

Ground Water Quality Standard for Freon 113

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NJDEP

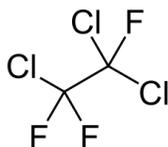
Summary of Decision: In accordance with the New Jersey Ground Water Quality Standards rules at N.J.A.C. 7:9C-1.7, the Department of Environmental Protection (Department) has developed an interim specific ground water quality criterion of 20,000 µg/L and PQL of 0.3 µg/L (ppb) for Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane). The basis for this criterion and PQL are discussed below. Pursuant to N.J.A.C. 7:9C-1.9 (c), **the applicable constituent standard is 20,000 µg/L.**

Freon 113 1,1,2-trichloro-1,2,2-trifluoroethane

Molecular Formula:



Molecular Structure:



Background: Freon 113 was one of the most commonly used CFSs (chlorofluorocarbon). It was used as a refrigerant in air conditioners and refrigerators and was also formerly used as a solvent to clean electronics, especially phones.

Reference Dose: The current USEPA reference dose (RfD) is based on an occupational epidemiology study that detected no adverse effects among exposed workers (Imbus and Adkins, 1972). A later study, however, provides evidence that Freon 113 can alter the profile of bile acids, although the toxicological significance of this effect is unclear (Neghab et al., 1997). There are no recent mutagenicity studies or cancer bioassays, however earlier mutagenicity studies provide no evidence of a mutagenic or carcinogenic potential (Longstaff, 1988). The USEPA based its oral RfD on the Imbus and Adkins (1972) occupational exposure study. The NOAEL (no observed adverse effects level) from this study derived an ingestion dose from the observed inhalation exposure of 273 mg/kg.

In addition to the uncertainty factor (UF) adjustment of 10 to account for inter-individual variability in sensitivity in the human population applied by the USEPA, the Department judged that consistency with USEPA policy requires the application of an additional UF of 10 to address the lack of data on reproductive or developmental effects in the database for Freon 113. This gives a value of 2.7 mg/kg/day that was rounded to one significant figure to give a reference dose (RfD) of 3 mg/kg/day.

RfD = NOEL/UFs
RfD = 3mg/kg/day

Therefore, the reference dose used as the basis of the ground water quality criterion for Freon 113 is 3 mg/kg/day.

Derivation of Ground Water Quality Criterion: The ground water quality criterion was derived pursuant to the formula established at N.J.A.C. 7:9C-1.7(c)4, using 3 mg/kg/day as the reference dose (as explained above), and standard default assumptions:

$$\frac{3 \text{ mg/kg/day} \times 70 \text{ kg} \times 0.2}{2 \text{ L/day}} = 21 \text{ mg/L or } 21,000 \text{ } \mu\text{g/L}$$

Where:

3 mg/kg/day = reference dose
70 kg = assumed body weight of average person
0.2 = Relative Source Contribution from drinking water
2 L/day = assumed daily drinking water intake

Derivation of PQL: The method detection limit (MDL) and the practical quantitation level (PQL) are performance measures used to estimate the limits of performance of analytical chemistry methods for measuring contaminants. The MDL is defined as "the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analytic concentration is greater than zero" (40 CFR Part 136 Appendix B). USEPA recommends that the MDL be multiplied by a factor of five or 10 to account for the variability and uncertainty that can occur at the MDL. The Department uses a value of five as the median upper boundary of the inter-laboratory MDL distribution from the New Jersey certified laboratory community and multiplies the MDL by five to derive the PQL. Establishing the PQL at a level that is five times the MDL provides a reliable quantitation level that most laboratories can be expected to meet during day-to-day operations.

1,1,2-Trichloro-1,2,2-trifluoroethane appears as a listed parameter in [National Environmental Methods Index \(NEMI\)](#). The limit of detection in the method is specified as 0.06 ppb. As explained above, the PQL is established by multiplying the limit of detection by five, $0.06 \text{ ppb} \times 5 = 0.3 \text{ ppb}$ (rounded to one significant figure). **Therefore, the Department has established a PQL of 0.3 ppb for 1,1,2-trichloro-1,2,2-tri-fluoro ethane.**

Conclusion: Based on the information provided above (and cited below), the Department has established an interim specific ground water quality criterion of 21,000 $\mu\text{g/L}$ and a PQL of 0.3 $\mu\text{g/L}$ (ppb) for 1,1,2-trichloro-1,2,2-trifluoroethane. As ground water criteria are rounded to one significant figure, the recommended interim specific ground water criterion for 1,1,2-trichloro-1,2,2-trifluoroethane is 20,000 $\mu\text{g/L}$. Pursuant to N.J.A.C. 7:9C-1.9(c), since the *criterion is higher than the PQL* for this constituent, **the applicable constituent standard for 1,1,2-trichloro-1,2,2-trifluoroethane is 20,000 $\mu\text{g/L}$.**

Technical Support Documents: *Interim Specific Ground Water Quality Criterion Recommendation Report for Freon 113*, Alan Stern, Dr.P.H., D.A.B.T, NJDEP, May 4, 2010
Procedure for Describing Process for Development of Analytical Practical Quantitation Levels (PQLs) for 1,1,2-trichloro-1,2,2-trifluoroethane, R. Lee Lippincott, Ph.D, NJDEP, March 13, 2014.

References:

Imbus HR, Adkins C. (1972) *Physical examinations of workers exposed to trichlorotrifluoroethane*. Arch Environ Health. 24:257-61.

Longstaff E (1988). [Carcinogenic and mutagenic potential of several fluorocarbons](#). Ann NY Acad Sci. 534:283-98.

Neghab M, Qu S, Bai CL, Caples J, Stacey NH (1997). [Raised concentration of serum bile acids following occupational exposure to halogenated solvents, 1,1,2-trichloro-1,2,2-trifluoroethane and trichloroethylene](#). Int Arch Occup Environ Health. 70:187-94.



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