Ground Water Quality Standard for

Tri-ortho-cresyl phosphate

CASRN# 78-30-8

October 2015 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 3 µg/L and PQL of 0.1 µg/L (ppb) for Tri-ortho-cresyl phosphate. 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 3 µg/L**.

Tri-ortho-cresyl phosphate

TOCP

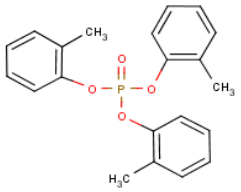
Tri-o-tolyl phosphate

Tris(o-cresyl)-phosphate

Molecular Formula:

$(CH_3C_6H_40)_3PO$

Molecular Structure:



Background: TOCP occurs as a component of mixed tri-cresyl phosphates. Tri-cresyl phosphates have been used as a plasticizer for chlorinated rubber, vinyl plastics, polystyrene, polyacrylic and polymethacrylic esters; as an adjuvant in milling pigment pastes; as a solvent and a binder in various natural resins; as a lubricant in synthetic lubricants and gasoline; as a hydraulic fluid; and as a fire retardant (NIOSH, 1977). It does not appear that TOCP was manufactured or used extensively for industrial purposes as a pure substance.

Reference Dose: The Reference Dose of 4×10^{-4} mg/kg/day is derived from Prentice and Majeed (1983). The Reference Dose is calculated as:

$NOAEL/UF_{total} = 1.25$ mg/kg/day$/3000 = 0.0004$ mg/kg/day $= 4 \times 10^{-4}$ mg/kg/day.

RfD = 4×10^{-4} mg/kg/day

Where the

NOAEL = 1.25 mg/kg/day

UF_{total} =Uncertainty factor = 3000

Therefore, the Reference Dose used as the basis of the ground water quality criterion for Tri -ortho-cresyl phosphate is 0.0004 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 [ ] mg/kg/day as the Reference Dose (as explained above), and standard default assumptions:

$$\frac{0.0004 \text{ mg/kg/day} \times 70 \text{ kg} \times 0.2}{2 \text{ L/day}} = 2.8 \times 10^{-3} \textbf{ mg/L}$$

Rounding to one significant figure gives an IGC 3 µg/L.

Where:

0.0004 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 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 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.

A laboratory survey and literature review were conducted for Tri-ortho-cresyl phosphate. The literature survey yielded several peer reviewed references for MDL values of 20 ng/L to routine quantification values from environmental assessments of 0.3 to 4.3 ng/L sensitivity levels. In addition, USGS method O-1423-01 has a reporting limit (RL) of 60 ng/L for the flame retardant tri-phenyl phosphate which is structurally similar to this parameter. Labelled isotopes of the analyte could be used to further enhance the sensitivity for this parameter. The value of 20 ng/L was selected from this review. As explained above, a more conservative detection limit is established using a multiplier of five. 5 X 20 ng/L or 0.1 ppb.

Therefore, the Department has established a PQL of 0.1 ppb for Tri-ortho-cresyl phosphate.

Conclusion: Based on the information provided above (and cited below), the Department has established an interim specific ground water quality criterion of 3µg/L and a PQL of 0.1 µg/L (ppb) for Tri-ortho-cresyl phosphate. *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 Tri-ortho-cresyl phosphate is 3 µg/L .**

Technical Support Documents: *Interim Specific Ground Water Quality Criterion Recommendation Report for Tri-ortho-cresyl phosphate* Alan H. Stern, P.h.D. D.A.B.T., NJDEP, November 16, 2010; *Procedure for Describing Process for Development of Analytical Practical Quantitation Levels (PQLs) for Tri-ortho-cresyl phosphate*, R. Lee Lippincott, Ph.D., NJDEP, March 19, 2014

References: Prentice DE, Majeed SK (1983). *A subchronic study (90 day) using multiple dose levels of tri-ortho-cresyl phosphate (TOCP): some neuropathological observations in the domestic hen.* Neurotoxicology. 4:277-82.

See: National Environmental Methods Index (NEMI) for the published USEPA methods

http://www.nemi.gov/ and the following references for the PQL determination;

(1) Williams DT, Lebel GL; Bull Environ Contam Toxicol 27: 450-7 (1981)

(2) Williams DT et al; Chemosphere 11: 262-76 (1982)

(3) Ishikawa S et al; Water Res 19: 119-25 (1985)

(4) Takimoto K et al; Atmos Environ 33: 3191-3200 (1999)

(5) Marklund A et al; Environ Sci Technol 39: 3555-3562 (2005)

(6) van der Veen I, de Boer J; Chemosphere 88: 1119-53 (2012)