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ISSUE

Recommendations for updating groundwater quality standards in ch. NR 140 for the volatile organic compounds (VOCs): Trichloroethylene (TCE), Tetrachloroethylene (PCE), 1,2,3-Trichloropropane (1,2,3-TCP), 1,1-Dichloroethane (1,1-DCA) and 1,4-Dioxane.

BACKGROUND

This paper provides an overview of the Wisconsin Department of Health Services recommendations for updating groundwater quality standards, for selected substances, in Wisconsin Administrative Code chapter NR 140. Specifically, this paper addresses recommended updated groundwater standards for the VOCs: Trichloroethylene (TCE), Tetrachloroethylene (PCE), 1,2,3-Trichloropropane (1,2,3-TCP), 1,1-Dichloroethane (1,1-DCA) and 1,4-Dioxane.

Wisconsin Statute chapter 160 establishes an administrative process for developing numerical state groundwater quality standards to be used as criteria for the protection of public health and welfare by all state groundwater regulatory programs. Chapter 160, Stats., directs the Department of Natural Resources (DNR) and the Department of Health Services (DHS) to use this administrative process to establish numeric groundwater quality standards for substances of public health or welfare concern, found in, or having a reasonable probability of being detected in, the groundwater resources of the state.

As part of a continuing commitment to protect public health, public welfare, and the environment, the DNR periodically updates groundwater quality standards in ch. NR 140, Wis. Adm. Code. The DNR requests that DHS review existing federal numbers and available toxicologic information and, as applicable under ch. 160 Stats., provide recommendations for new or revised groundwater quality standards for substances of public health concern. The DNR then proposes amendments to ch. NR 140, Wis. Adm. Code, to incorporate the DHS recommended standards into rule. Since its establishment in 1985, the Natural Resources Board has approved amendments to ch. NR 140 twelve times in order to revise existing standards, establish new standards and clarify rule language.

SETTING NEW/REVISING EXISTING GROUNDWATER STANDARDS UNDER CHAPTER 160

A list of substances which are detected in groundwater, or have a reasonable probability of entering groundwater, is compiled from one of two sources: 1) lists of substances submitted by state regulatory agencies (in accordance with s. 160.05(1), Stats.) related to facilities, activities and practices within their authority to regulate and which have been detected in, or have a reasonable probability of entering, the groundwater resources of the state; or 2) substances petitioned by any person (in accordance with s. 160.05(2), Stats.) to be added to the list.

As it appeared that new toxicological information was available for the VOCs listed above, the DNR requested that DHS review available technical information and, if warranted, provide recommendations for updated groundwater quality standards for those substances. Under ch. 160, Wis. Stats., the DHS uses the most recent federal number as the recommended enforcement standard unless one does not exist or there is significant technical information that was not considered when the federal number was established and that indicates a different number should be used.

DNR and DHS determine which substances on the priority list are of public health concern and which are of public welfare concern. In accordance with ss. 160.07 and 160.13, Stats., DHS develops recommendations for state groundwater quality standards for substances of public health concern. DNR develops proposed groundwater quality standards for substances which are not health-related, but cause aesthetic or other effects. Scientific support documents for all recommended groundwater standards are prepared as part of the rulemaking process.

Please note: to ensure full discussion of DG program's rule changes, information on recommended groundwater standards for Volatile Organic Compounds, Pesticides, Indicator Bacteria and PFAS/PFOS, substances have been divided among different meetings and white papers. This paper focuses on recommended updated groundwater quality standards for Volatile Organic Compounds.

RECOMMENDATIONS FOR NEW AND REVISED GROUNDWATER QUALITY STANDARDS

Recommended groundwater standards for incorporation into ch. NR 140 are organized by substance. A summary of information on how the recommended groundwater standard for each substance on the Cycle 10 list was established, and the method used by the DHS, is provided in a Scientific Support Document. The Scientific Support Documents for the recommended groundwater standards for substances described in this paper can be found on the DHS website at:

<https://www.dhs.wisconsin.gov/publications/p02434v.pdf> .

DEFINITIONS

Enforcement standard: Level of a substance in groundwater that is used to protect public health or welfare and the level at which the sources of the substance might be regulated.

Preventive action limit: Level of a substance in groundwater that is used by regulatory agencies to determine when action may be needed so that levels do not reach or exceed the enforcement standard.

Federal number: A numerical expression of the concentration of a substance in water, established as:

- (a) A drinking water standard or maximum contaminant level, by the federal environmental protection agency;
- (b) A suggested no-adverse-response level, by the federal environmental protection agency; or
- (c) For oncogenic substances, a concentration based on a risk level determination by the federal environmental protection agency or a concentration based on a probability of risk model determined by the national academy of sciences.

Carcinogen: Cancer causing

Mutagenic: Causes DNA damage

Teratogenic: Causes birth defects

Interactive effects: Can affect the toxicity of another substance or its toxicity can be affected by another substance.

CAS RN: Chemical Abstracts Service (CAS) Registry Number (RN) is a chemical naming system that makes it easier to identify specific chemical substances.

UNITS

1 nanogram per liter (ng/L) = 1 part per trillion (ppt), equivalent to one drop of a substance in an Olympic swimming pool.

1 microgram per liter (ug/L) = 1 part per billion (ppb), equivalent to one thousand drops of a substance in an Olympic swimming pool.

1 milligram per liter (mg/L) = 1 part per million (ppm), equivalent to one million drops of a substance in an Olympic swimming pool.

RECOMMENDATIONS FOR UPDATED GROUNDWATER QUALITY STANDARDS FOR SELECTED VOCs

Trichloroethylene (TCE)

Trichloroethylene is an organic solvent that has been primarily used as a degreaser to clean metal parts and machinery. It is a human-made chemical that does not occur naturally in the environment. TCE is produced in large volumes for commercial use and is found in home products, such as paints, spot removers, metal cleaners, and varnishes. Before 1960, TCE was heavily used in the dry cleaning industry. TCE can enter groundwater and surface water from industrial discharge or from improper disposal.

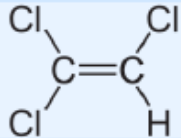
The current ch. NR 140 Groundwater Quality Public Health Enforcement Standard of 5 micrograms per liter ($\mu\text{g/L}$) for TCE is based on United States Environmental Protection Agency's (EPA's) maximum contaminant level from the 1980s. DHS recommends lowering the enforcement standard for TCE to 0.5 $\mu\text{g/L}$. The recommended standard is based on EPA's drinking water concentration, which is based on a cancer risk level determination. A concentration of 0.5 $\mu\text{g/L}$ corresponds with a lifetime cancer risk level of 1 in 1,000,000. DHS also recommends setting the ch. NR 140 Groundwater Quality Public Health Preventive Action Limit for TCE at 10% of the enforcement standard because it has been shown to have carcinogenic, mutagenic, and teratogenic effects.

Recommended Standards:

Enforcement Standard **0.5 $\mu\text{g/L}$ (ppb)**

Preventive Action Limit **0.05 $\mu\text{g/L}$ (ppb)**

Trichloroethylene Chemical Profile

Trichloroethylene	
Structure:	
CAS Number:	79-01-6
Formula:	C_2HCl_3
Molar Mass:	131.38 g/mol
Synonyms:	Algylen, Anamenth, Benzinol, Caswell, Ethylene trichloride, Trichloroethene, Trilene

Tetrachloroethylene (PCE)

Tetrachloroethylene is an organic solvent that has been primarily used as a degreaser to clean metal parts and machinery. It is a human-made chemical that does not occur naturally in the environment. PCE is produced in large volumes for commercial use and is used for dry cleaning, metalworking, textile processing, and fluorocarbons manufacturing.

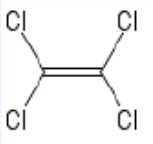
The current ch. NR 140 Groundwater Quality Public Health Enforcement Standard of 5 micrograms per liter ($\mu\text{g/L}$) for PCE is based on the United States Environmental Protection Agency's (EPA's) maximum contaminant level from the 1990s. DHS recommends raising the enforcement standard to 20 $\mu\text{g/L}$. The recommended standard is based on EPA's drinking water concentration, which is based on a cancer risk level determination. A concentration of 20 $\mu\text{g/L}$ corresponds with a lifetime cancer risk level of 1 in 1,000,000. DHS also recommends setting the ch. NR 140 Groundwater Quality Public Health Preventive Action Limit for PCE at 10% of the enforcement standard because it has been shown to have carcinogenic, mutagenic, and teratogenic effects.

Recommended Standards:

Enforcement Standard **20 $\mu\text{g/L}$ (ppb)**

Preventive Action Limit **2 $\mu\text{g/L}$ (ppb)**

Tetrachloroethylene Chemical Profile

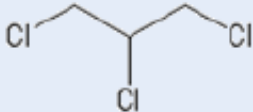
Tetrachloroethylene	
Structure:	
CAS Number:	127-18-4
Formula:	C_2Cl_4
Molar Mass:	165.8 g/mol
Synonyms:	1,1,2,2-tetrachloroethylene, perchloroethylene, PERC

1,2,3-Trichloropropane (1,2,3-TCP)

1,2,3-Trichloropropane is a clear liquid that somewhat mixes with water. It is currently used as a solvent in the manufacture of other chemicals. In the past, it was used as a fumigant (chemical used to treat soil), cleaning solvent, paint and varnish remover, and degreasing agent.

The current ch. NR 140 Groundwater Quality Public Health Enforcement Standard for 1,2,3-trichloropropane of 60 micrograms per liter ($\mu\text{g/L}$) is based on United States Environmental Protection Agency's (EPA's) oral reference dose from the 1990s. DHS recommends lowering the enforcement standard to 0.3 nanograms per liter (ng/L). The recommended standard is based on EPA's cancer slope factor for 1,2,3-trichloropropane from 2009. DHS recommends that the preventive action limit for 1,2,3-trichloropropane be set at 0.03 ng/L, 10% of the enforcement standard, because new studies have shown that 1,2,3-trichloropropane has carcinogenic and mutagenic effects.

Recommended Standards:Enforcement Standard **0.3 ng/L (ppt)**Preventive Action Limit **0.03 ng/L (ppt)****1,2,3-Trichloropropane Chemical Profile**

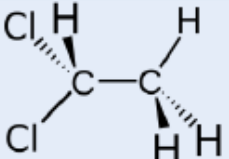
1,2,3-Trichloropropane	
Structure:	
CAS Number:	96-18-4
Formula:	C ₃ H ₅ Cl ₃
Molar Mass:	147.423 g/mol
Synonyms:	Allyl trichloride Glycerol trichlorohydrin Trichlorohydrin

1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane is a colorless, oily liquid with a sweet odor. 1,1-Dichloroethane is used mostly as an intermediate in the manufacture of other organic solvents. It evaporates easily at room temperature and burns easily. It does not occur naturally in the environment.

The current ch. NR 140 Groundwater Quality Public Health Enforcement Standard for 1,1-dichloroethane of 850 micrograms per liter (µg/L) is based on a study that found that breathing 1,1-dichloroethane can cause liver damage in animals. Because 1,1-dichloroethane in water can evaporate quickly into the air, DHS used this study to determine how much can be in water without there being an appreciable health risk. DHS recommends no change in the Enforcement Standard and 85 µg/L Preventive Action Limit for 1,1-dichloroethane. DHS did not find any new significant technical information to indicate that a change is warranted.

Recommended Standards/Current Standards:Enforcement Standard **850 µg/L (ppb)**Preventive Action Limit **85 µg/L (ppb)****1,1-Dichloroethane Chemical Profile**

1,1-Dichloroethane	
Structure	
Chemical Symbol:	75-34-3
CAS Number:	C ₂ H ₄ Cl ₂
Molar Mass:	98.96 g/mol
Synonyms:	Ethylidene dichloride Ethylidene chloride 1,1-DCA

1,4-Dioxane

1,4-Dioxane is a clear liquid that mixes easily with water. It is used as a solvent in the manufacture of other chemicals and as a laboratory reagent. It can also be found as a contaminant in cosmetics, detergents, and shampoos and is a byproduct of the manufacture of some common plastics. Some pesticides used to treat crops also contain 1,4-dioxane.

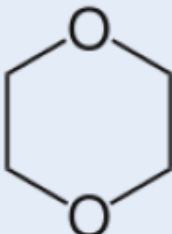
The current ch. NR 140 Groundwater Quality Public Health Enforcement Standard for 1,4-dioxane of 3 micrograms per liter ($\mu\text{g/L}$) is based on EPA's cancer slope factor from the 1990s. DHS recommends lowering the enforcement standard to $0.35 \mu\text{g/L}$. The recommended standard is based on the United States Environmental Protection Agency's cancer slope factor for 1,4-dioxane. DHS recommends that the preventive action limit for 1,4-dioxane be set at $0.035 \mu\text{g/L}$, 10% of the enforcement standard, because 1,4-dioxane has been shown to have carcinogenic, mutagenic, and teratogenic effects in animals.

Recommended Standards/Current Standards:

Enforcement Standard **$0.35 \mu\text{g/L}$ (ppb)**

Preventive Action Limit **$0.035 \mu\text{g/L}$ (ppb)**

1,4-Dioxane Chemical Profile

1,4-Dioxane	
Structure:	
CAS Number:	123-91-1
Formula:	$\text{C}_4\text{H}_8\text{O}_2$
Molar Mass:	88.10 g/mol
Synonyms:	Diethylene ether 1,4-diethylene dioxide Diethylene oxide Dioxyethylene ether Dioxane

AFFECTED RULE CHAPTERS

Wisconsin Administrative Code chapter NR 140

OTHER RELATED RULE REVISIONS

None

COMPARABLE FEDERAL AND STATE POLICIES

The United States Environmental Protection Agency (US EPA) establishes health based drinking water maximum contaminant levels (MCLs), cancer risk levels and health advisories (HAs). Federal drinking water MCLs are established based on scientific risk assessments and, in some cases, economic and technological considerations. Cancer risk levels are established as the concentration of a chemical in drinking water that corresponds to a specific excess estimated lifetime cancer risk. Federal lifetime health advisories (LHAs) are developed based on an established health risk acceptable daily intake (ADI) level or reference dose (RfD).

The groundwater quality standards contained in ch. NR 140 are used in Wisconsin by state regulatory agencies as state groundwater protection standards. These standards are used as contamination site cleanup levels, design and management criteria for regulated activities and as minimum public health and welfare protection standards for contaminants in groundwater. The states surrounding Wisconsin: Minnesota, Michigan, Illinois and Iowa, also use groundwater protection values/levels/standards in their regulation of practices and activities that might impact the quality of groundwater resources. Groundwater protection quality standards are developed based on health risk assessments. Because states follow state specific health risk assessment methodologies, that use state specific health risk assessments and factors in calculating and developing their groundwater protection standards, different groundwater protection standard levels may be established for the same substance by different states.

DISCUSSION OF POTENTIAL ECONOMIC IMPACTS

The proposed DHS recommended updates are intended to revise health-based standards for four VOCs, all of which have been found in groundwater in Wisconsin. These VOCs are all carcinogens. New toxicological information is available for these VOCs and, based on review of this information, DHS has recommended updated groundwater quality standards for the substances. The recommended updates are intended to make the numeric groundwater standards consistent with new information. These proposed revisions don't introduce new requirements that would likely have a significant economic impact; however, impacts will be considered in further detail as the rule language is drafted.

COMMENTS

Section 281.12(1), Stats., grants the DNR the authority to carry out planning, management and regulatory programs necessary to protect, maintain and improve the quality and management of the waters of the state, ground and surface, public and private. Section 281.15, Stats., states that the Department shall promulgate rules setting standards of water quality, applicable to the waters of the state, that protect the public interest, including the protection of public health and welfare, and the present and prospective future use of such waters for public and private water systems. Section 281.19(1), Stats., grants the Department the authority to issue general orders and adopt rules applicable throughout the state for the construction, installation, use and operation of practicable and available systems, methods and means for preventing and abating pollution of the waters of the state.