo(a)anthracene	56-55-3	0.05

Benzo(a)pyrene	50-32-8	0.005
Benzo(b)fluoranthene	205-99-2	0.05
Benzo(g,h,i)perylene	191-24-2	200
Benzo(k)fluoranthene	207-08-9	0.5
Benzoic acid	65-85-0	30,000
Benzyl alcohol	100-51-6	700
Beryllium	7440-41-7	4
Bis(chloroethyl)ether	111-44-4	0.03
Bis(2-ethylhexyl) phthalate	117-81-7	3
Boron	7440-42-8	700
Bromodichloromethane	75-27-4	0.6
Bromoform	75-25-2	4
Bromomethane	74-839-9	10
n-Butanol	71-36-3	590
sec-Butanol	78-92-2	10,000
n-Butylbenzene	104-51-8	70
sec-Butylbenzene	135-98-8	70
tert-Butylbenzene	98-06-6	70
Butylbenzyl phthalate	85-68-7	1,000
Cadmium	7440-43-9	2
Caprolactam	105-60-2	4,000
Carbofuran	1563-66-2	40
Carbon disulfide	75-15-0	700
Carbon tetrachloride	56-23-5	0.3
Chlordane	12789-03-6	0.1
Chloride	16887-00-6	250,000
Chlorobenzene	108-90-7	50
Chloroethane	75-00-3	3,000
Chloroform	67-66-3	70
Chloromethane	74-87-3	3

2-Chlorophenol	95-57-8	0.4
2-Chlorotoluene	95-49-8	100
4-Chlorotoluene	106-43-4	24
Chromium	7440-47-3	10
Chrysene	218-01-9	5
Cobalt	7440-48-4	1
Coliform organisms (total)		1 per 100 mL
Color		15 color units
Copper	7440-50-8	1,000
Cyanide (free cyanide)	57-12-5	70
2,4-D (2,4-dichlorophenoxy acetic acid)	94-75-7	70
Dalapon	75-99-0	200
DDD	72-54-8	0.1
DDE	72-55-9	0.1
DDT	50-29-3	0.1
Dibenz(a,h)anthracene	53-70-3	0.005
1,4-Dibromobenzene	106-37-06	70
Dibromochloromethane	124-48-1	0.4
1,2-Dibromo-3-chloropropane	96-12-8	0.04
Dibutyl phthalate	84-74-2	700
Dichloroacetic acid	79-43-6	0.7
1,2-Dichlorobenzene	95-50-1	20
1,3-Dichlorobenzene	541-73-1	200
1,4-Dichlorobenzene	106-46-7	6
Dichlorodifluoromethane	75-71-8	1,000
1,1-Dichloroethane	75-34-3	6
1,2-Dichloroethane	107-06-2	0.4
1,2-Dichloroethene (cis)	156-59-2	70
1,2-Dichloroethene (trans)	156-60-5	100
1,1-Dichloroethylene	75-35-4	350

2,4-Dichlorophenol	120-83-2	0.98
1,2-Dichloropropane	78-87-5	0.6
1,3-Dichloropropene (cis and trans isomers)	542-75-6	0.4
Dieldrin	60-57-1	0.002
Diethylphthalate	84-66-2	6,000
2,4-Dimethylphenol	105-67-9	100
2,4-Dinitrotoluene	121-14-2	0.05
2,6-Dinitrotoluene	606-20-2	0.05
Di-n-octyl phthalate	117-84-0	100
Dinoseb	88-85-7	7
1,4-Dioxane	123-91-1	3
Dioxin (2,3,7,8-TCDD)	1746-01-6	0.0002 ng/L
1,1-Diphenyl	92-52-4	400
Diphenyl ether	101-84-8	180
Diquat	85-00-7	20
Dissolved solids (total)		500,000
Disulfoton	298-04-4	0.3
Diundecyl phthalate (Santicizer 711)	3648-20-2	100
Endosulfan	115-29-7	40
Endosulfan sulfate	115-29-7	40
Endothall	145-73-3	100
Endrin, total (includes endrin, endrin aldehyde, and endrin ketone)	72-20-8	2
Epichlorohydrin	106-89-8	4
Ethyl acetate	141-78-6	3,000
Ethylbenzene	100-41-4	600
Ethylene dibromide	106-93-4	0.02
Ethylene glycol	107-21-1	10,000
Fluoranthene	206-44-0	300
Fluorene	86-73-7	300
Fluoride	16984-48-8	2,000

Foaming agents		500
Formaldehyde	50-00-0	600
Gross alpha (adjusted) particle activity (excludes radium-226 and uranium)	12587-46-1	15 pCi/L
Heptachlor	76-44-8	0.008
Heptachlor epoxide	1024-57-3	0.004
Heptane	142-82-5	400
Hexachlorobenzene	118-74-1	0.02
Hexachlorobutadiene	87-68-3	0.4
Hexachlorocyclohexane isomers (technical grade)	608-73-1	0.02
alpha-Hexachlorocyclohexane	319-84-6	0.006
beta-Hexachlorocyclohexane	319-85-7	0.02
gamma-Hexachlorocyclohexane (Lindane)	58-89-9	0.03
n-Hexane	110-54-3	400
Indeno(1,2,3-cd)pyrene	193-39-5	0.05
Iron	7439-89-6	300
Isophorone	78-59-1	40
Isopropyl ether	108-20-3	70
Isopropylbenzene	98-82-8	70
4-Isopropyltoluene	99-87-6	25
Lead	7439-92-1	15
Manganese	7439-96-5	50
Mercury	7439-97-6	1
Methanol	67-56-1	4,000
Methoxychlor	72-43-5	40
Methylene chloride	75-09-2	5
Methyl butyl ketone	591-78-6	40
Methyl ethyl ketone	78-93-3	4,000
Methyl isobutyl ketone	108-10-1	100
Methyl methacrylate	80-62-6	25
1-Methylnapthalene	90-12-0	1

2-Methylnaphthalene	91-57-6	30
2-Methylphenol	95-48-7	400
3-Methylphenol	108-39-4	400
4-Methylphenol	106-44-5	40
Methyl tert-butyl ether (MTBE)	1634-04-4	20
Naphthalene	91-20-3	6
Nickel	7440-02-0	100
Nitrate (as N)	14797-55-8	10,000
Nitrite (as N)	14797-65-0	1,000
N-nitrosodimethylamine	62-75-9	0.0007
Oxamyl	23135-22-0	200
Pentachlorophenol	608-93-5	0.3
~~Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA), total~~	~~1763-23-1 (PFOS); 335-67-1 (PFOA)~~	~~0.07~~
Petroleum aliphatic carbon fraction class (C5 – C8)		400
Petroleum aliphatic carbon fraction class (C9 – C18)		700
Petroleum aliphatic carbon fraction class (C19 – C36)		10,000
Petroleum aromatics carbon fraction class (C9 – C22)		200
pH		6.5 - 8.5 (no unit)
Phenanthrene	85-01-8	200
Phenol	108-95-2	30
Phorate	298-02-2	1
n-Propylbenzene	103-65-1	70
Propylene glycol	57-55-6	100,000
Pyrene	129-00-0	200
Selenium	7782-49-2	20
Silver	7440-22-4	20
Simazine	122-34-9	4
Strontium	7440-24-6	2,000
Styrene	100-42-5	70
Sulfate	14808-79-8	250,000

1,2,4,5-Tetrachlorobenzene	95-94-3	2
1,1,2,2-Tetrachloroethane	79-34-5	0.2
1,1,1,2-Tetrachloroethane	630-20-6	1
Tetrachloroethylene (PCE)	127-18-4	0.7
2,3,4,6-Tetrachlorophenol	58-90-2	200
Thallium	7440-28-0	2
Tin (inorganic forms)	7440-31-5	2,000
Toluene	108-88-3	600
Toxaphene	8001-35-2	0.03
2,4,5-TP (Silvex)	93-72-1	50
1,2,4-Trichlorobenzene	120-82-1	70
1,1,1-Trichloroethane	71-55-6	200
1,1,2-Trichloroethane	79-00-5	0.6
Trichloroethylene (TCE)	79-01-6	3
Trichlorofluoromethane	75-69-4	2,000
2,4,5-Trichlorophenol	95-95-4	63
2,4,6-Trichlorophenol	88-06-2	4
1,2,3-Trichloropropane	96-18-4	0.005
1,2,4-Trimethylbenzene	95-63-6	400
1,3,5-Trimethylbenzene	108-67-8	400
Vanadium	7440-62-2	7
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	200,000
Vinyl chloride	75-01-4	0.03
Xylenes	1330-20-7	500
Zinc	7440-66-6	1,000

(i) Class GSA Standards. The standards for this class are the same as those for Class GA except as follows:

(1) chloride: allowable increase not to exceed 100 percent of the natural quality concentration; and

(2) dissolved solids (total): 1000 mg/L.

(j) Class GC Standards.

(1) The concentrations of substances that, at the time of classification, exceed the standards applicable to Class GA or GSA groundwaters shall not be caused to increase, nor shall the concentrations of

other substances be caused to exceed the GA or GSA standards as a result of further disposal of contaminants to or beneath the surface of the land within the boundary of the area classified GC.

(2) The concentrations of substances that, at the time of classification, exceed the standards applicable to GA or GSA groundwaters shall not be caused to migrate as a result of activities within the boundary of the GC classification, so as to violate the groundwater or surface water quality standards in adjoining waters of a different class.

(3) Concentrations of specific substances, that exceed the established standard at the time of classification, are listed in Section .0300 of this Subchapter.

History Note: *Authority G.S. 143-214.1; 143B-282(a)(2);*
Eff. June 10, 1979;
Amended Eff. November 1, 1994; October 1, 1993; September 1, 1992; August 1, 1989;
Temporary Amendment Eff. June 30, 2002;
Amended Eff. August 1, 2002;
Temporary Amendment Expired February 9, 2003;
Amended Eff. April 1, 2013; January 1, 2010; April 1, 2005;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. March 6, 2018.
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