Cesium Presence in Moss Samples

A report written by Norm Buske and issued by The RadioActivist Campaign (TRAC) and Concerned Citizens for Nuclear Safety (CCNS) in late October 2003 cites samples of aquatic moss from Spring 4A and the Pajarito Stream containing "...consistently low levels of cesium-137 *of LANL origin* [emphasis added]. This is the first confirmed detection of LANL radioactivity entering the Rio Grande from a groundwater pathway." The report also cited moss samples from other sites as testing positive for Cs-137 and said samples showed Cs-137 "...in the range of 0.01 to 6 picocuries/kilogram..."

The Laboratory's response

- TRAC's reported Cs-137 levels in moss are within the range of fallout levels for plants observed in northern New Mexico, and fallout is the likely Cs-137 source. The concentrations reported by Buske do not pose a danger to human health, as the TRAC report states: "Cesium-137... is... at levels far too low to be considered a public health concern." However, the Laboratory remains committed to ensuring the health and safety of its employees and the communities in which we live and work; we will fully cooperate with the New Mexico Environment Department and any other official agency follow-up into the reported findings.
- One of the strongest cases against the report is that cesium-137 is a common radioactive element that was distributed globally during atmospheric nuclear tests. The moss likely accumulated cesium from worldwide fallout, not from ground water.
- When converted to grams, the moss measurements made by Buske are 0.0024 to 0.0058 picocuries per gram. TRAC's highest Cs-137 concentration in moss was 0.0058 pCi/g wet. The Laboratory's measured fallout back-ground level for crops across northern New Mexico, based on decades of sampling, is about 0.0025 to 0.015 pCi/g wet, depending on the plant. Therefore, the amount measured by TRAC is within the background concentration for plants in northern NM.
- A highly regarded and cited text on environmental radioactivity (*Environmental Radioactivity* by Merril Eisenbud and Thomas Gesell, Academic Press, 1997) indicates that the dominant Cs-137 uptake mechanism in plants is by foliar accumulation from worldwide fallout, while root uptake is insignificant. Therefore, for the TRAC report to state that LANL is the source of the Cs-137 is, at best, a negligently hasty conclusion.
- The argument of a fallout source for Cs-137 in moss is supported by the fact that decades of environmental sampling show that soils around northern New Mexico have levels of cesium from worldwide fallout of about 0.6 to 1.7 picocuries per gram, which is one hundred times the levels detected in the moss.
- Numerous scientific studies have shown that Cs-137 remains in soil long after fallout deposition, because it absorbs or "sticks" strongly to rocks, clays and soils. As a result, Cs-137 does not move effectively into groundwater, nor is it easily taken up through plant roots. Therefore, the assumption that Cs-137 has moved great distances to the environs of the Rio Grande by way of a groundwater pathway is highly suspect.
- A short half-life of about 30 years, combined with strong adsorption, ensures that Cs-137 does not move any distance through groundwater in amounts sufficient to create a significant health effect (*Aqueous Environmental Chemistry*, Donald Langmuir, Prentice Hall, 1997).
- TRAC reports a Cs-137 value in Spring 4A water of 0.01 pCi/L. This is far below LANL's usual detection limit of 3

Laboratory staff members routinely sample and test for pollutants in springs.

pCi/L. The TRAC value is also far below regulatory limits, as their report states. DOE's derived concentration guide for Cs-137, intended to protect the public from any impact of DOE's activities on drinking water, is 120 pCi/L.

- The Environmental Protection Agency does not regulate Cs-137. Under the Atomic Energy Act, authority for regulation of Cs-137 for radiation protection of the public and environment belongs to the Department of Energy and Nuclear Regulatory Commission. DOE's derived concentration guide for Cs-137, intended to protect the public from any impact of DOE's activities on drinking water, is 120 pCi/L. This value is based on a 4 mrem dose and continuous exposure (consumption of 2 liters/day). Both agencies' public exposure limits on activity of Cs-137 in effluent releases are based on a 100 mrem public dose, using different exposure scenarios. DOE's DCG for public dose (100 mrem), which governs effluent releases and assumes occasional exposure, is 3000 pCi/L. NRC regulations contained in 10 CFR 20 limit Cs-137 in discharges to unrestricted areas to 1000 pCi/L. For releases to sewer systems, NRC's limit is 10,000 pCi/L.

- If Cs-137 traveled through groundwater to a spring along the Rio Grande, several non-adsorbing chemical constituents that usually reflect groundwater contamination, such as nitrate or tritium, would accompany and precede Cs-137. Tritium and nitrate values in Spring 4A indicate the spring water reflects background aquifer conditions unaffected by Laboratory discharges. The tritium values show that Spring 4A water has been isolated from surface effects for hundreds of years.

- TRAC's news release refers to a Cs-137 value from Spring 4A, measured by LANL in 2000, of 9.1 pCi/L. Environmental monitoring measurements rely on a body of data rather than on a single value, which could be affected by problems during sampling or laboratory analysis. Since 1995, LANL has made 121 Cs-137 measurements in White Rock Canyon springs, with only two detections in the data set. Nine of these measurements (with only one detection) were from Spring 4A. Thus, the body of data does not support presence of Cs-137 in any White Rock spring, at an average detection limit of 3 pCi/L..

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