Comm - 034

Utah Department of Environmental Quality
Division of Radiation Control
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To: DRC
From: Gary M. Sandquist, PhD, PE, CHP

Subj: Licensing Requirements for Land Disposal of Radioactive Waste – Technical Analysis

I have responded to Stephen Nelson (BYU Geochemist) recent statement concerning the impact of a dramatic rise of the Great Salt Lake (circa 50,000 years) upon the integrity and dissolution of depleted uranium (DU) in encroaching waters impacting the Clive Disposal Site.

Attached is a calculation entitled
"Analysis –Uranium in expanding GSL that intercepts Clive Site"

The conclusion of the analysis utilizing USGS and Utah Geological Survey Data and References is the following.

If GSL expands to reach Clive Site total "possible" dissolved U in water is 0.25 ppm DU in water.

Average Utah soil contains 2.8 ppm of natural U or 11 times more U than water with dissolved U from rising GSL that reaches Clive Site. (Note: DU has about 60% radioactivity of natural U)

Even if entire US inventory of DU (estimated at ~600,000 MT) were disposed at Clive then maximum possible U content in this expanded GSL would be 2.5 ppm or still less than UT soil average.

Worldwide average uranium content is 3 ppm in soils, deep sea clays, and stream sediments.

However, DU metal is insoluble in water as are oxidized products of DU, viz. UO_2 & U_3O_8.

U normally exists as deposits of insoluble sediments in water bodies.

Sincerely yours

Gary M. Sandquist

ANALYSIS- URANIUM IN EXPANDING GSL THAT INTERCEPTS CLIVE SITE (Gary Sandquist)

About 49,000 tons of DU are stored in Clive and an additional 11,000 tons of DU are awaiting storage for a total inventory of 60,000 of DU.

This material is disposed of at Clive at a minimum depth of 10 feet below top of cell,

The current elevation of GSL is 4194 ft above sea level and has a water volume of about 11 million acre feet within an area of 969 square miles. (UT Geological Survey Data)

The elevation of Clive site is 4288 feet or 94 feet above current level of GSL.
(Data source: U.S. Geological Survey Maps, GSL and Clive-Aragonite.

If GSL is inundated and a return of Lake Bonneville occurred then water level at 4288 feet would provide a surface area of about 4500 sq miles (UT Geological Survey Data Topographical Maps)

So total area for expanded lake = 4500 sq miles + 969 sq miles = 5400 sq miles

Total water volume for this = 1.7 E8 acre-ft (added water) +11E6 acre-ft (present GSL) = 1.8 E8 acre-ft

1.8 E8 acre feet x 43,560 cubic feet/acre-feet = 7.8 E 12 cubic feet

Water has a density of 0.031 tons/cu ft

So water mass in this expanded GSL = 7.8 E 12 cubic feet x 0.031 tons/cu ft = 2.4 E11 tones

Clive disposal of DU is 60,000 tons so = 60,000 (tons DU)/2.4 E11 (tons H2O) = 0.25 ppm U in water.

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Even if entire US inventory of DU (estimated at ~600,000 MT) were disposed at Clive then maximum possible U content in this expanded GSL would be 2.5 ppm or still less than UT soil average.

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However, DU metal is insoluble in water as are oxidized products of DU, viz. UO2 & U3O8. U normally exists as deposits of insoluble sediments in water bodies.

Physical Characteristics of Uranium Compounds (CRC Handbook Chemistry & Physics)

Compound	Melting Point (°C)	Crystal Particle (Density (g/cm^3))	Bulk (Density (g/cm^3))	Solubility in Water at Ambient Temperature
U_3O_8	Decomposes to UO2 at 1,300	8.30	1.5 - 4.0	Insoluble
UO_2	2,878 ± 20	10.96	2.0 - 5.0	Insoluble
Uranium metal	1,132	19.05	19	Insoluble

Counter to popular belief, main risk of exposure to DU (or natural U) is chemical hazard from uranium oxide rather than radioactivity. A microgram of U in body has an alpha activity of less than 1 disintegration per minute (uranium is a very weak alpha emitter).