Ground Water Quality Standard for 2-Ethyl-1-Hexanol

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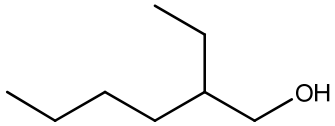
Summary of Decision: In accordance with the New Jersey Ground Water Quality Standards rules at N.J.A.C. 7:9C-1.7, the Department of Environmental Protection (Department) has developed an interim specific ground water quality criterion of 200 µg/L and PQL of 0.5 µg/L (ppb) for 2-ethyl-1-hexanol. The basis for this criterion and PQL are discussed below. Pursuant to N.J.A.C. 7:9C-1.9(c), **the applicable constituent standard is 200 µg/L**.

2-Ethyl-1-Hexanol
Molecular Formula: $C_8H_{18}O$
Molecular Structure:



Background: 2-ethyl-1-hexanol is a high production chemical that is widely used yet lacks a complete toxicological database. 2-ethyl-1-hexanol was nominated, but not tested, for carcinogenicity testing by the National Toxicology Program (NTP) because it is a high-volume chemical and a major metabolite of di(2-ethylhexyl) phthalate, which is a known hepatocarcinogen and a known contaminant in blood storage bags (Arneson et al., 1995). 2-ethyl-1-hexanol can be emitted from carpets and some plastics. Occupational or non-occupational standards do not exist for this constituent.

Reference Dose: The long-term F-344 Fischer rat study had a Lowest Observed Adverse Effect Level (LOAEL) of 50 mg/kg/day, adjusted to 35.7 mg/kg/day to account for exposure over 5 days/week, based on a significant dose-related increase in stomach weight. This LOAEL is considered a minimal LOAEL and, as such, calls for an uncertainty factor of 3, rather than the more customary 10, to obtain a No Observed Effect Level (NOEL). The rat study demonstrated statistically significant body weight reductions as early as the first month of dosing, as well as highly statistically significant multiple organ weight changes. As per the U.S. Environmental Protection Agency (USEPA) Guidelines for Carcinogen Risk Assessment (2005), considering the totality of all the evidence available, the Department has classified 2-ethyl-1-hexanol as "Inadequate Evidence to Assess Carcinogen Potential" and has treated it as a non-carcinogen for risk assessment. Based on the adjusted LOAEL of 35.7 mg/kg/day in male rats, the Reference Dose is derived as follows:

Uncertainty factor (UF) adjustment:

$UF_{\text{interspecies extrapolation}} = 10$
$UF_{\text{sensitive subpopulations}} = 10$

$UF_{conversion\ from\ LOAEL\ to\ NOEL}$ = 3*
$UF_{database\ insufficiencies}$ = 3*

UF = UF_{total} = 10 x 10 x 10 = 1000

*Note: Factors of 3 are considered to be 1/2 logs of 10; therefore, the use of 2 factors of 3 is equivalent to one factor of 10 (USEPA, 2002).

$\mathbf{RfD_{oral}}$ = NOEL/UF

$$= \frac{35.7\ mg/kg/day}{1000}$$

RfD = 0.0357 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 0.0357 mg/kg/day as the Reference Dose (as explained above), and standard default assumptions:

$$\frac{0.0357\ mg/kg/day \times 70\ kg \times 0.2}{2\ L/day} = 0.2499\ mg/L$$ (rounded to 0.2 mg/L) = **200 µg/L**

Where:
0.02 mg/kg/day = the derived RfD
70 kg = the assumed weight of an adult human
0.2 = the assumed relative source contribution
2 L/day = the assumed daily volume of water consumed.

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 analytic 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 analyte 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.

No published method was listed in the National Environmental Methods Index (NEMI) database for this chemical. A Dialog search located a peer reviewed journal article that contained sufficient performance information to generate a PQL. According to this article, Solid Phase Micro Extraction (SPME) headspace/GC/MS has been used extensively over the past seven years to detect purgable organoleptic compounds that impart an undesirable taste and odor to finished drinking water. 2-ethyl-1-hexanol is a purgable organic compound and performance of this method has been observed down to sub parts-per-billion levels. A method detection limit of 0.1 ppb was reported (Furton, 2003).

As explained above, a more conservative detection limit is established using a multiplier of five. 0.1 ppb x 5 = 0.5 ppb. Therefore, the Department has established a PQL of 0.5 ppb for 2-ethyl-1-hexanol.

Conclusion: Based on the information provided above (and cited below), the Department has established an interim specific ground water quality criterion of 200 µg/L and a PQL of 0.5 µg/L (ppb) for 2-ethyl-1-hexanol. Since the ground water quality criterion is higher than the PQL for this constituent, pursuant to N.J.A.C. 7:9C-1.9(c), **the applicable constituent standard for 2-ethyl-1-hexanol is 200 µg/L** .

Technical Support Documents: *Interim Specific Ground Water Quality Criterion Recommendation Report for 2-Ethyl-1-Hexanol*, Dr. Thomas Ledoux, NJDEP, May 2006; *Procedure for Describing Process for Development of Analytical Practical Quantitation Levels (PQLs) for 2-Ethyl-1-Hexanol*, R. Lee Lippincott, Ph.D., NJDEP, February 26, 2003.

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