Utah Department of Environmental Quality
Division of Radiation Control

Fact Sheet

May 2015

Safety Evaluation Report (SER)
Eight Unresolved Issues

The DEQ evaluation found that the Energy*Solutions* depleted uranium (DU) performance assessment (PA) has not satisfied all of the Department's concerns regarding the disposal of large quantities of DU at Energy*Solutions'* Clive facility. Brief explanations of the eight topics that are not resolved at this time can be found below.

1. **Evapotranspiration (ET) cover**

   The evapotranspiration cover limits water contact with the DU waste and also inhibits the release of radon gas from the subsurface.

   DEQ proposed additional HYDRUS simulations because there are still a number of unresolved concerns related to the interface between HYDRUS, a modeling program that analyzes water flow and transport, and GoldSim, a probabilistic Monte Carlo simulation used to model complex environmental conditions. DEQ is concerned that problems with the modeling may be leading to unrealistically low infiltration rates as well as other issues. Appendix B, Volume 2, of the SER provides a more detailed discussion and specific examples of these concerns.

2. **Infiltration**

   Infiltration rates are important for determining the movement of water over DU in saturated and unsaturated conditions, and the subsequent release and transport of radionuclides from the disposal site.

   To properly estimate infiltration rates, the design and modeling of new cover systems must account for expected degradation of the shallow portions of these cover systems over time (soil permeability). A variety of physical and biological processes combine to cause this degradation, including frost heave, other freeze-thaw activity, wet-dry cycling, distortion, insect and animal burrowing, plant root intrusion, and other disruptive processes. Additional modeling of the ET cover infiltration rates must be conducted because DEQ is unable to conclude if the infiltration rates predicted by the GoldSim model are reliable or representative of future conditions up to 10,000 years.

3. **Erosion of cover**

   The "gully model" is a simplistic model of gully erosion and landscape changes that provides the basis for discussion on the importance of gullies in exposing DU waste.

   Energy*Solutions'* analysis does not consider associated effects such as biotic processes, effects on radon dispersion, or local changes in infiltration within the gullies. DEQ requests that Energy*Solutions* demonstrate through modeling that, among other things, gullying through the cover system will not appreciably affect infiltration and contaminant transport. DEQ is also concerned that the SIBERIA model, which simulates the evolution of landscapes over time through erosion and runoff and was used by Energy*Solutions* to model the flow of water and transported soils from the top slope above the waste and the side slopes of the waste embankment, may underestimate the rates of water flow to erosion of the side slopes, the shoulders, and adjacent portions of the top slope of the waste embankment.

Contact

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Public Informational Meetings

Wednesday, May 6, 2015
5:00 PM. to 8:00 PM.
Tooele County Courthouse
47 South Main Street,
Tooele, Utah

Thursday, May 7, 2015
5:00 PM. to 8:00 PM.
Utah Department of Environmental Quality, Board Room #1015
195 North 1950 West,
Salt Lake City, Utah

DEQ Website
www.deq.utah.gov/businesses/E/EnSolutions/depleteduranium/performassess/index.htm

DEQ Social Media

Blog

www.dequtah.blogspot.com/

Facebook

www.facebook.com/udeq

Twitter

www.twitter.com/UtahDEQ

4. **Frost damage**

   Freezing can cause substantial damage to radon barriers and the soils above them if sufficiently cold temperatures reach the barriers. Repeated cycles of frost heave (upward swelling of soil during freezing conditions) can move gravel in soil to the ground surface. Accumulated gravel of even several centimeters at the surface can greatly inhibit evaporation. This can increase infiltration rates, resulting in faster rates of contaminant transport. The upward movement of soil water in response to freezing conditions in the overlying soil would adversely impact infiltration of water and perhaps the release of radon.

   DEQ requests that Energy*Solutions* account in its modeling for substantial disruption of near-surface layers above and within the radon barriers by frost, with accompanying decreases in evapotranspiration and increases for initially low-permeability soil which could affect modeled infiltration and radon release rates. Energy*Solutions* must model infiltration under realistic long-term assumed site conditions before DEQ can consider this requirement to be resolved

5. **Effects of biologicals on radionuclide transport**

   Biointrusion — the impacts of plants, insects, and animals on waste barriers or covers — can dramatically increase downward infiltration rates through waste covers.

   Energy*Solutions* has not shown that the cover system is sufficiently thick or designed with adequate materials to protect the cover system or the underlying waste in the embankments against deep rooting by indigenous greasewood/other plants or against biointrusion by indigenous ants or mammals.

6. **Clay liner**

   The DU will be placed on a protective cover over a two-foot-thick clay liner.

   DEQ staff are concerned that Energy*Solutions* does not account for the deterioration of the clay liner over time, which the U.S. Army Corps of Engineers has shown to be a nearly universal occurrence. DEQ has concerns with Energy*Solutions'* approach to evaluating the deterioration of the clay liner over time, particularly through freeze-thaw cycles.

7. **GoldSim quality assurance**

   EnergySolutions used the GoldSim modeling program to carry out the probabilistic performance assessment of waste disposal to facilitate simulation of radionuclide transport in soils, water, air, animals, and plants.

   DEQ is trying to better understand the discrepancy between the HYDRUS infiltration outputs and the GoldSim inputs. This discrepancy creates a dilemma, since the infiltration rates are the foundation for contaminant fate and transport and dose predictions.

8. **Deep time analysis**

   Deep time is the time scale of geologic events that is beyond most human events or even human comprehension. Because DU reaches its peak dose at approximately 2 million years, modeling scenarios for DU disposal need to take into account projected geologic changes over deep time, including 100,000 year global glacial cycles and the formation of pluvial lakes in proposed disposal sites.

   DEQ believes that there are still open questions related to ground surface radon fluxes. Recent calculations performed by DEQ/SC&A have shown that the ground surface radon fluxes after an intermediate lake recedes could be substantially above those presented in the Energy*Solutions* revised Deep Time Analysis. Comparing the calculated post-intermediate lake inside radon concentration to national, state, and local radon concentrations shows the calculated concentration to between one to two orders of magnitude larger, and it could be larger still with a different lake sedimentation rate distribution.