FACT SHEET
REISSUANCE OF VPDES GENERAL PERMIT FOR DISCHARGES FROM GROUNDWATER REMEDIATION OF CONTAMINATED SITES, DEWATERING ACTIVITIES OF CONTAMINATED SITES, AND HYDROSTATIC TESTS

The Virginia State Water Control Board has under consideration the reissuance of a VPDES general permit for point source discharges from petroleum and non-petroleum contaminated sites, groundwater remediation, dewatering activities, and hydrostatic tests to surface waters of the Commonwealth of Virginia. This general permit will replace VAG83 (petroleum and metals contaminated sites, groundwater remediation, groundwater dewatering, and hydrostatic tests general permit) which expires February 25, 2023. Owners covered under the expiring general permit who wish to continue to discharge under a general permit must register for coverage under the new general permit.

Permit Number:	VAG83
Name of Permittee:	Any owner of a qualifying facility in the Commonwealth of Virginia agreeing to be regulated under the terms of this general permit.
Facility Location:	Commonwealth of Virginia
Receiving Waters:	Surface waters within the boundaries of the Commonwealth of Virginia, except those specifically named in Board regulations which prohibit such discharges.

On the basis of preliminary review and application of lawful standards and regulations, the State Water Control Board proposes to issue the general VPDES permit subject to certain conditions and has prepared a draft permit. The Board[1] has determined that this category of discharges is appropriately controlled under a general permit. The category of discharges to be included involves facilities with the same or similar types of operations and the facilities discharge the same or similar types of wastes. The draft general permit requires that all covered facilities meet standard effluent limitations, special conditions, monitoring requirements and Water Quality Standards (9VAC25-260).

Persons may comment in writing on the proposed issuance of the general permit within 60 days from the start of the public comment period. Comments should be addressed to the contact person listed below. Comments shall include the name, address, and telephone number of the writer, and shall contain a complete, concise statement of the factual basis for comments. Comments may also be submitted through the Public Forum feature of the Virginia Regulatory Town Hall web site at www.townhall.virginia.gov. Only those comments received within the comment period will be considered by the Board.

All pertinent information is on file and may be inspected, and arrangements made for copying by contacting:

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A public hearing will be held on this draft permit. Notice of the public hearing will be published in newspapers, on the Virginia Regulatory Town Hall web site at www.townhall.virginia.gov, and in the Virginia Register. Following the public comment period, the Board will make its determinations regarding the proposed issuance.

1.0 Activities Covered By This General Permit

Petroleum contamination can occur as a result of leaks from above ground or underground storage tanks, pipeline leaks, surface oil spills and poor housekeeping at facilities that handle petroleum products. When

1 Note: Pursuant to SB 657 (2022), the following definition in this general permit has been revised: "Board" means the State Water Control Board. However, when used outside the context of the promulgation of regulations, including regulations to establish general permits, "board" means the "Department of Environmental Quality"

the structural integrity of storage tanks or pipelines is tested with water pressure, the water may become contaminated with petroleum products. Metals may be released into the environment via industrial processes and handling and disposal of spent or waste materials. Chlorinated hydrocarbon solvents may be released into the environment via leakage from tanks, lines, process-related equipment, and the handling and disposal of spent or waste materials. For the purposes of this general permit, "petroleum products" means petroleum-based substances comprised of a complex blend of hydrocarbons derived from crude oil such as motor fuels, jet fuels, distillate fuel oils, residual fuel oils, lubricants, petroleum solvents and used oils. Petroleum products do not include hazardous waste as defined by the Virginia Hazardous Waste Regulations, 9VAC20-60. "Chlorinated hydrocarbon solvents" means solvents containing carbon, hydrogen, and chlorine atoms and the constituents resulting from the degradation of these chlorinated hydrocarbon solvents.

Contaminants may be introduced into surface waters when potable, or non-potable waters are used to hydrostatically test new or repaired petroleum or natural gas pipelines, petroleum storage tanks, or water storage tanks and pipelines. These tests are commonly done in the pipeline industry and even though the events are usually sporadic in nature, they may produce a discharge significant in volume. Therefore, a general permit would adequately govern this type of activity.

This general permit will cover point source discharges of wastewaters from sites contaminated by petroleum products, metals, and chlorinated hydrocarbon solvents and also the point source discharges of hydrostatic test wastewaters resulting from the testing of petroleum and natural gas storage tanks and pipelines, and water storage tanks and pipelines. These wastewaters may be discharged from the following activities: excavation dewatering; post-construction dewatering activities, conducting aquifer tests to characterize site conditions; pumping contaminated groundwater to remove free product from the ground; discharges resulting from another petroleum product or chlorinated hydrocarbon solvent remediation activity approved by the Board; hydrostatic tests of natural gas and petroleum storage tanks, pipelines, and associated distribution equipment; and hydrostatic tests of water storage tanks, pipelines, and associated distribution equipment. This general permit shall not cover discharges from cooling tower flushing.

The effluent limits in the proposed general permit are established according to the type of petroleum product, chlorinated hydrocarbon solvent, or metals causing the contamination.

2.0 Substantive Revisions to the Expiring VPDES General Permit Regulation for Petroleum Contaminated Sites, Groundwater Remediation and Hydrostatic Tests

The title of the regulation was changed to “Virginia Pollutant Discharge Elimination System (VPDES) General Permit Regulation For Discharges From Contaminated Sites, Groundwater Remediation, Dewatering Activities and Hydrostatic Tests” to better represent the activities covered under this general permit and to be consistent with other VPDES General Permit regulation titles.

The “Applicability of incorporated references based on the date that they became effective” section (9VAC25-120-15) was simplified to be consistent with other VPDES general permits and the date referenced was changed to July 1, 2021.

The “Purpose” section (9VAC25-120-20) was modified to address the discharge of wastewaters from “petroleum contaminated” sites, “non-petroleum contaminated sites, groundwater remediation discharges” and “dewatering activities,” . The general permit continues to address the hydrostatic testing of natural gas storage tanks and pipelines, the hydrostatic testing and dewatering of petroleum storage tank systems and associated distribution equipment, and the hydrostatic testing of water storage tanks and pipelines.

The “Effective date of the permit” section (9VAC25-120-50) was revised to provide updated dates for the regulation (effective March 1, 2023; expires February 29. 2028). It should be noted that these dates were updated through the other sections of the regulation.

The following addition was made in section (9VAC25-120-60C): Added the phrase, “including compliance with the water withdrawal reporting, 9VAC25-200, and the groundwater permitting program 9VAC25-

610." This is to clarify that compliance these requirements as applicable is a separate and independent of obligation from compliance with this general permit.

The following modification and additions were made to the "Registration Statement" section (9VAC25-120-70): in subdivision E.19 a section was added for the owner to provide information if the facility is enrolled in the Voluntary Remediation Program (VRP) if applicable for the project; subdivision E.9 the location was changed to latitude and longitude; in subdivision E.21 a requirement was added for the owner to provide the State Corporation Commission entity identification number if the facility is required to obtain one by law; and in subdivision G a contingent provision (requiring notification and a three-month period) requiring electronic submission of registration statement was added to meet EPA and State electronic reporting requirement.

The following modification and additions were made to the "Effluent Limitations and Monitoring Requirements" section (9VAC25-120-80) Part I A 2: A revision was made to the approved methodology for Total Petroleum Hydrocarbons. The limit for Total Petroleum Hydrocarbons was revised to two significant figures consistent with VPDES program policy.

The following modification and additions were made to the "Effluent Limitations and Monitoring Requirements" section (9VAC25-120-80) Part I A 3: Revised the Benzene effluent limit to reflect the changes to the Virginia Water Quality Standard Human Health criteria for Public Water Supplies, Removed the decimal place for the Ethanol effluent limitation because the detection limit for this compound using Method 8260B is 200 ug/l. To carry this to the required significant figure would likely require secondary ion mass spec analysis – a big cost burden for no apparent value. Added "Total" for Hardness monitoring since this is how hardness is reported. Limitations for Toluene, Total Xylenes, MTBE, and Ethlyene Dibromide in freshwater PWS, were revised to two significant figures. Total Recoverable Lead is now expressed as a numeric limitation to eliminate confusion with reporting and determining compliance.

The following modification and additions were made to the "Effluent Limitations and Monitoring Requirements" section (9VAC25-120-80) Part I A 4: Revised the Benzene effluent limit to reflect the changes to the Virginia Water Quality Standard Human Health criteria for Public Water Supplies. A revision was made to the approved methodology for Total Petroleum Hydrocarbons. The limitations for Total Petroleum Hydrocarbons and MTBE were revised to two significant figures.

The following modification and additions were made to the "Effluent Limitations and Monitoring Requirements" section (9VAC25-120-80) Part I A 5: The Chloroform effluent limitation was revised to reflect the changes to the Virginia Water Quality Standards and is now expressed as two significant figures. The limitations for cis-1,2 Dichloroethylene, trans-1,2 Dichloroethylene, 1,1,1 Trichloroethane, and 1,2 Dichlorobenzene were revised to two significant figures.

The following addition was added to 9VAC25-120-80: section Part I A 6 was added to address metals contamination from groundwater remediation or post-construction dewatering activities. Limitations for pH, Total Recoverable Arsenic, Total Recoverable Cadmium, Total Recoverable Chromium, Total Recoverable Copper, Total Recoverable Lead, Total Recoverable Nickel, Total Recoverable Selenium, Total Recoverable Silver, Total Recoverable Thallium, and Total Recoverable Zinc were included. Monitoring for Flow and Total Hardness were also added. The limits identified in Part I A 1, for Short Term Projects, now also include those in A 6 as applicable under the terms of A 1.

3.0 Effluent Limitations and Monitoring Requirements

3.1 Discharges of Water Contaminated with Gasoline - All Receiving Waters (subsection I A 3)

Parameter	Limitation
Flow	No limit, monitoring required
Benzene	5.8 µg/l instantaneous maximum
Toluene	43 µg/l instantaneous maximum
Ethylbenzene	4.3 µg/l instantaneous maximum
Total Xylenes	33 µg/l instantaneous maximum

Total Recoverable Lead (1)	7.2 µg/l instantaneous maximum
Total Hardness (as $CaCO_3$)(1)	mg/l, No limit, monitoring required
Ethylene Dibromide (EDB) (1)	1.9 µg/l instantaneous maximum (freshwaters not listed as public water supplies and saltwater) 0.16 µg/l / instantaneous maximum (freshwater listed as public water supply)
1,2 Dichloroethane (1,2 DCA) (1)	3.8 µg/l instantaneous maximum
pH	6.0 instantaneous minimum- 9.0 instantaneous maximum
MTBE	440 µg/l instantaneous maximum (freshwaters not listed as public water supplies and saltwater) 15 µg/l instantaneous maximum (freshwater listed as public water supply)
Ethanol (2)	4,100 µg/l instantaneous maximum

(1) Monitoring this parameter is required only when contamination results from leaded fuel.
(2) Monitoring for ethanol is only required for discharges of water contaminated by gasoline containing greater than 10% ethanol.

The monitoring frequency for discharges into freshwaters not listed as public water supplies and saltwater is once per month. The permittee may request in writing that the monitoring frequency for ethanol be reduced to once per quarter if monitoring results from the first year of permit coverage demonstrate full compliance with the effluent limits.

The monitoring frequency for discharges into freshwaters listed as public water supplies is twice per month for all constituents or parameters. If the first year's results demonstrate full compliance with the effluent limitations, the permittee may request that the monitoring frequency for ethanol be reduced to once per quarter and the other parameters to once per month.

3.2 Discharges of Water Contaminated with Petroleum Products Other than Gasoline - All Receiving Waters (I A 4)

Parameter	Limitation
Flow	No limit, monitoring required
Naphthalene	8.9 µg/l instantaneous maximum
Total Petroleum Hydrocarbons	15 mg/l instantaneous maximum
pH	6.0 instantaneous minimum- 9.0 instantaneous maximum
Benzene	5.8 µg/l instantaneous maximum (public water supplies only)
MTBE	15 µg/l instantaneous maximum (public water supplies only)

The monitoring frequency for discharges into freshwaters not listed as public water supplies and saltwater is once per month.

The monitoring frequency for discharges into freshwaters listed as public water supplies is twice per month for all constituents or parameters. If the first year's results demonstrate full compliance with the effluent limitations, the permittee may request that the monitoring frequency to once per month.

3.3 Discharges of Water from Hydrostatic Tests - All Receiving Waters (I A 2)

Parameter	Limitation
Flow	No limit, monitoring required
pH	6.0 instantaneous minimum- 9.0 instantaneous maximum
Total Petroleum Hydrocarbons (TPH)	15 mg/l instantaneous maximum
Total Organic Carbon (TOC)	No limit, monitoring required
Total Suspended Solids (TSS)	No limit, monitoring required
Total Residual Chlorine (TRC)	0.011 mg/l instantaneous maximum

The monitoring frequency for all parameters is once per discharge.

3.4 Discharges of Water Contaminated by Chlorinated Hydrocarbon Solvents - All Receiving Waters (I A 5)

Parameter	Limitation
Flow	No limit, monitoring required
Chloroform	60 µg/l instantaneous maximum
1,1 dichloroethane	2.4 µg/l instantaneous maximum
1,2 dichloroethane	3.8 µg/l instantaneous maximum
1,1 dichloroethylene	7.0 µg/l instantaneous maximum
cis 1,2 dichloroethylene	70 µg/l instantaneous maximum
trans 1,2 dichloroethylene	100 µg/l instantaneous maximum
Methylene chloride	5.0 µg/l instantaneous maximum
Tetrachloroethylene	5.0 µg/l instantaneous maximum
1,1,1 trichloroethane	54 µg/l instantaneous maximum
1,1,2 trichloroethane	5.0 µg/l instantaneous maximum
Trichloroethylene	5.0 µg/l instantaneous maximum
Vinyl chloride	2.0 µg/l instantaneous maximum
Carbon tetrachloride	2.3 µg/l instantaneous maximum
1,2 dichlorobenzene	16 µg/l instantaneous maximum
Chlorobenzene	3.4 µg/l instantaneous maximum
Trichlorofluoromethane	5.0 µg/l instantaneous maximum
Chloroethane	3.6 µg/l instantaneous maximum
pH	6.0 instantaneous minimum- 9.0 instantaneous maximum

The monitoring frequency for discharges into surface waters not listed as public water supplies is once per month.

The monitoring frequency for discharges into surface waters listed as public water supplies is twice per month for the first year of permit coverage. If the permittee is in complete compliance with all effluent limitations, they may request that the monitoring frequency be reduced to once per month.

3.5 Discharges of Water Contaminated by Metals- All Receiving Waters (I A 6)

Parameter	Limitation
Flow	No limit, monitoring required
Total Hardness (as $CaCO_3$)	mg/l, No limit, monitoring required
Total Recoverable Antimony	5.6 µg/l instantaneous maximum
Total Recoverable Arsenic	10 µg/l instantaneous maximum
Total Recoverable Cadmium	0.55 µg/l instantaneous maximum
Total Recoverable Chromium	11 µg/l instantaneous maximum
Total Recoverable Copper	6.6 µg/l instantaneous maximum
Total Recoverable Lead	7.2 µg/l instantaneous maximum
Total Recoverable Mercury	0.77 µg/l instantaneous maximum
Total Recoverable Nickel	15 µg/l instantaneous maximum
Total Recoverable Selenium	5.0 µg/l instantaneous maximum
Total Recoverable Silver	1.9 µg/l instantaneous maximum
Total Recoverable Thallium	0.24 µg/l instantaneous maximum
Total Recoverable Zinc	87 µg/l instantaneous maximum
pH	6.0 instantaneous minimum- 9.0 instantaneous maximum

The monitoring frequency for discharges into surface waters not listed as public water supplies is once per month.

The monitoring frequency for discharges into surface waters listed as public water supplies is twice per month for the first year of permit coverage. If the permittee is in complete compliance with all effluent limitations, they may request that the monitoring frequency be reduced to once per month.

4.0 Permit Special Conditions

1. The general permit prohibits discharge of floating solids or visible foam in other than trace amounts. This is a standard requirement for all permits per the VPDES Permit Manual (2014) and conforms to the general water quality criteria at 9VAC25-260-20.

2. This special condition clarifies the requirement for reporting of effluent monitoring results. Discharge monitoring is required each month in which a discharge occurs. For months when no discharge occurs, the permittee must submit a DMR indicating “No Discharge”. This system will allow DEQ to verify that either the effluent met the permit limits or that there was no discharge during the month.

3. Permittees that discharge treated wastewater are required to develop an Operations and Maintenance manual for the treatment works. This requirement is imposed to assure proper operation and maintenance of facilities discharging under the general permit.

4. In order to assure that the proposed cleanup is conducted according to the methods outlined by the permittee in the approved Registration Statement, the permittee must construct treatment works prior to discharging and the permittee must notify DEQ within 5 days of commencement of operation.

5. The general permit contains a condition designed to prevent pollution from materials stored on the site, which are not otherwise controlled by the effluent limitations.

6. If the proposed discharge is to surface waters via a municipal storm sewer system, the general permit requires the permittee to notify the owner of the storm sewer system in writing, and include the name of the facility, a contact person and telephone number, the location of the discharge, the nature of the discharge, and the facility's VPDES general permit number. This is required in order to facilitate the municipality's efforts to control dry weather flows from the storm sewer. A copy of the notice must be provided to DEQ, and DMRs required to be submitted must be sent to DEQ and the owner of the municipal storm sewer system.

7. The general permit requires that any monitoring results be reported using the same number of significant digits as listed in the permit.

8. Discharges authorized by this permit shall be controlled as necessary to meet applicable water quality standards.

9. Approval for coverage under this general permit does not relieve any owner of the responsibility to comply with any other federal, state or local statute, ordinance or regulation. This special condition repeats the requirement in 9VAC25-120-60 C (Authorization to Discharge).

10. Owners of facilities that are a source of the specified pollutant of concern to waters where an approved “total maximum daily load” (TMDL) has been established shall implement measures and controls that are consistent with the assumptions and requirements of the TMDL. The condition was developed since general permit discharges are considered insignificant to the overall TMDL waste load allocation. This special condition allows staff more flexibility to allow permit coverage for discharges without requiring immediate modification of the TMDL. DEQ will track all the general permit discharges and once they become significant for purposes of the TMDL, the TMDL will be modified to include the load.

11. A request for termination of coverage under the permit is required to provide documentation for the permittee and the DEQ that the activities covered under the general permit have been concluded and coverage is no longer necessary.

12. DEQ must be notified when the permittee knows or has reason to believe that any activity has occurred

or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in this permit if that discharge will exceed the highest of the notification levels specified in 9VAC25-31-200 A 1. DEQ must be notified when the permittee knows or has reason to believe that any activity has occurred or will occur that would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant that is not limited in this permit if that discharge will exceed the highest of the notification levels specified in 9VAC25-31-200 A 2.

5.0 Discharges to Public Water Supplies

This permit may be used to authorize discharges to public water supplies. The Virginia Department of Health, Office of Water Supply Programs generally requires a minimum of 5 miles separation between a discharge and a downstream public water supply intake (12VAC5-590-200). This general permit will use the same separation distance. Discharges into a surface water designated as a public water supply will not be allowed under this permit if the discharge location is less than 5 miles upstream of the public water supply intake.

6.0 Basis for Effluent Limitations

6.1 Discharges of Gasoline Contaminated Water

This general permit contains both technology-based and water quality-based effluent limits. Where both types of limits were available, the more stringent of the two was chosen. The U.S. EPA has developed a model NPDES permit for discharges from gasoline contaminated underground storage tank sites. The model permit provides technology-based effluent limitations for surface water discharges. The technology basis for those limitations is free product removal followed by air stripping. The limits are set for benzene and the sum of benzene, toluene, ethylbenzene, and xylenes (BTEX). These parameters are used as indicators of the compounds most likely to be found in gasoline. Benzene is considered a good indicator of the removal of volatile organic gasoline constituents via air stripping because of its relatively high water solubility and low volatility compared to other gasoline components.

The EPA model permit states that air strippers have the potential to operate at 99.5% efficiency and it uses this as the basis for limitations on benzene and BTEX. However, it also states that one cannot assume optimal operational conditions at all times and that permit limitations must be achievable with existing technology at reasonable cost. The model permit then establishes optional limitations based on 95% removal efficiency. The 95 percent efficiency rating accounts for operational difficulties which may be encountered during periods of low temperature and/or high humidity when air strippers may not be expected to perform at the 99.5% peak efficiency level. The EPA Treatability Database (RREL Version 5.0) contains information on treatment of the BTEX compounds at various concentrations by air stripping and granular activated carbon. The average removal efficiencies in contaminated ground water are as follows: benzene 97%, toluene 97.4%, ethylbenzene 87% and xylene 88%. The 95% removal efficiency also provides the possibility for considerable cost savings for the tank owners/operators involved in remediating underground storage tank (UST) sites, many of whom are small businesses without the resources to install state-of-the-art equipment. The number of sites remediated under the Virginia Petroleum Storage Tank Fund would also potentially increase if the cost per site were less.

The technology-based benzene limit of 50 µg/l in the EPA model permit is derived by assuming a concentration of 1 mg/l benzene in the influent to the treatment system and 95% removal.

The water quality-based effluent limitations in this general permit are established pursuant to the VPDES Permit Regulation, 9VAC25-31-220 D, and the Virginia Water Quality Standards, 9VAC25-260-140 B. The limits are set at what are believed to be safe concentrations for the protection of beneficial uses including the growth and propagation of aquatic organisms inhabiting surface waters which receive the discharge. They assume zero dilution of the effluent by the receiving waters so that they can be applied without regard to effluent or receiving water flows. They are based on information provided in EPA criteria documents for priority pollutants, EPA toxicity databases, and conservative application factors.

The aggregate parameter BTEX is used in the EPA model NPDES permit previously discussed to limit 4 parameters. It sets an effluent limitation for BTEX at 750 µg/l based on an assumed influent BTEX concentration of 15 mg/l and the 95% air stripper removal efficiency. The model permit documentation states that the composition of gasoline is highly variable and any one of the four BTEX components may be the primary constituent. The discussion of water quality-based limits which follows identifies cases where the 750 µg/l technology-based limitation on BTEX would not protect aquatic life from adverse effects.

In some circumstances, if a specific BTEX component were to dominate the mixture the resulting effluent could be toxic at, or below 750 µg/l. For instance, Thomas and Delfino (1991) found that toluene comprises about 50% of the total BTEX in gasoline when analyzed by EPA Methods 610 and 602. If the BTEX limit were set at 750 µg/l then this could allow up to 375 µg/l of toluene in an effluent. The discussion on water quality-based limits which follows sets a limit of 43 µg/l for toluene in discharges to freshwater. The same researchers found that xylenes made up about 30% of the total BTEX in gasoline. When applied to the 750 µg/l BTEX limit in the EPA model permit this results in a possible xylene discharge level of 225 µg/l. Based on available information, total xylenes should not exceed 33 µg/l in freshwater. Without limits on individual parameters, ethylbenzene in discharges to saltwater could still be chronically toxic at the 100 µg/l BTEX technology-based limit given in the model permit using 99.5% removal efficiency.

Based on this discussion, the general permit does not contain a technology-based BTEX limit. Instead, it establishes water quality-based limits on the individual components (benzene, toluene, ethylbenzene and total xylenes), which result in lower total BTEX levels in the discharge.

6.1.1 Benzene

Freshwater

The EPA criteria document for benzene (EPA 440/5-80-018, EPA 1980a) states that benzene may be acutely toxic to freshwater organisms at concentrations as low as 5,300 µg/l. This concentration represents an LC50 value for rainbow trout (*Oncorhynchus mykiss*). The document also states that acute toxicity would occur at lower concentrations among more sensitive species. No data were available concerning the chronic toxicity of benzene to sensitive freshwater organisms. The derivation of a protective level for benzene was based on the 5,300 µg/l LC50. *(This value was divided by 10 in order to approximate a level which would not be expected to cause acute toxicity. The use of an application factor of 10 was recommended by the National Academy of Sciences in the EPA's publication "Water Quality Criteria, 1972" (EPA/R3/73-033). This use of application factors when setting water quality criteria is still considered valid in situations where data are not sufficient to develop criteria according to more recent guidance.)* The resulting "non-lethal" concentration of 530 µg/l was divided by an assumed acute to chronic ratio of 10 to arrive at the water quality-based permit limitation of 53 µg/l.

The Virginia Water Quality Standard Regulation (9 VAC 25-260-10 et seq.) contains a human health standard of 160 µg/l for benzene in surface waters that are not public water supplies. This concentration is above the aquatic toxicity concentration of 53 µg/l and the technology-based concentration of 50 µg/l.

Saltwater

The limited data for benzene and saltwater organisms in the EPA criteria document indicates that stress and survival effects occur at concentrations as low as 700 µg/l when fish are exposed for long periods. Based on the application of a 0.10 safety factor to this chronic effect concentration, the water quality-based limit for discharges to saltwater would be 70 µg/l.

Public Water Supplies

The Virginia Water Quality Standard Regulation (9 VAC 25-260-10 et seq.) contains a human health standard of 5.8 µg/l for benzene in public water supplies. This concentration is below the aquatic toxicity concentration of 53 µg/l and the technology-based concentration of 50 µg/l. Previously, the human health standard for benzene in public water supplies was 12 µg/l and this was the effluent limit for benzene in waters listed as public water supplies.

Discharge Monitoring Report Data Reported for Benzene

DEQ staff reviewed Discharge Monitoring Report (DMR) data submitted by permittees during the current permit term (April 2018 through December 2021). The data were reviewed to evaluate compliance with existing effluent limits and see the effluent concentrations that are being achieved by permittees. The DMR data indicates that the treatment systems being used by permittees typically reduce benzene concentrations in the effluent to below quantifiable levels.

Recommended Effluent Limit for Benzene

EPA lists a technology-based limit of 50 µg/l for benzene in wastewater from leaking underground storage tank sites. The DMR data indicates that benzene in the effluent typically is below quantifiable levels and that few permittees would have trouble meeting the benzene effluent limit of 5.8 µg/l. DEQ staff recommend an effluent limit of 5.8 µg/l for benzene.

6.1.2 Ethylbenzene

Freshwater

The EPA criteria document for ethylbenzene (EPA 440/5-80-048, EPA 1980b) gives an acute effects concentration of 32,000 µg/l . This is an LC50 for bluegill sunfish (*Lepomis macrochirus)*. EPA noted that acute toxicity may occur at lower concentrations if more sensitive species were tested. Brooke (1987) evaluated the effects of ethylbenzene on scuds (*Gammarus pseudolimnaeus*) and found exposure to ethylbenzene at a concentration of 1,940 µg/l was lethal to 50% of the scuds tested. No definitive data are available on the chronic toxicity of ethylbenzene to freshwater organisms. In order to derive an acceptable level of ethylbenzene for the protection of freshwater organisms the acute value of 1,940 µg/l was divided by 100, using the same assumptions employed above for benzene. The resulting value of 19.4 µg/l is a calculated chronic toxicity concentration for ethylbenzene.

The human health water quality standard for ethylbenzene in surface waters that are not public water supplies is 130 µg/l. The chronic toxicity concentration of 19.4 µg/l is below the human health standard.

Saltwater

According to the criteria document, ethylbenzene is acutely toxic to certain saltwater organisms at concentrations as low as 430 µg/l and may be acutely toxic at lower concentrations if more sensitive organisms are tested. Dividing this number by the 100 application factor yields the proposed effluent limit of 4.3 µg/l for discharges to saltwater receiving waters.

Public Water Supplies

The Virginia human-health water quality standard for ethylbenzene in public water supplies is 68 µg/l. The freshwater effluent limit based on aquatic toxicity is more stringent than human-health based standard for public water supplies and should be protective of human health concerns.

Discharge Monitoring Report Data Reported for Ethylbenzene

DEQ staff reviewed Discharge Monitoring Report (DMR) data submitted by permittees during the current permit term (April 2018 through December 2021). The data were reviewed to evaluate compliance with existing effluent limits and see the effluent concentrations that are being achieved by permittees. The DMR data indicates that the treatment systems being used by permittees typically reduce ethylbenzene concentrations in the effluent to below quantifiable levels.

Recommended Effluent Limit for Ethylbenzene

The DMR data indicates that ethylbenzene in the effluent typically is below quantifiable levels and that few permittees would have trouble meeting an ethylbenzene effluent limit of 4.3 µg/l. DEQ staff recommend an effluent limit of 4.3 µg/l for ethylbenzene for all receiving waters.

6.1.3 Toluene

The EPA criteria document for toluene (EPA 440/5-80-075, EPA 1980c) states that acute toxicity to freshwater organisms occurs at 17,500 µg/l and would occur at lower concentrations if more sensitive organisms were tested. Marchini and associates (1983) found that exposure to toluene at a concentration of 9,000 µg/l was lethal to 50% of the water fleas (*Ceriodaphnia dubia*) tested. No data are available on the chronic toxicity of toluene to freshwater species. Based on the available data for acute toxicity and dividing by the application factor of 100, an effluent limit for toluene discharged to freshwater would be 90 µg/l.

The EPA criteria document for toluene (EPA 440/5-80-075, EPA 1980c) indicates that toluene is chronically toxic to certain saltwater organisms at concentrations as low as 5,000 µg/l. Dividing this chronic effects level by 10 results in a potential saltwater discharge effluent limit of 500 µg/l . Benville and Korn (1977) found that during a one day test, half of the bay shrimp (*Crangon franciscorum*) died from exposure to toluene at a concentration of 12,000 µg/l. The four day LC50 concentration for exposure to toluene was found to be 4300 µg/l (Benville and Korn 1977). Dividing this acute effects level by 100 results in an effluent limit of 43 µg/l.

The Virginia human health standards for toluene in drinking and non-drinking water streams are 57 µg/l and 520 µg/l, respectively. The proposed effluent limits based on aquatic toxicity are more stringent than human health based standards and should be protective of human health.

Discharge Monitoring Report Data Reported for Toluene

DEQ staff reviewed Discharge Monitoring Report (DMR) data submitted by permittees during the current permit term (April 2018 through December 2021). The data were reviewed to evaluate compliance with existing effluent limits and see the effluent concentrations that are being achieved by permittees. The DMR data indicates that the treatment systems being used by permittees typically reduce toluene concentrations in the effluent to below quantifiable levels.

Recommended Effluent Limit for Toluene

The DMR data indicates that toluene in the effluent typically is below quantifiable levels and that few permittees would have trouble meeting a toluene effluent limit of 43 µg/l. DEQ staff recommend an aquatic toxicity-based effluent limit of 43 µg/l for toluene.

The Part I.A.3 Table contains a limit of 43.0 µg/l for toluene. Agency guidance GM06-2016 notes that “effluent limitations should generally be written using two significant figures,” so with this reissuance, staff has updated the limit from 43.0 µg/L to 43 ug/L in Part I.A.3.

6.1.4 Xylenes

Xylene is not a 307(a) priority pollutant, therefore no criteria document exists for this compound. There are three isomers of xylene (*ortho*, *meta*, and *para*) and the general permit limits are established so that the sum of all xylenes is considered in evaluating compliance. The proposed effluent limits are based on a search of the EPA's ECOTOX data base. According to ECOTOX, the lowest freshwater LC50 for xylenes is 3,300 µg/l reported for rainbow trout (Mayer and Ellersieck 1986). Based on the rationale presented earlier for other compounds, this acutely toxic concentration was divided by 10 to account for species that were not tested but which may be more sensitive than rainbow trout. Then, in order to find a concentration that is expected to be safe over chronic exposures, an additional safety factor of 10 was applied to arrive at the proposed effluent limitation of 33 µg/l total xylenes.

The LC50 of 7,400 µg/l for grass shrimp (Neff et al. 1979) is the lowest saltwater value in the ECOTOX database. This LC50 concentration was divided by 100 to derive the effluent limit of 74 µg/l total xylenes.

There is no Virginia human health water quality standard for xylenes. The Maximum Contaminant Level and Maximum Contaminant Level Goal for xylenes in the EPA Safe Drinking Water Regulation, 40 CFR Part 141, are both set at 10 mg/l (10,000 µg/l). The proposed permit limits based upon aquatic toxicity are more stringent than drinking water standards for xylenes and are expected to be protective of human health.

Discharge Monitoring Report Data Reported for Xylenes

DEQ staff reviewed Discharge Monitoring Report (DMR) data submitted by permittees during the current permit term (April 2018 through December 2021). The data were reviewed to evaluate compliance with existing effluent limits and see the effluent concentrations that are being achieved by permittees. The DMR data indicates that the treatment systems being used by permittees typically reduce xylenes concentrations in the effluent to below quantifiable levels.

Recommended Effluent Limit for Xylene

The DMR data indicates that xylene in the effluent typically is below quantifiable levels and that few permittees would have trouble meeting the xylene effluent limit of 33 µg/l that DEQ has used in the past for discharges into freshwater. DEQ staff recommend an effluent limit of 33 µg/l for xylene.

The Part I.A.3 Table contains a limit of 33.0 µg/l for Total Xylenes. Agency guidance GM06-2016 notes that "effluent limitations should generally be written using two significant figures," so with this reissuance, staff has updated the limit from 33.0 µg/L to 33 ug/L in Part I.A.3.

6.1.5 Lead

The EPA permit model for discharges of petroleum contaminated water does not contain a recommended effluent limit for lead. It is recognized that tetraethyl and tetramethyl lead may be present in gasoline at leaking storage tank sites. These organic lead compounds, if present, are expected to be removed via air stripping along with other volatile organics.

The proposed effluent limits for lead are based upon the Virginia Water Quality Standards for the protection of fresh and saltwater organisms to chronic exposure to lead. The effluent limit for lead in wastewater discharged into streams listed as public water supplies also must meet the water quality standard for lead in public water supplies. While the water quality standards require analysis for dissolved metals, this permit requires that samples be analyzed for Total Recoverable Lead as required by the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9VAC25-31-230C. The chronic standard for lead in saltwater when the general permit regulation was initially adopted was 8.5 µg/l. Less stringent water quality criteria were adopted by the Board on September 25, 1997.

Virginia's freshwater lead standard for the chronic exposure of organisms to this constituent is based upon the hardness of the water in the waste stream. In the current general permit, the water quality criteria equation for lead (from the Virginia Water Quality Standard Regulation dated January 2011) was included in the permit and a limit was to be determined for each facility. The permit also included hardness monitoring since hardness is used in the equation to determine the criteria. Staff determined that in many cases, the permittee did not report lead (included NR – Not Required) on the Discharge Monitoring Report. Also, it is unclear if DEQ determined the compliance status of the permittee if lead was reported.

For this proposed reissuance, it is staff's professional judgement that a numeric limit should be included as is done in individual permits and in other general permits adopted in Virginia. Staff utilized the Total Hardness data collected during the current permit term and determined that the 10^{th} percentile Total Hardness value is 70 mg/l as $CaCO_3$. Utilizing this hardness value, the criteria are calculated to be 63 µg/l acute and 7.2 µg/l chronic. The Human Health water quality standard for lead in public water supplies is 15 µg/l. When wastewater is discharged to a public water supply, the effluent will be the lower of 15 µg/l or the calculated aquatic toxicity based limit. Staff proposes a Total Recoverable Lead limit of 7.2 µg/l for the upcoming reissuance.

6.1.6 Ethylene Dibromide (EDB)

Ethylene dibromide (a.k.a. 1,2 dibromoethane, CAS Number: 106-93-4) is a compound added to leaded gasolines to remove lead from the combustion chamber and prevent lead oxide and lead sulfide deposits from forming within an internal combustion engine. Lead scavengers such as ethylene dibromide (EDB) are persistent in ground water and, in combination with the BTEX constituents can be indicators of a leaded gasoline release.

EPA has no criteria documents for EDB nor are there existing water quality standards for this constituent. According to the ECOTOX database, the lowest freshwater LC50 concentration for this constituent is

15,000 µg/l for largemouth bass (Davis and Hardcastle 1959). Dividing this LC50 value by 100 leads to a concentration of 150 µg/l. In saltwater, the lowest LC50 is 4800 µg/l for the sheepshead minnow (Landau and Tucker 1984). Dividing this LC50 value by 100 leads to a saltwater aquatic toxicity value of 48 µg/l.

The procedure used by Virginia for calculating water quality standards for human health involves using risk factors, average adult body weight, intake of water and fish (public water supplies) and fish only, and a bioconcentration factor for the constituent. Ethylene dibromide is considered a human carcinogen and equation 3 listed below is used by Virginia to derive human-health based water quality criteria for waters that are not public water supplies. Based upon an excess lifetime cancer risk of one in one hundred thousand and an oral carcinogenic potency slope factor of 2 mg/kg/day (EPA IRIS database, EPA 2007c), a human health concentration of 1.94 µg/l (round to 1.9 µg/l) was derived for EDB in surface waters that are not public water supplies. This human health concentration is much more stringent than the fresh or saltwater toxicity values and it is the recommended effluent limit for EDB in waters that are not listed as public water supplies.

The federal drinking water standard for EDB is 0.05 µg/l. Equation 4 shown below is used by Virginia to develop human health based water quality criteria for surface waters listed as public water supplies. Based upon an excess lifetime cancer risk of one in one hundred thousand and an oral carcinogenic potency slope factor of 2 mg/kg/day (EPA IRIS database, EPA 2007c), a human health concentration of 0.161 µg/l was derived for EDB in surface waters that are public water supplies. This human health concentration is the recommended effluent limit for EDB in surface waters listed as public water supplies.

Equation to derive human health criteria for surface waters that are not public water supplies

$$(3) \quad WQS = \frac{\text{risk} * \text{adult body weight}}{SFo * FI * BCF}$$

Equation to derive human health criteria for public water supplies

$$(4) \quad WQS = \frac{\text{risk} * \text{adult body weight}}{SFo * [\text{ water intake} + (FI * BCF)]}$$

Risk = excess lifetime cancer risk. The Water Quality Standards are based on an excess lifetime cancer risk of one in one hundred thousand risk level or 10^{-5}

Adult body weight = 70 kg

SFo = carcinogenic slope factor, oral exposure route (mg/kg-day)

Water intake = typical daily water intake for an adult, 2 l/day

FI = fish intake. The Water Quality Standards are based on a fish intake of 0.0175 kg/day

BCF = bioconcentration factor (l/kg)

Derivation of Human Health concentration for EDB in surface waters that are not public water supplies

$$WQS = \frac{1 \times 10\text{-}5 * 70 \text{ kg}}{2 \text{ mg/kg-day} * 0.0175 \text{ kg/day} * 10.2 \text{ l/kg}}$$

$WQS = 1.94 \times 10^{-3}$ mg/l or 1.94 µg/l

According to EXTOXNET DATABASE (1996), the bioaccumulation factor for EDB is 10.2 l/kg. The carcinogenic slope factor, oral exposure route for EDB is 2 mg/kg/day (EPA IRIS database, EPA 2007c).

Derivation of Human Health concentration for EDB in surface waters that are Public Water Supplies

1 x 10-5 * 70 kg

WQS = --------------------------
2 mg/kg-day * [2 l/day + (0.0175 kg/day * 10.2 l/kg)]

WQS = 1.61×10^{-4} mg/l or 0.161 µg/l

The Part I.A.3 Table contains a limit of 0.161 µg/l for Ethylene Dibromide in freshwaters designated at public water supplies. Agency guidance GM06-2016 notes that "effluent limitations should generally be written using two significant figures," so with this reissuance, staff has updated the limit from 0.161 µg/L to 0.16 ug/L in Part I.A.3.

6.1.7 1,2-Dichloroethane (1,2 DCA)

Another compound commonly added to leaded gasoline as a lead scavenger is1,2-Dichloroethane (1,2 DCA, CAS Number: 107-06-20). The EPA criteria document for chlorinated ethanes (EPA 440/5-80-029, EPA 1980d) states that acute toxicity to freshwater organisms exposed to 1,2 DCA occurs at 118,000 µg/l and would occur at lower concentrations if more sensitive organisms were tested. According to the ECOTOX database, the lowest reported LC50 concentration for 1,2 DCA was 130,000 for sheepshead minnows (*Cyprinodon variegates*, Heitmuller and associates 1981). No data are available in the ECOTOX database related to the chronic toxicity of 1,2 DCA to freshwater species. Based on the lowest available data for acute toxicity and dividing by the application factor of 100, an aquatic toxicity limit for 1,2 DCA in freshwater is 1,180 µg/l.

The available data indicate that 1,2 DCA is acutely toxic to certain saltwater organisms at concentrations as low as 113,000 µg/l. Based on the available data for acute toxicity and dividing by the application factor of 100, the aquatic toxicity limit for 1,2 DCA in saltwater is 1,130 µg/l.

The Virginia human health standards for 1,2 DCA in surface waters that are public water supplies and surface waters that are not public water supplies are 99 µg/l and 6,500 µg/l , respectively. The human health criteria are more stringent than the aquatic toxicity criteria. Analysis of the DMR data submitted to DEQ indicates that in all cases, the DCA concentration was below detectable or quantifiable levels.

Due to anti-backsliding, staff recommends retaining the former human health standard of 3.8 µg/l as the effluent limit for 1,2 Dichloroethane in public water supplies.

6.1.8 Methyl Tertiary Butyl Ether

Methyl-tertiary-butyl ether (MTBE) is a common additive in "reformulated" automotive gasolines. If MTBE is used, it can be present in gasoline at up to 15% of the volume of the fuel. MTBE is an extremely hydrophilic compound. The presence of MTBE in gasoline can increase the solubility of the fuel mixture in groundwater. MTBE may be removed from contaminated ground water by air stripping treatment technologies. However, due to its hydrophilic nature, a higher air/water ratio is required to remove this constituent via air stripping than is required for BTEX removal. According to the EPA Treatability Database (RREL Version 5.0), MTBE removal efficiency via air stripping ranges from approximately 63 percent to 79 percent. If the MTBE concentration in the system influent is 10 mg/l and removal efficiency of 75 percent is achieved, air stripping should be capable of reducing the MTBE concentration to 2.5 mg/l.

Neither EPA nor the DEQ has established water quality criteria for MTBE for protection of aquatic life or human health. Literature searches indicated several studies that evaluated the effects of MTBE on aquatic organisms. According to BenKinney et al. (1994), MTBE was acutely toxic (LC50) to green algae (*Selanastrum capricornutum*) at a concentration of 184,000 µg/l. Geiger and associates (1988) found that MTBE was acutely toxic to the fathead minnow (*Pimephales promelas*) at a concentration of 672 mg/l (672,000 µg/l). Application of the customary safety factor of 100 to the LC50 concentration for green algae results in a concentration of 1,840 µg/l. This concentration is recommended as the discharge limit for MTBE into freshwater.

The literature search revealed several studies performed on the toxicity of MTBE to marine organisms. BenKinney et al. (1994) found that MTBE was acutely toxic to the inland silverside (*Menidia beryllinia*) at a concentration of 574 mg/l. According to Boeri and associates (1994), MTBE was acutely toxic to mysid shrimp (*Mysidopsis bahia*) at 44 mg/l (44,000 µg/l). Application of the customary safety factor of 100 to the LC50 for the mysid shrimp results in a concentration of 440 µg/l. A concentration of 440 µg/l is recommended as the effluent limit for MTBE discharged into saltwater.

According to Fujiwara et al. (1984) and the European Fuel Oxygenates Association, bioaccumulation factors for MTBE in fish tissue are 1.5 l/kg and 1.6 l/kg, respectively. Moreover, Fujiwara found that discontinued exposure of the fish to MTBE caused fish to quickly excrete the MTBE remaining in their tissues.

Derivation of Human Health concentration for MTBE in surface waters that are not public water supplies

$$WQS = \frac{1 \times 10\text{-}5 * 70 \text{ kg}}{1.8 \times 10^{-3} \text{ mg/kg-day} * 0.0175 \text{ kg/day} * 1.6 \text{ l/kg}}$$

WQS = 13.80 mg/l or 13,820 µg/l

NOTE: The Carcinogenic Slope Factor, oral exposure route of 1.8 X 10^{-3} mg/kg-day is a value from the EPA Region III June 2011 Risk Based Concentration Table (EPA Region III 2011).

Derivation of Human Health concentration for MTBE in surface waters that are public water supplies

$$WQS = \frac{1 \times 10\text{-}5 * 70 \text{ kg}}{1.8 \times 10^{-3} \text{ mg/kg-day} * [2 \text{ l/day} + (0.0175 \text{ kg/day} * 10.2 \text{ l/kg})]}$$

WQS = 0.175 mg/l or 175 µg/l

The Virginia Department of Health, Office of Water Programs has established a trigger level of 15 µg/l for MTBE in public drinking water. The U.S. EPA has established a drinking water health advisory for MTBE of 20 – 40 µg/l based upon taste and odor effects. These levels are lower than the lowest concentration that caused observable effects in animals. For waters designated as public water supplies, an effluent limit of 15 µg/l for MTBE is recommended.

Discharge Monitoring Report Data Reported for MTBE

DEQ staff reviewed Discharge Monitoring Report (DMR) data submitted by permittees during the current permit term (April 2018 through December 2021). The data were reviewed to evaluate compliance with existing effluent limits and see the effluent concentrations that are being achieved by permittees. The DMR data indicates that the treatment systems being used by permittees typically reduce MTBE concentrations in the effluent to below quantifiable levels.

Recommended Effluent Limit for MTBE

The DMR data indicates that MTBE is commonly found in effluent thus suggesting that treatment technologies employed at many sites are not nearly as effective at removing MTBE as they are at removing other petroleum constituents. Staff recommend two effluent limits for MTBE. An aquatic toxicity based effluent limit of 440 µg/l is recommended for discharges to both saltwater and freshwater. An effluent limit of 15 µg/l, based upon the Health Department's trigger level, is recommended for discharges into public water supplies.

The Part I.A.3 Table contains a limit of 15.0 µg/l for MTBE. Agency guidance GM06-2016 notes that "effluent limitations should generally be written using two significant figures," so with this reissuance, staff has updated the limit from 15.0 µg/L to 15 ug/L in Part I.A.4.

6.1.9 Ethanol

Ethanol has been used in U.S. automotive gasolines for over thirty years. During the oil embargo of 1973, ethanol was used as a gasoline extender to counteract rising fuel prices and increase the nation's gasoline supply (Texas State Energy Conservation Office, 2007a). As lead was phased out of gasoline, ethanol and MTBE were used as octane enhancers in lieu of tetraethyl lead. Later, MTBE and ethanol were the primary products used to meet the standards for the Wintertime Oxygenated Fuels Program (1992) and Phase 1 and Phase 2 of the Reformulated Gasoline Program (RFG, 1995 and 2000). Ethanol was used primarily in gasoline sold in the Midwest and MTBE was used in gasoline sold in most of the rest of the U.S.

The federal Energy Policy Act of 2005 removed the oxygenate mandate for RFG and established a national renewable fuel standard (RFS; Meyers 2006). Consequently, suppliers requested major pipelines to remove MTBE from RFG. In February 2006, Colonial Pipeline, which serves Virginia, announced that it would discontinue shipping RFG with MTBE (O'Connor 2006). In the Spring of 2006, many RFG marketers in Virginia began being supplied with gasoline containing up to 10% ethanol (E10) in order to replace the MTBE.

The fate and transport of ethanol in ground water is controlled primarily by biodegradation (Ulrich 1999). Based on the chemical behavior of ethanol, it is expected that ethanol in subsurface releases of oxygenated gasolines will rapidly partition into ground water and will become the dominant dissolved contaminant immediately downgradient of the release. It is believed that mechanisms for attenuating subsurface contaminants, such as sorption, volatilization, and abiotic degradation, will not substantially contribute to the decreased mobility or loss of ethanol in subsurface aquifers.

According to EPA (2000), ethanol is not expected to persist in the groundwater because it biodegrades readily nor does ethanol appear to pose as great a danger to groundwater supplies as does MTBE. Ethanol is considerably less volatile than MTBE in surface waters because it has a lower Henry's law constant (Layton and Daniels 1999). Though ethanol's volatilization-loss rate from water is much less than that of MTBE, ethanol will not persist in water because it undergoes fairly rapid biodegradation. Thus, ethanol is a short-lived compound in surface waters and subsurface aquifers.

Under the Clean Water Act, the EPA promulgated effluent limitations and standards controlling discharges from the production of organic chemicals, plastics, and synthetic fibers (EPA 2005 and 2007a), and from pharmaceutical facilities with operations in fermentation; extraction; chemical synthesis; mixing, compounding, and formulating; and research (EPA 1999 and 2007b). For certain pharmaceutical facilities directly discharging ethanol, the maximum daily discharge limit for ethanol is 10.0 mg/L, and the average monthly discharge must not exceed 4.1 mg/L.

Jack Hwang of EPA Region 3 performed initial research on discharge limits and extra parameters for monitoring blended fuel releases in response to inquiries from the State of Maryland and the Commonwealth of Virginia (Hwang 2007). Based discussions with an EPA regional toxicologist and with Dr. John Wilson, one of EPA's microbiologists, Mr. Hwang indicates that:

> "There is no concern for human health risk - the limit would be very high. There is no significant concern for ECOTOX - a study reported that the ethanol-polluted water with a BOD (Biological Oxygen Demand) of can recover 65% of its theoretical OD (Oxygen Demand) in 10 days. If there is a need for setting ethanol limit, the most likely reason would be due to the consideration of "oxygen depletion" in surface water. However, the limit could be site specific depending on the characteristics of the receiving water body and the allowable dilution ratio."

Ethanol is a short-lived compound in the environment due to the ubiquity of microorganisms capable of metabolizing ethanol and to the rapid rates of ethanol biodegradation (Ulrich 1999). Since ethanol is rapidly metabolized, it is unlikely that ethanol will travel a substantial distance once released into the subsurface or that it will persist in the subsurface or surface waters. It should be noted, however, for E85 (ethanol comprises 85% of the gasoline) releases or neat ethanol releases into surface waters microorganisms involved with breaking down the ethanol could scavenge the available oxygen thereby creating anaerobic conditions and causing a fish kill (Kuhn 2007). The same would likely hold true for large E10 releases into surface waters.

Neither the DEQ nor EPA has promulgated acute and chronic water quality criteria for ethanol in surface waters. Acute and chronic water quality benchmarks for ethanol were developed using toxicity information available for aquatic invertebrates (*Daphnia* species), rainbow trout, and the fathead minnow from EPA's ECOTOX database (Iott 2001). Based on the available data and using Tier II procedures outlined in the for EPA's Final Water Quality Guidance for the Great Lakes System, an acute water quality benchmark for ethanol in surface water is 564 mg/L, and a chronic water quality benchmark for ethanol is 63 mg/L. The values indicate that an ethanol concentration of 564 mg/L in the water column is likely to cause acute toxicity to freshwater aquatic life and that an ethanol concentration of 64 mg/L in the water column is likely to cause chronic toxicity to freshwater life. The chronic and acute water quality benchmarks developed for ethanol (EPA 2006) are lower than draft water quality criteria developed by the EPA.

The DEQ has limited experience in dealing with ethanol in discharges to surface water. The DEQ Valley Regional Office has reissued a permit to Merck & Co. to discharge treated production and sanitary wastewater generated at a pharmaceutical manufacturing facility, non-contact cooling water, and storm water generated in the area around the facility (Aschenbach 2007). Revisions were made to the previous effluent limits, in part, so that new effluent monitoring and limitations matched the requirements of the Federal Effluent Guidelines for the Pharmaceutical Manufacturing Category. Though Virginia does not have Water Quality Standard for ethanol, Outfall 101 of the permit follows the EPA Guideline of 10 mg/L for a daily maximum limit (DML) and 4.1 mg/L for a monthly average limit (MAL) in terms of ethanol concentration or 45 kg/d for a DML19 kg/d and 45 kg/d for MAL in terms of ethanol loading. The surface water that receives the discharge from the facility is designated as a Tier 1 water body which means that the existing uses of the water body and water quality to protect such uses must be maintained in accordance with the State Water Control Board's antidegradation policy.

Ethanol does not bioaccumulate or bioconcentrate in the tissue of living organisms due to ethanol's chemical properties and to the ability of most organisms to metabolize ethanol (Iott 2001). Human health risks from exposure to ethanol appear to be minimal, especially when compared with the risks posed by other gasoline constituents. Likewise, aquatic toxicity levels for ethanol are quite high. Ethanol also appears to degrade rapidly in both surface and subsurface environments. Based upon these factors, the DEQ does not believe that effluent limits for ethanol are needed for discharge of waters associated with petroleum products containing up to 10% ethanol.

Ethanol concentrations in discharges of petroleum products containing greater than 10% ethanol may pose risks to aquatic organisms. For discharge of petroleum products containing greater than 10% ethanol into surface water bodies not designated as a PWS, a maximum discharge limit of 4.1 mg/L is proposed. This same limit also is proposed for saltwater receiving bodies. With this reissuance, the limit shall be revised from 4100.0 to 4100 µg/l, since the added precision associated with five significant figures requires additional testing capability that is not necessary to demonstrate compliance.

6.1.10 pH

The pH limits in this general permit are based on the Virginia Water Quality Standards and range from a low of six (6.0) standard units to nine (9.0) standard units.

6.2 Basis for Effluent Limitations - Discharges of Petroleum Products other than Gasoline

The EPA model permit for UST remediation sites only addresses gasoline contaminated sites. This general permit is also designed to be used at sites which are contaminated by petroleum products other than gasoline (non-gasoline motor fuels, jet fuels, distillate fuel oils, residual fuel oils, lubricants, petroleum solvents and used oils). In addition to containing small amounts of the volatile organic compounds such as benzene, these products contain more of the polynuclear aromatic hydrocarbons (PAHs) than are found in gasoline. PAHs are less soluble in water than the volatile compounds and they are less amenable to air stripping. It is possible that a treatment system that is capable of removing the volatile compounds like benzene to acceptable levels may not effectively remove the PAHs. Based upon the types and relative proportions of the constituents present in the non-gasoline petroleum products, benzene and the BTEX constituents are not good indicator parameters to use in evaluating the quality of effluents from sites contaminated with this category of petroleum.

6.2.1 Naphthalene

The effluent limitation for naphthalene proposed in this general permit is a water quality-based limit. It is to be applied at sites where contamination is from diesel or other fuels that are not classified as gasoline. Naphthalene is a component of gasoline and non-gasoline petroleum products, but its relative concentration is higher in products such as diesel and kerosene than in gasoline (Thomas & Delfino, 1991). It is less soluble in water than benzene (solubility 30 mg/l vs 1,780 mg/l) and is less amenable to air stripping (Henry's Law Constant 4.83×10^{-4} vs 5.55×10^{-3} @ 25°C). These characteristics make the treatability of naphthalene more similar to that of the heavier PAH components than the BTEX compounds.

PAHs in general are relatively insoluble in water. For instance, the solubilities of the typical petroleum PAHs anthracene, phenanthrene and fluorene are 1.29 mg/l, 0.8 mg/l and 1.9 mg/l, respectively. These compounds are more likely to be found in free product or adsorbed onto soils at a petroleum contaminated site rather than dissolved in ground water. As a moderately soluble compound, naphthalene is more likely to dissolve in ground water and migrate from the source of contamination. Therefore, it occupies an intermediate position between the volatile BTEX compounds and the less soluble PAHs. By selecting naphthalene as the indicator parameter for this category of contaminated sites, the general permit relies on the assumption that if naphthalene has been removed to acceptable levels, then the heavier PAHs associated with the contamination should have either remained in the soils at the source or been reduced to an acceptable level with the treatment for naphthalene.

The limited data available in the EPA Treatability Database indicate that treatment with granular activated carbon (GAC) filtration is more effective in removing naphthalene and other PAHs than is air stripping. Although this general permit does not mandate a treatment technology, the low solubility of PAHs makes them amenable to treatment by GAC filtration of the contaminated ground water.

The EPA criteria document for naphthalene (EPA 440/5-80-059) gives a chronic effect concentration of 620 µg/l with fathead minnows, but it states that effects would occur at lower concentrations if more sensitive freshwater organisms were tested. According to the ECOTOX DATABASE, naphthalene at a concentration of 1,000 µg/l was lethal to 50% of the water fleas (*Daphnia pulex*) tested (Truco et al. 1983). DeGaere and associates (1982) tested the effects of naphthalene on Rainbow Trout and reported an LC50 concentration of 1600 µg/l. Based upon these more recent studies, it is recommended that the effluent limit for naphthalene in freshwater be set at 10 µg/l.

The lowest observed LC50 value in the EPA criteria document for naphthalene (EPA 1980e) reportedly was 2,350 µg/l, in a test with grass shrimp. Korn and associates (1979) tested the effects of naphthalene on humpy shrimp (*Pandalus goniurus*) and found that a naphthalene concentration of 1020 µg/l was lethal to 50% of the shrimp tested. Pink salmon (*Onchrhynchus gorbuscha*) were exposed to naphthalene and Rice and Thomas (1989) found that a concentration of 890 µg/l was lethal to 50% of the fish tested. Dividing this LC50 by 100 results in the proposed saltwater effluent limit of 8.9 µg/l.

There is no Virginia human health water quality standard for naphthalene. Equation 5 below is used by DEQ staff to derive human health based water quality standards for discharges of non-carcinogens to public water supplies. The human health derived value is much greater than the freshwater aquatic toxicity value of 10 µg/l. The saltwater aquatic toxicity value of 8.9 µg/l is both achievable and a little more protective than the freshwater aquatic toxicity limit and is recommended as the naphthalene effluent limit in public water supplies.

$$(5) \quad WQS = \frac{RfD * \text{adult body weight}}{\text{water intake} + (FI * BCF)}$$

RfD = Reference Dose (mg/kg-day).

Adult body weight = 70 kg

Water intake = typical daily water intake for an adult, 2 l/day

FI = fish intake. The Water Quality Standards are based on a fish intake of 0.0175 kg/day

BCF = bioaccumulation factor (l/kg), a value of 10.5 l/kg was used for Naphthalene (EPA 2002)

$$WQS = \frac{2 \times 10^{-2} \text{ mg/kg-day} * 70 \text{ kg}}{2 \text{ l/day} + (0.0175 \text{ kg/day} * 10.5 \text{ l/kg})}$$

WQS = 0.641 mg/l = 641 µg/l

Note: The reference dose is from the EPA IRIS database (EPA 2007c) and the bioaccumulation factor is from EPA (2002).

Discharge Monitoring Report Data Reported for Naphthalene

DEQ staff reviewed Discharge Monitoring Report (DMR) data submitted by permittees during the current permit term (April 2018 through December 2021). The data were reviewed to evaluate compliance with existing effluent limits and see the effluent concentrations that are being achieved by permittees. The DMR data indicates that the treatment systems being used by permittees typically reduce Naphthalene concentrations in the effluent to below quantifiable levels.

Recommended Effluent Limit for Naphthalene

The DMR data indicates that naphthalene in the effluent typically is below quantifiable levels and that few permittees would have trouble meeting the naphthalene effluent limit of 8.9 µg/l that DEQ has used in the past for discharges into saltwater. DEQ staff recommend an effluent limit of 8.9 µg/l for naphthalene for all discharges covered by this permit regulation.

6.2.2 Benzene and MTBE (discharges to Public Water Supplies only)

Benzene and MTBE are not found in high concentrations in petroleum products other than gasoline. MTBE is a gasoline additive and not intentionally placed in petroleum products other than gasoline. Benzene has a relatively low boiling point and most of the benzene in crude oil feedstocks will remain with the gasoline fraction hydrocarbons during the petroleum refining process.

After refining, petroleum products are transported via a common transportation network (pipelines, tanker trucks) and there is some unintentional mixing of products that occurs. While middle distillates (kerosene, diesel, #2 fuel oil) contain only very small amounts of benzene and MTBE is not intentionally placed in them, DEQ staff have found that MTBE and benzene are the most commonly found petroleum constituents in drinking water supplies contaminated by middle distillates. Due the presence of these constituents in water contaminated by petroleum products other than gasoline, it is recommended that all discharges of petroleum-contaminated wastewater to public water supplies contain effluent limits for benzene and MTBE. Limits proposed for these constituents are 5.8 µg/l for benzene and 15 µg/l for MTBE.

6.2.3 Total Petroleum Hydrocarbons

The general permit proposes a technology-based limit of 15 mg/l for the parameter Total Petroleum Hydrocarbons (TPH). This limit is applicable for discharges where the contamination is from petroleum products other than gasoline. It is based on the ability of simple oil/water separator technology to recover free product from water. Wastewater that is discharged without a visible sheen is generally expected to meet this effluent limitation. DEQ has utilized an effluent limitation of 15 mg/l oil & grease for many years in individual permits for potential sources of petroleum hydrocarbons. DEQ determined that the oil & grease analytical method is better suited for detection of animal and vegetable fats rather than petroleum. Therefore, the parameter TPH is being limited in the general permit rather than oil & grease.

The term "used oils" is used in the general permit to refer to those petroleum products that have served their useful purpose and have been collected for recycling or disposal. Tanks that store used oils are found at industrial sites and at automotive service stations. These tanks have the potential to leak into surrounding soils and contaminate ground water. The materials in used oil storage tanks can be a mixture of motor oils and other petroleum products, as well as solvents or other organic chemicals. Used oils also may contain dissolved metals derived from the machinery from which the oil was recovered. These mixtures pose potential environmental impacts that may not be adequately addressed by the pollutant parameters established to control discharges from the sites contaminated by products other than gasoline. Therefore, the general permit proposes to require that when the contamination is from used oils, addition monitoring shall be conducted to scan the wastewater for a wide range of organic compounds and metals. In no case will the general permit allow a discharge of wastewaters if the contamination is from used oils that are classified as hazardous materials according to the Virginia Hazardous Waste Regulation, 9VAC20-60-10 et seq.

In the current permit, the TPH limit appears as 15.0 mg/L. Agency guidance GM06-2016 notes that "effluent limitations should generally be written using two significant figures," so with this reissuance, staff has updated the limit from 15.0 mg/L to 15 mg/L.

6.3 Discharges from Hydrostatic Testing of Tanks and Pipelines

When this permit was reissued in 1998, hydrostatic test waters from petroleum facilities were included so that a VPDES permit could properly govern them. The permit regulation was further expanded in 2003 to include coverage of discharges from hydrostatic testing of natural gas pipelines.

Natural gas, like other petroleum products, is not constant in its composition or the relative proportions of individual constituents within that product. According to Technocarb (2002), methane typically makes up approximately 95 percent of natural gas by volume. Ethane and propane generally make up approximately two and one percent of the gas, respectively. Other constituents that typically make up the remaining two percent of the mixture include butane, carbon dioxide, and nitrogen. There is no aquatic or human toxicity data for these compounds.

Permit coverage includes hydrostatic test discharges from water storage tanks, pipelines, and associated distribution equipment. Discharges from these tests are similar to those from petroleum and natural gas storage tanks and pipelines.

Discharges from hydrostatically testing pipelines are generally one-time occurrences of less than 48 hours. Such frequencies and durations preclude the necessity for application of toxic parameters except for total residual chlorine (TRC). TRC is potentially present in high concentrations when treated potable water is used as the source water for testing. Discussion of the recommended effluent limits for discharges of hydrostatic test water from natural gas pipelines is presented below. In addition to the effluent limits, the following requirements will also apply to hydrostatic discharges from natural gas pipelines:

1. The equipment being tested shall be substantially free of debris, raw material, product, or other residual materials.
2. The discharge flow shall be managed to control the volume and velocity of the discharge, including peak flow rates and total volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion.

6.3.1 Total Petroleum Hydrocarbons (TPH)

The limit of 15 mg/l for TPH is based on the ability of simple oil-water separator technology to recover petroleum from water. Wastewater that is discharged without a visible sheen is generally expected to meet this effluent limitation. DEQ has used this limitation for many individual permits for many years and monitoring data has demonstrated that it is readily achievable. Mass limits are not applicable to this type of pollutant and discharge and are not required.

6.3.2 Total Organic Carbon (TOC)

Total organic carbon (TOC) is monitored to assure that the effluent is not contaminated with non-petroleum organic substances. Staff members generally believe that TOC concentrations in this type of discharge are low. However, should sampling data indicate high levels of TOC; the permit may be modified at a later time to include such a limit.

6.3.3 Total Suspended Solids (TSS)

Total suspended solids (TSS) are monitored to assure that the effluent is not contaminated with excessive amounts of solids that might be flushed out of pipes along with the test waters. If significant concentrations of suspended solids are detected, the permit may be modified at a later time to include a limit.

6.3.4 Total Residual Chlorine (TRC)

Total residual chlorine (TRC) is necessary for those hydrostatic tests that use chlorinated potable drinking water as the source water for testing. The limit of .011 mg/l is based on the chronic aquatic life criterion in Virginia's water quality standards.

6.3.5 pH

The pH limits in this general permit are based on the Virginia Water Quality Standards and range from six (6.0) standard units to nine (9.0) standard units.

6.4 Discharges of Water Contaminated by Chlorinated Hydrocarbon Solvents

Many different chlorinated hydrocarbons are, or have been, used as solvents. Controlling these materials when they have been released into the environment is further complicated by the fact that they often break down into other chlorinated hydrocarbon compounds; many of which also are solvents. Therefore, although only one type of chlorinated hydrocarbon may have been released at a site, subsequent cleanup efforts may have to deal with multiple chlorinated hydrocarbons. Figures 1 and 2 present the degradation products that are or can be created by the breakdown of 1,1,1 trichloroethane, tetrachloroethane, and carbon tetrachloride.

Effluent limits recommended for chlorinated hydrocarbon solvent constituents were based upon both the toxicity of the material as well as treatment technology. Some of the toxicity-based limits that were considered include promulgated water quality standards; drinking water maximum contaminant levels (MCLS), aquatic toxicity data from the EPA ECOTOX database, and tap water risk –based concentrations from EPA Region III. Staff also considered effluent limits that had been placed in VPDES individual permits.

Staff recommended one set of effluent limits for these chlorinated hydrocarbon solvents and set the limits to protect both aquatic life and human health. The effluent limits were based upon the assumption of a discharge into a public water supply and the limits had to meet criteria for public water supplies. Table 1 summarizes the pertinent regulatory values that exist for chlorinated hydrocarbon solvent compounds and the effluent limits that have been proposed for these constituents.

Figure 1. Reductive Dehalogenation of 1,1,1 TCA and Tetrachloroethylene (from Dragun 1988)

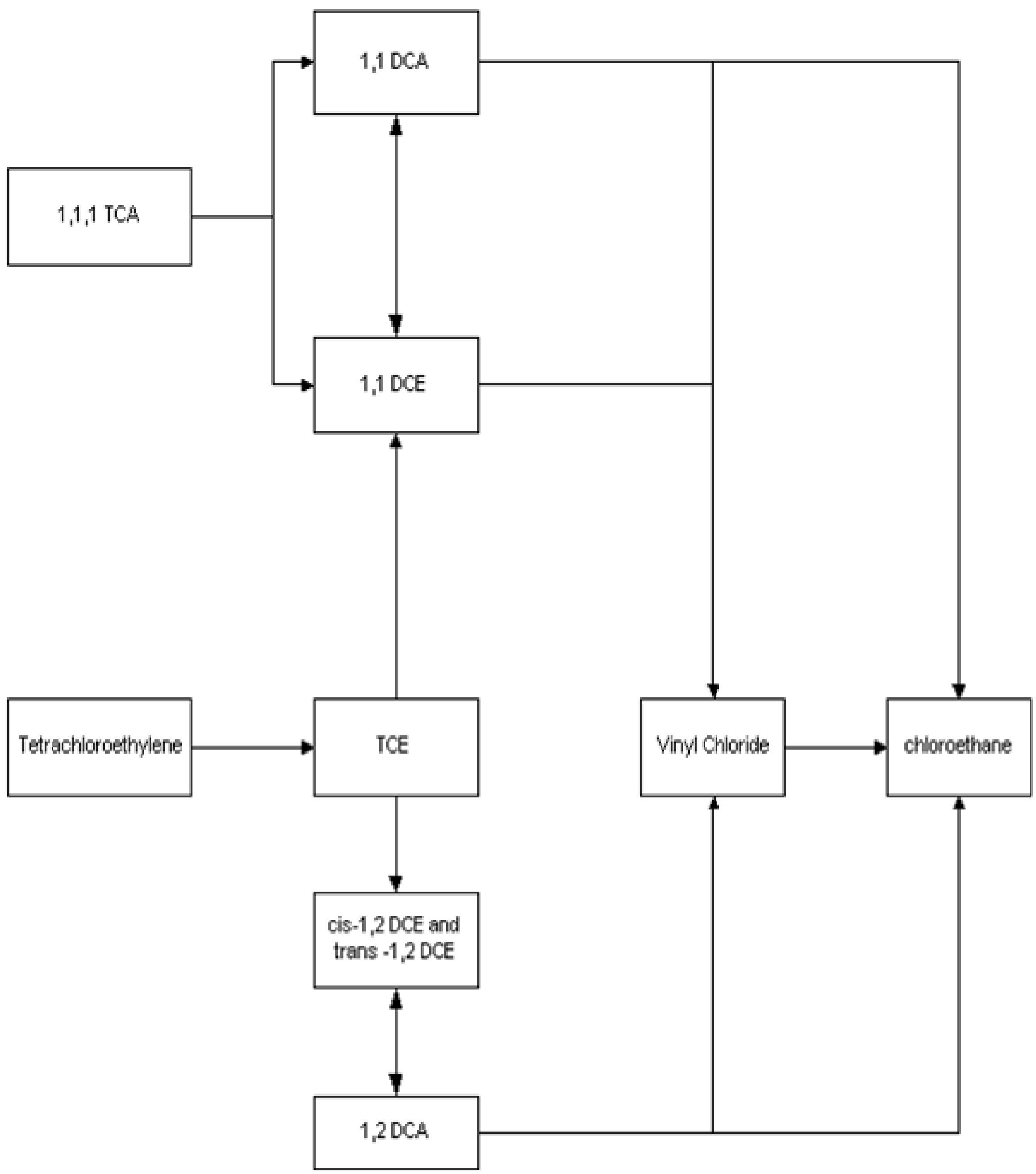

Figure 2. Reductive Dechlorination of Carbon Tetrachloride
(from RTDF Bioremediation Consortium 1988)

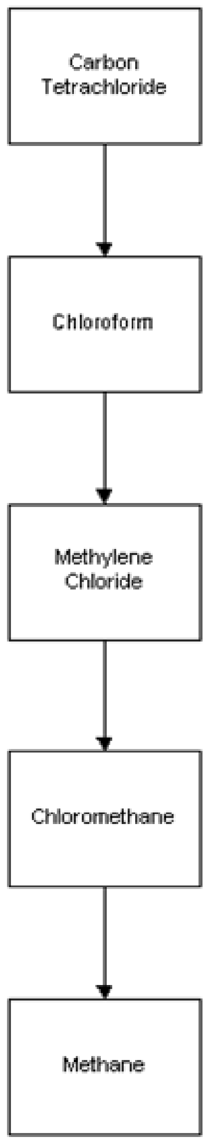

Table 1. Effluent Limit and Regulatory Information Matrix for Chlorinated Hydrocarbon Solvents

Name	CAS Number	Effluent limits from individual permits (µg/l)	Drinking Water MCL (µg/l)	WQS, HH for PWS[1] (µg/l)	WQS, HH for Other Waters[2] (µg/l)	Toxicity FW[3] (µg/l)	Toxicity SW[4] (µg/l)	EPA Reg. III Tap Water RBC[5] (µg/l)	Recommended Effluent Limit (µg/l)
Chloroform	67663	100 (3 permits)	80 [6]	60	2000	290	815		60
1,1 Dichloroethane	75343	4 (one permit), 5 (2 permits)				5000		2.4	2.4
1,2 Dichloroethane	107062	5 (3 permits)	5	99	6500	1160	1130		3.8
1,1 Dichloroethylene [A]	75354	7 (4 permits)	7	300	20000	740	2240		7.0
cis-1,2 Dichloroethylene	159592	70 (3 permits)	70			5000			70
trans-1,2 Dichloroethylene	156605	100 (4 permits)	100	100	4000	2200			100
Methylene Chloride [A]	75092	5 (2 permits)	5	20	1000	1930	770		5.0
Tetrachloroethylene [A]	127184	5 (4 permits) and 79 (1 permit)	5	100	290	18	13		5.0
1,1,1 Trichloroethane	71556	200 (4 permits)	200			54	3120		54
1,1,2 Trichloroethane	79005	5	5	5.9	160	180	270		5.0
Trichloroethylene	79016	5 (3 permits)	5	25	300	19	140		5.0
Vinyl Chloride	75014	2 (3 permits)	2	0.22	16				2.0
Carbon Tetrachloride	56235	5	5	4.0	50	20	500		2.3
1,2 Dichlorobenzene	95501	600	600	1000	3000	15.8	19.7		16
Chlorobenzene	108907	NL	100	100	800	3.4	89		3.4
Trichlorofluoromethane	75694	5						1300	5.0
Chloroethane, [A]	75003	5						21000	3.6

[1] The values in this column are human health criteria for public water supplies from the Virginia Water Quality Standards (9 VAC 25-260).

[2] The values in this column are human health criteria for surface waters that are not public water supplies. These numbers are from the Virginia Water Quality Standards (9VAC 5-260).

[3]

[4]

[5] These are tap water risk-based concentrations from the EPA Region III Risk-Based Concentration Table (June 2011). These values are provided only for constituents for which regulatory concentrations do not exist.

[6] This Maximum Contaminant Level (MCL) is for Total Trihalomethanes.

A Synonyms: dichloromethane = methylene chloride, ethyl chloride = chloroethane, 1,1 dichloroethene = 1,1 dichloroethylene, perchloroethylene = tetrachloroethylene

6.4.1 Chloroform

According to Howard (1990), chloroform is used as an industrial solvent, extractant, and chemical intermediate. Chloroform also may be created by the reductive dehalogenation of carbon tetrachloride that has been released into the environment (RRDF Bioremediation Group 1988). The human-health Water Quality Standards for chloroform are 60 µg/l for public water supplies and 2,000 µg/l for other surface waters. The DEQ Northern Regional Office had issued three individual permits having an effluent limit for chloroform and Northern Regional Staff used a technology-based limit of 100 µg/l for all three permits. LeBlanc (1980) found that chloroform, at a concentration of 29,000 µg/l , killed fifty percent of the water fleas (*Daphnia magna*) tested. Bentley and associates (1979) found that chloroform killed fifty percent of the pink shrimp (*Penaeus douranum*) tested when the chloroform concentration was 81,500 µg/l. Applying the safety factor of 100 to these LC50 values resulted in chronic toxicity levels for freshwater and saltwater organisms of 290 and 815 µg/l respectively. DEQ staff recommend that the effluent limit of 80.0 µg/l for chloroform be updated to an effluent limitation of 60 µg/l to be protective of the updated human health criterion for public water supplies.

6.4.2 1,1 Dichloroethane

1,1 Dichloroethane (1,1 DCA) predominantly is used to make other chemicals (Howard 1990 and ATSDR 1999a). This constituent also is used to dissolve substances such as paint and varnish, and as a degreasing agent (ATSDR 1999a). 1,1 DCA may be created by the breakdown of 1,1,1 trichloroethane that has been released into the environment (Dragun 1988).

There is very limited aquatic toxicity information for 1,1 dichloroethane. The EPA ECOTOX database cited a LOEC (lowest observed effects concentration) of 500,000 µg/l for fathead minnows (*Pimephales promelas*) exposed to 1,1 DCA (Great Lakes Environmental Center 2005). The effect observed was mortality. Applying the safety factor of 100 to this LOEC would result in an effluent limit of 5,000 µg/l. There are no promulgated drinking water standards for this constituent nor is there a drinking water MCL. The EPA Region III risk-based concentration for this constituent in tap water is 2.4 µg/l. The DEQ Northern Regional Office has placed an effluent limit of 4 µg/l for this constituent in one VPDES individual permit and 5 µg/l in two permits. DEQ staff recommend an effluent limit of 2.4 µg/l for 1,1 dichloroethane.

6.4.3 1,2 Dichloroethane

According to ATSDR (2001a), 1,2 dichloroethane (1,2 DCA) is used in the production of vinyl chloride which, in turn, is used to make a variety of plastic and vinyl products. 1,2 DCA also is used as a solvent and as a lead scavenger in leaded gasoline. This constituent may be created in the environment by reducing the carbon-carbon double bonds in the cis and trans 1,2 dichloroethylene isomers (Dragun 1988).

The Northern Regional Office had placed an effluent limit of 5 µg/l for 1,2 dichloroethane (1,2 DCA) in 3 VPDES individual permits. The Federal drinking water MCL for 1,2 DCA is 5 µg/l. Virginia's human-health based water quality standards for this constituent were 3.8 µg/l and 990 µg/l for public water supplies and for other surface waters, respectively. The updated human health standards for this parameter are 99 µg/l and 6,500 µg/l. According to the ECOTOX database, the lowest saltwater LC50 concentration for 1,2 DCA is 113,000 µg/l (EPA 1978). The lowest freshwater LC50 concentration reported for 1,2 DCA is 116,000 µg/l (Walbridge 1983). Applying the safety factor of 100 to these LC50 values results in concentrations of 1,160 µg/l and 1,130 µg/l for freshwater and saltwater, respectively. In previous permits, the water quality criteria of 3.8 µg/l for public water supplies was applied as the effluent limit since it is more protective than the drinking water MCL and the aquatic toxicity-based values. Due to backsliding considerations, DEQ staff recommends that this effluent limit of 3.8 µg/l for 1,2 DCA be carried forward with this reissuance.

6.4.4 1,1 Dichloroethylene

1,1 Dichloroethylene (1,1 DCE) is used in the manufacture of plastic wrap, adhesives, and synthetic fiber (Howard 1989). This constituent is formed during the anaerobic biodegradation of trichloroethylene (TCE) and the hydrolysis of 1,1,1 trichloroethane (1,1,1 TCA, Howard 1989 and Dragun 1988). The human health

Water Quality Standards for 1,1 DCE are 310 µg/l for public water supplies and 17,000 µg/l for other surface waters. The MCL for 1,1 DCE is 7 µg/l. Dill and associates (1980) found that 1,1 DCE at a concentration of 11,600 µg/l killed half of the water fleas (*Daphnia magna*) tested. The lowest reported LC50 concentration for saltwater organisms was 224,000 µg/l (EPA 1978).

The DEQ Northern Regional Office had an effluent limit of 7 µg/l for 1,1 DCE in four VPDES individual permits. This effluent limit is the same as the MCL and is recommended as the effluent limit for this general permit.

6.4.5 cis-1,2 Dichloroethylene

The cis-1,2 dichloroethylene (cis 1,2 DCE) isomer is not a priority pollutant. Much of the cis-1,2 DCE that is found in the environment comes from reductive dehalogenation of trichloroethylene (Howard 1990). There is limited aquatic toxicity data for this constituent. The ECOTOX database lists a LOEC value of 500,000 µg/l for fathead minnows (*Pimephales promelas*) exposed to this constituent (Great Lakes Environmental Center 2005). The observed effect was mortality. Applying the safety factor of 100 to this concentration would yield an effluent limit of 5,000 µg/l. The MCL for cis-1,2 DCE is 70 µg/l. The DEQ Northern Regional Office had three VPDES individual permits with effluent limits for this constituent and all of them had an effluent limit of 70 µg/l. DEQ staff recommend an effluent limit of 70 µg/l for cis-1,2 DCE.

6.4.6 trans 1,2 Dichloroethylene

Trans1,2 dichloroethylene (trans-1,2 DCE) is a priority pollutant and the preferred isomer of DCE in most applications (HSDB 1995). This constituent is used as a solvent and extractant used in manufacturing perfumes, lacquers, and thermoplastics (Howard 1990). Trans 1,2 DCE also can be created by the reductive dehalogenation of trichloroethylene (Dragun 1988). The MCL for trans-1,2 DCE is 100 µg/l . Northern Regional Office staff also used an effluent limit of 100 µg/l for trans-1,2 DCE in four VPDES individual permits issued by that office. Current human health-based water quality standards for this constituent are 100 µg/l for public water supplies and 4,000 µg/l for other surface waters. LeBlanc (1980) found that a concentration of 220,000 µg/l trans-1,2 DCE in water was lethal to 50 percent of the water fleas (*Daphnia magna*) tested.

The 2018 TAC recommended that the effluent limit for trans-1,2 DCE be set at 100 µg/l. DEQ staff recommends that this limit be carried forward with this reissuance since it will be protective of the human health criterion for public water supplies.

6.4.7 Methylene Chloride

Methylene chloride is a solvent and paint remover that may be found in certain aerosols and pesticides, and is used to manufacture photographic film (Howard 1990 and ATSDR 2001b). According to the RTDF Bioremediation Consortium (1998), methylene chloride also may be derived from the anaerobic degradation of chloroform. The lowest freshwater LC50 concentration reported for methylene chloride is 193,000 µg/l for fathead minnows (*Pimephales promelas*, Alexander 1978). Burton and Fisher (1990) found that methylene chloride, at a concentration of 97,000 µg/l, was lethal to 50 percent of the mummichogs (*Fundulus heteroclitus*) tested. The Federal drinking water MCL for methylene chloride is 5 µg/l and this is also the effluent limit that the Northern Regional Office staff used in the two permits that had limits for this constituent. The human health Water Quality Standards for methylene chloride are 20 µg/l and 1,000 µg/l for public water supplies and other surface waters, respectively. DEQ staff recommend an effluent limit of 5 µg/l for methylene chloride be carried forward.

6.4.8 Tetrachloroethylene

Tetrachloroethylene, also known as perchloroethylene, is used widely for dry cleaning fabrics and as a metal degreasing agent (Howard 1990 and ATSDR 1997). According to Yoshioka and others (1986), tetrachloroethylene at a concentration of 1,800 µg/l was lethal to 50 percent of the water fleas (*Moina macrocopa*) tested. The lowest saltwater LC50 value reported for tetrachloroethylene is 1,300 µg/l for daggerblade grass shrimp (*Palaemonetes pugio*, Horne et al. 1983). Applying the safety factor of 100 to these LC50 values results in limits of 18 µg/l and 13 µg/l, respectively.

The human health-based water quality standards for tetrachloroethylene are 100 µg/l for public water supplies and 290 µg/l for other surface waters. The MCL for tetrachloroethylene is 5 µg/l.

Five VPDES individual permits in the Northern Regional Office had effluent limits for tetrachloroethylene. Four of these permits have an effluent limit of 5 µg/l and one of the permits had an effluent limit of 79 µg/l.

DEQ staff recommend an effluent limit of 5 µg/l for tetrachoroethylene.

6.4.9 1,1,1 Trichloroethane

1,1,1 Trichloroethane (1,1,1 TCA) was used as a solvent, a degreasing agent, and as an ingredient of household products such as glues, spot removers, and aerosol sprays (ATSDR 2006a and Howard 1990). According to ATSDR 2006a, TCA was not to be manufactured for domestic use in the United States after January 1, 2002, due to its effects on the ozone layer.

The MCL for 1,1,1 Trichloroethane (1,1,1 TCA) is 200 µg/l. Four VPDES individual permits in the Northern Regional Office had effluent limits for 1,1,1 TCA and the effluent limit in each permit is 200 µg/l.

Virginia has not promulgated water quality standards for 1,1,1 TCA.

The lowest freshwater LC50 value for 1,1,1 TCA that is reported in the ECOTOX database is 5,400 µg/l for water fleas (*Daphnia magna*, Thompson and Carmichael 1989). EPA (1978) found that 1,1,1 TCA at a concentration of 312,000 µg/l was lethal to 50 percent of the opossum shrimp (*Americamysis bahia*) tested. If the customary safety factor of 100 is applied to these LC50 values, results in concentrations of 54 µg/l and 3,120 µg/l, respectively that are expected to be protective of aquatic and marine life.

The most conservative or protective concentration for 1,1,1 TCA is the value that was derived from toxicity of this constituent to water fleas. DEQ staff recommends an effluent limit of 54 µg/l for 1,1,1 TCA.

6.4.10 1,1,2 Trichloroethane

1,1,2 TCA is a solvent and an intermediate in the production of 1,1 DCA (ATSDR 199b). Only one individual permit in the Northern Regional Office had an effluent limit for 1,1,2 TCA and the limit in that permit is 5 µg/l. The MCL for 1,1,2 TCA also is 5 µg/l.

The Virginia Water Quality Standards for 1,1,2 TCA are 5.9 µg/l for public water supplies and 160 µg/l for other surface waters. LeBlanc (1980) found that 1,1,2 TCA, at a concentration of 18,000 µg/l, was lethal to 50 percent of the water fleas (*Daphnia magna*) tested. The lowest LC50 value reported for this constituent for saltwater organisms is 27,000 µg/l (Adema and Vink 1981). Applying the safety factor of 100 to these LC50 values results in concentration of 18 µg/l and 27 µg/l, respectively.

DEQ staff recommends an effluent limit of 5 µg/l for 1,1,2 TCA.

6.4.11 Trichloroethylene

Trichloroethylene (TCE) is a solvent commonly used to remove grease from metal parts (Howard 1990 and ATSDR 2003). TCE also is an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers (ATSDR 2003). TCE can be formed by the breakdown of tetrachloroethylene that has been released into the environment.

The MCL for TCE is 5 µg/l and this is the same effluent limit that the Northern Regional Office staff used for all three VPDES permits that contained limits for TCE. The promulgated water quality standard for public water supplies is 25 µg/l and the water quality standard for all other surface water is 300 µg/l.

The lowest freshwater LC50 value reported to TCE is 1,900 µg/l (Yoshioka 1986). Ward and associates (1986) found that TCE at a concentration of 14,000 µg/l was lethal to 50 percent of the opossum shrimp (*Americamysis bahia*) tested. Applying the safety factor of 100 to these LC50 values results in concentrations of 19 µg/l and 140 µg/l.

DEQ staff recommends an effluent limit of 5.0 µg/l for TCE.

6.4.12 Vinyl Chloride

Most vinyl chloride is used to manufacture polyvinyl chloride (PVC, Howard 1989 and ATSDR 2006b). This constituent is commonly found in the environment due the breakdown of other chlorinated hydrocarbon solvents (Dragun 1988 and ATSDR 2006b).

The MCL for vinyl chloride is 2 µg/l and is the effluent limit that the DEQ Northern Regional Office staff had used for all three of their individual VPDES permits having a limit for this constituent. The Water Quality Standard for public water supplies is 0.22 µg/l and the water quality standard for other surface waters is 16 µg/l.

DEQ staff recommend an effluent limit of 2.0 µg/l for vinyl chloride. This limit is the same as the MCL and, as a promulgated MCL, is both protective and achievable. Current analytical methods typically cannot quantify vinyl chloride or other volatile organic compounds at concentrations of less than 1 µg/l. MCLs also are set at limits that are believed protective of human health and are can be reached by current treatment technologies. Members of previous TACs utilized during the 2013 general permit reissuance process were not confident that an effluent limit of less than 1 µg/l for vinyl chloride may be achieved by current treatment technologies.

6.4.13 Carbon Tetrachloride

According to Howard (1990) large quantities of carbon tetrachloride are used for the chemical synthesis of fluorocarbon refrigerants and propellants. Carbon tetrachloride also is used as a degreaser, a cleaning fluid, and a grain fumigant pesticide (Howard 1990 and ATSDR 2005).

The Water Quality Standards for carbon tetrachloride are 4.0 µg/l for public water supplies and 50 µg/l for other surface waters. The MCL for carbon tetrachloride is 5 µg/l.

DEQ staff in the Northern Regional Office had issued one VPDES individual permit having an effluent limit for carbon tetrachloride and that limit was 5 µg/l.

Yoshioka and associates (1986) found that carbon tetrachloride at a concentration of 2,000 µg/l was lethal to 50 percent of the Medaka, high-eyes (*Oryzias latipes*) tested. The lowest saltwater LC50 value listed in the ECOTOX database was 50,000 µg/l for sole order (*Pleuronectiformes*, Pearson and McConnell 1975).

In previous permits, the water quality criteria of 2.3 µg/l for public water supplies was applied as the effluent limit since it is more protective than the drinking water MCL and the aquatic toxicity-based values. Due to backsliding considerations, DEQ staff recommends that the current effluent limit of 2.3 µg/l for Carbon Tetrachloride be carried forward with this reissuance.

6.4.14 1,2 Dichlorobenzene

According to the National Toxicology Program (NTP), U.S. Department of Health and Human Services (1985), the major use of 1,2 dichlorobenzene is as an intermediate in the synthesis of other organic compounds including the herbicides propanil, diuron, and neburon. This constituent also is used as an engine cleaner, de-inking solvent, a degreasing agent, a heat exchange medium, and a fumigant pesticide (NTP 1985).

The water quality standard for 1,2 dichlorobenzene in public water supplies is 1,000 µg/l and the water quality standard for other surface waters is 3,000 µg/l. There is no promulgated MCL for this constituent.

Staff in the Northern Regional Office issued one VPDES individual permit having an effluent limit for 1,2 dichlorobenzene and the limit in that permit was 600 µg/l.

EPA (1978) reported that 1,2 dichlorobenzene at a concentration of 1,970 µg/l killed 50 percent of the opossum shrimp (*Americamysis bahia*) tested. The lowest freshwater LC50 value reported in the ECOTOX database for this constituent was 1,580 µg/l for rainbow trout (*Oncorhynchus mykiss*, Call and Associates 1983). Applying the customary safety factor of 100 to the LC50 value for rainbow trout results in a concentration of 15.8 µg/l.

DEQ staff previously recommended an effluent limit of 15.8 µg/l for 1,2 dichlorobenzene.

Agency guidance GM06-2016 notes that "effluent limitations should generally be written using two significant figures," so with this reissuance, staff has updated the limit from 15.8 µg/L to 16 ug/L in Part I.A.5.

6.4.15 Chlorobenzene

Chlorobenzene production has declined by over half since its peak of use in 1960 (ATSDR 1998). Presently, chlorobenzene is used as a solvent for pesticides, a degreasing agent, and a chemical intermediate (ATSDR 1998).

The MCL for chlorobenzene is 100 µg/l. The water quality standards for this constituent are 100 µg/l for public water supplies and 800 µg/l for other surface waters.

Birge and others (1979) reported that a concentration of 340 µg/l was lethal to 50 percent of the largemouth bass (*Micropterus salmoides*) they tested. The lowest saltwater LC50 value reported in the ECOTOX database for this constituent is 8,900 µg/l for sheepshead minnows (*Cyprinodon variegates*, Heitmuller and others 1981). Applying the customary safety factor of 100 to these LC50 values results in concentrations of 3.4 µg/l and 89 µg/l, respectively. DEQ staff recommend an effluent of 3.4 µg/l for chlorobenzene.

6.4.16 Trichlorofluoromethane

Trichlorofluoromethane, also known as Freon 11, was used as a propellant for aerosol sprays until its use for this application was banned in the United States on December 15, 1978 (Howard 1990). Trichlorofluoromethane is used as a refrigerant, foaming agent, solvent, degreaser, and fire extinguishing agent (Howard 1990).

There is no MCL for this constituent, no promulgated water quality standards, and no aquatic toxicity data that has been summarized in the ECOTOX database. The DEQ Northern Regional Office staff had written one individual permit having an effluent limit for this constituent and that effluent limit is 5 µg/l. EPA Region III has listed a risk-based value for trichlorofluoromethane in tap water and that concentration is 1,300 µg/l. DEQ staff recommend an effluent limit of 5 µg/l for trichlorofluoromethane be carried forward.

6.4.17 Chloroethane

According to ATSDR (1999c), chloroethane is used in the production of cellulose dyes, medicinal drugs, and other commercial products. This constituent is used as a solvent and refrigerant. Chloroethane has been shown to form as a degradation byproduct of other chlorinated hydrocarbon solvents (Howard 1990 and Dragun 1988).

Little aquatic toxicity information exists for chloroethane. The DEQ Northern Regional Office staff had written an individual permit having an effluent limit for this constituent and that effluent limit is 5 µg/l. In 2006, EPA Region III listed a risk-based value of 3.6 µg/l for chloroethane in tap water. The June 2011 Region III Risk Based Concentration Table listed a risk-based concentration of 21,000 µg/l for chloroethane (a.k.a. ethyl chloride) in Tap Water. Due to anti-backsliding policy, DEQ staff recommends retaining the effluent limit of 3.6 µg/l for chloroethane.

6.5 Discharges of Water Contaminated by Metals

With this reissuance of the general permit, DEQ staff proposes to expand the general permit to include other sources of contamination not identified as petroleum or chlorinated hydrocarbon solvents. Non-petroleum sources of contamination include, but are not limited to releases of solvents, degreasers, cleaners, or paint removers, releases from industrial operations, and improper waste management, disposal or transport. The types of sites eligible for coverage under this activity category may be a result of remediation activities related to groundwater pump and treat systems, dewatering systems or other activities where non-petroleum-related sources are a known source of a contaminant of concern, including sites where metals are present.

Adding these limited additional activities and pollutants to the scope of activities authorized under this general permit is needed to better serve the regulated community, to better coordinate across DEQ programs and to save staff time and resources.

Across the state, participation in the Voluntary Remediation Program (VRP) has increased significantly. The Voluntary Remediation Program encourages hazardous substance cleanups that might not otherwise take place. The program is a streamlined mechanism for site owners or operators to voluntarily address contamination sites with support from DEQ. The main goals are site redevelopment and enhanced environmental outcomes. Approximately 25% of statewide VRP work is located in the greater beltway area of Alexandria, Arlington, and Fairfax. In this area, due to economics and costs associated with site redevelopment, the redevelopment tends to be more vertical (i.e. parking garages and deeper parking garages resulting in more dewatering) instead of horizontal. Furthermore, there is an increased awareness of the dewatering issues and permitting, resulting in more sites seeking coverage. In these highly developed areas other contaminants are being encountered whether from the site itself or migrating onto the property. These additional contaminants that are not currently authorized under the general permit have to be addressed.

Cleanup of VRP sites is not limited to sites contaminated by petroleum products or chlorinated hydrocarbon solvents. Increased participation in the VRP program has led to an increase in sites seeking coverage under VAG83. For sites with contamination outside the scope the current general permit, coverage cannot be issued and an individual permit and/or connection to sanitary would be required to properly manage wastewater generated onsite. Connecting to sanitary is costly, and not all POTWs have the treatment capacity to accept these discharges.

Staff recommended one set of effluent limits for the metals and set the limits to protect both aquatic life and human health (including public water supplies). All limits are expressed as total recoverable as required by 9VAC25-31-230C. For metals with criteria that are hardness-based, a Total Hardness value of 70 mg/l as $CaCO_3$ was used to derive the acute and chronic water quality criteria. This hardness value was derived as the 10^{th} percentile of the total hardness data collected during the current permit cycle. The 10^{th} percentile was selected as a conservative value to represent the hardness of the effluent and receiving streams statewide.

The metals limitations established for a specific site covered under this general permit shall be determined by the data provided (e.g. data from the Voluntary Remediation Program) with the registration statement. Permit writers will review the data provided (all available data must be submitted) and select the metals that have the reasonable potential to be in the final effluent.

Utilizing DEQ's R-Tool, the following criteria were established:

Parameter (Units)	Background Conc.	Water Quality Criteria			
		Acute	Chronic	HH (PWS)	HH
Antimony (ug/ l)	0			5.6000	640.0000
Arsenic (ug/ l)	0	340.0000	150.0000	10.0000	
Barium (ug/ l)	0			2.00E+03	
Cadmium (ug/ l)	0	1.2852	0.5493	5.0000	
Chromium III (ug/ l)	0	425.4318	55.3399		
Chromium VI (ug/ l)	0	16.0000	11.0000		
Chromium, Total (ug/ l)	0			100.0000	
Copper (ug/ l)	0	9.6033	6.6030	1.30E+03	
Iron (ug/ l)	0			300.0000	
Lead (ug/ l)	0	63.6573	7.2320	15.0000	
Mercury (ug/ l)	0	1.4000	0.7700		
Nickel (ug/ l)	0	134.8584	14.9876	610.0000	4.60E+03
Selenium, Total Recoverable (ug/ l)	0	20.0000	5.0000	170.0000	4.20E+03
Silver (ug/ l)	0	1.8680			
Thallium (ug/ l)	0			0.2400	0.4700
Zinc (ug/ l)	0	86.6177	87.3262	7.40E+03	2.60E+04

6.5.1. Total Recoverable Antimony

The Water Quality Standards for Antimony only have Human Health criteria. For Public Water Supplies, the Human Health Criteria is 5.6 µg/l and it is staff's professional judgement that this be established as an instantaneous maximum limitation.

6.5.2 Total Recoverable Arsenic

The Human Health Standard for Public Water Supplies is 10 µg/l and is well below the established aquatic life criteria, so it is staff's professional judgement that it be used as the instantaneous maximum limitation.

6.5.3 Total Recoverable Barium

Staff used professional judgement and did not include a Barium limitation with this reissuance since it has not appeared as a pollutant of concern in data submitted through the Voluntary Remediation Program.

6.5.4 Total Recoverable Cadmium

Cadmium is a hardness-based criteria, so the aquatic acute and chronic criteria were established using the 70 mg/l Total Hardness value. The chronic criteria for aquatic life is significantly lower than the Human Health criteria for Public Water Supplies, so it is staff's professional judgement to establish the Total Recoverable Copper instantaneous maximum limitation at 0.55 µg/l.

6.5.5 Total Recoverable Chromium

Chromium III is a hardness-based criteria, so the aquatic acute and chronic criteria were established using the 70 mg/l Total Hardness value. The acute and chronic criteria for Chromium VI for aquatic life are independent of hardness as is the Human Health standard for Total Chromium. It is staff's professional judgement to establish the Total Recoverable Chromium instantaneous maximum limitation at 11 µg/l which shall be protective for all valence states of Chromium.

6.5.6 Total Recoverable Copper

Copper is a hardness-based criteria, so the aquatic acute and chronic criteria were established using the 70 mg/l Total Hardness value. The chronic criteria for aquatic life is an order of magnitude lower than the Human Health criteria for Public Water Supplies, so it is staff's professional judgement to establish the Total Recoverable Cadmium instantaneous maximum limitation at 6.6 µg/l.

6.5.7 Total Recoverable Iron

Staff used professional judgement and did not include an Iron limitation with this reissuance since this criterion is to maintain acceptable taste, odor or aesthetic quality of drinking water and applies at the drinking water intake.

6.5.8 Total Recoverable Lead

Lead is a hardness-based criteria, so the aquatic acute and chronic criteria were established using the 70 mg/l Total Hardness value. The Human Health water quality standard for lead in public water supplies is 15 µg/l. When wastewater is discharged to a public water supply, the effluent will be the lower of 15 µg/l or the calculated aquatic toxicity based limit. The chronic criteria for aquatic life is lower than the Human Health criteria for Public Water Supplies, so it is staff's professional judgement to establish the Total Recoverable Lead instantaneous maximum limitation at 7.2 µg/l.

6.5.9 Total Recoverable Mercury

Aquatic life criteria are established for Mercury. There are no Human Health criteria established; therefore, it is staff's professional judgement to establish the Total Recoverable Mercury instantaneous maximum limitation at 0.77 µg/l.

6.5.10 Total Recoverable Nickel

Nickel is a hardness-based criteria, so the aquatic acute and chronic criteria were established using the 70 mg/l Total Hardness value. The Human Health water quality standard for nickel in public water supplies is 610 µg/l. The chronic criteria for aquatic life is significantly lower than the Human Health criteria for Public Water Supplies, so it is staff's professional judgement to establish the Total Recoverable Nickel instantaneous maximum limitation at 15 µg/l.

6.5.11 Total Recoverable Selenium

Selenium is not a hardness-based criteria. The Human Health water quality standard for nickel in public water supplies is 170 µg/l. The chronic criteria for aquatic life is significantly lower than the Human Health criteria for Public Water Supplies, so it is staff's professional judgement to establish the Total Recoverable Selenium instantaneous maximum limitation at 5 µg/l.

6.5.12 Total Recoverable Silver

Silver is a hardness-based criteria, so the aquatic acute criteria was established using the 70 mg/l Total Hardness value. There is no Human Health water quality standard for silver. It is staff's professional judgement to establish the Total Recoverable Silver instantaneous maximum limitation at 1.9 µg/l.

6.5.13 Total Recoverable Thallium

The Water Quality Standards for Thallium only have Human Health criteria. For Public Water Supplies, the Human Health Criteria is 0.24 µg/l and it is staff's professional judgement that this be established as an instantaneous maximum limitation.

6.5.14 Total Recoverable Zinc

Zinc is a hardness-based criteria, so the aquatic acute and chronic criteria were established using the 70 mg/l

Total Hardness value. The Human Health water quality standard for zinc in public water supplies is 7,400 µg/l. The chronic criteria for aquatic life is significantly lower than the Human Health criteria for Public Water Supplies, so it is staff's professional judgement to establish the Total Recoverable Nickel instantaneous maximum limitation at 87 µg/l.

Total Hardness

When a permittee monitors for a hardness-based metal, they shall also monitor for Total Hardness in the effluent.

pH

The pH limits in this general permit are based on the Virginia Water Quality Standards and range from six (6.0) standard units to nine (9.0) standard units.

7.0 Administration of this General Permit Regulation

The general permit shall have a fixed term of five (5) years effective upon Board approval. Every authorization to discharge under this general permit will expire at the same time and all authorizations to discharge will be renewed on the same date. Discharges will be covered under the general permit either upon approval of the Registration Statement and delivery of a copy of the general permit to the applicant, or in the case of authorized "short term" projects and hydrostatic testing, immediately upon the permit's effective date of March 1, 2023.

This general permit does not apply to any new or increased discharge that will result in significant effects to the receiving waters. That determination is made in accordance with the State Water Control Board's Antidegradation Policy contained in the Virginia Water Quality Standards, 9 VAC 25-260. Anti-backsliding will also be considered prior to granting coverage under this general permit to operations currently discharging under another VPDES permit.

If an applicant for a discharge appears to qualify for this general permit, the applicant will be required to submit a general permit Registration Statement. (This does not apply to authorized "short term" projects and hydrostatic testing, which do not require the submittal of a Registration Statement). The Board will review the Registration Statements received and either send a copy of the general permit to those that qualify, or send a copy of the application for an individual permit to those that do not qualify.

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