Ground Water Quality Standard for Strontium

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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 1500 µg/L and PQL of 5 µg/L (ppb) for Strontium. The basis for this criterion and PQL are discussed below. Pursuant to N.J.A.C. 7:9C-1.9(c), rounded to one significant figure, **the applicable constituent standard is 2000 µg/L.**

Strontium

Background: Strontium is a metal found in the ores celestite and strontianite. It is mined in the United Kingdom, Tunisia, Russia, Germany, Mexico and the United States. Strontium is used in color television tubes, to make red flares in fireworks and in phosphorescent paint.

Reference Dose: The USEPA IRIS database currently contains a Reference Dose (RfD) for strontium (Sr) of 0.6 mg/kg/day. This value was entered into IRIS in 1992. In 2014, the USEPA Office of Water published a revised Draft Health Effects Support Document for Strontium (available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OW-2012-0155-0008). The RfD derived in the USEPA's 2014 document is 0.3 mg kg/day. It is based on adverse alterations in bone calcification during post-natal bone growth (Marie et al., 1985). This study is a better basis for the derivation of an RfD for strontium than the older IRIS value because of clear reporting of doses; a longer duration of exposure; better quantitative reporting of effects; and ability to apply benchmark dose modeling to the dose-response data in order to more accurately assess a point of departure.

Therefore, the Reference Dose used as the basis of the ground water quality criterion for strontium is 0.3 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 0.3 mg/kg/day as the Reference Dose (as explained above), and standard default assumption for the relative source contribution. However, because the adverse effects addressed by this RfD are specific to earlier life stages when daily drinking water intake on a body weight basis (L/kg/day) is greater than during adulthood, EPA (2014, Appendix B) applied an age adjusted time-weighted average drinking water intake for birth to 21 years of 0.040 L/kg/day.

[300 µg//kg/day]/(0.040 L/kg/day) x 0.2 = **1500 µg/L**

Where:
300 µg/kg/day = the RfD
0.2 = assumed relative source contribution
0.040 L/kg/day= the age adjusted time-weighted average 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 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.

Strontium appears as a listed parameter in National Environmental Methods Index (NEMI). The upper confidence interval (UCL) for a 7 lab inter-laboratory MDLs is 0.57 µg/L. As explained above, a PQL can be established by multiplying the limit of detection by five, 0.57 ug/L x 5 = 3 ug/L (rounded to one significant figure) that can be achieved by 96% of the labs using USEPA Method 200.7. However, current calibration procedures for the state primacy laboratory and Site Remediation Program contractual laboratories use a reporting limit of 5 ppb for this parameter. The PQL of 5 µg/L is recommended to be consistent with these current calibration practices. Therefore, the Department has established a PQL of 5 µg/L for strontium.

Conclusion: Based on the information provided above (and cited below), the Department has established an interim specific ground water quality criterion of 1500 µg/L and a PQL of 5 µg/L (ppb) for strontium. *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), rounded to one significant figure, **the applicable constituent standard for strontium is 2000 µg/L** .

Technical Support Documents: *Interim Specific Ground Water Quality Criterion Recommendation Report for Strontium*, Alan Stern, Dr.P.H., NJDEP, April 29, 2015; *Procedure for Describing Process for Development of Analytical Practical Quantitation Levels (PQLs) for Strontium*, R. Lee Lippincott, Ph.D., NJDEP, June 4, 2015.

References: EPA, 2014, Draft Health Effects Support Document for Strontium (available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OW-2012-0155-0008

Marie PJ, Garba MT, Hott M, Miravet L.(1985) Effect of low doses of stable strontium on bone metabolism in rats.