Meeting Report:

Utah Department of Environmental Quality, Division of Radiation Control Open House on DEQ Review of the Energy*Solutions* Depleted Uranium Performance Assessment November 13, 2013,

and

Information Meeting with HEAL and Energy*Solutions* Representatives November 14, 2013,

Salt Lake City, Utah

Prepared for

State of Utah

Division of Radiation Control

Contract No. 146061

Prepared by

SC&A, Inc.

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Contents

Appendices (see separate PDF file)

1. Open House – November 13, 2013

Purpose

On November 13, 2013, 4:00–6:00 p.m., Utah Department of Environmental Quality (DEQ) hosted an Open House at its offices to give interested members of the public an opportunity to ask questions about the review process for the Energy*Solutions* Performance Assessment for the disposal of depleted uranium (DU).

Information Provided by DEQ

DEQ provided the public with posters, handouts, and the opportunity to ask questions and discuss concerns with DEQ and contractor technical staff and DEQ project management.

Posters

Five posters were arranged on easels around the perimeter of the room, to be read in clockwise order. There was ample space around each poster for multiple participants to pause to read or ask questions of DEQ and contractor technical staff.

Participants entering by the main door first encountered an overview of the project written on the whiteboard immediately to the left of the first poster. The whiteboard text was:

> Overview
>
> 1. Under DEQ regulations, Energy*Solutions* has submitted a Performance Assessment to DEQ to dispose of depleted uranium at the Energy*Solutions* site in Clive, UT.
> 2. DEQ is reviewing the Performance Assessment to decide the suitability of disposing of large quantities of depleted uranium in Clive.
> 3. The first step in the DEQ review process is to determine whether the Performance Assessment is complete – the "Completeness Review."

The topics of the five posters were as follows (see Attachments A–D for copies of the posters):

- Poster 1: Depleted Uranium (DU) Performance Assessment (PA) Review – DEQ's review timeline
- Poster 2: Depleted Uranium (DU) Waste – What is DU?; explanation of daughter products; photos of current DU storage
- Poster 3: Conceptual Site Model for the Proposed Depleted Uranium Low Level Waste Facility – cross-section graphic of storage facility, including external factors affecting the integrity of the barrier
- Posters 4 and 5: Selected Major Findings of the Completeness Review of the Clive Depleted Uranium Performance Assessment Submitted by Energy*Solutions* (two posters) – a summary of SC&A's main findings from the completeness review

Handout and Email Sign-up

DEQ provided a handout at the entrance: "Utah Department of Environmental Quality Division of Radiation Control, Frequently Asked Questions: Depleted Uranium Performance Assessment"

- Information in this handout included DEQ contacts, Web, Twitter, and Facebook links and text answering the questions: What is Depleted Uranium (DU)? How Does Depleted Uranium Waste Change Over Time? What is a Performance Assessment? What is the Tentative Timeline for DRC Review of the Performance Assessment?

Also at the entrance, participants could sign up to receive emails about future events related to the application.

Personnel

The following personnel were distributed around the room to answer participant questions at each poster and in general:

- DEQ & SC&A technical staff
- DEQ management
- DEQ and SC&A facilitator and communications staff

DEQ and SC&A facilitator and communications staff greeted participants at the door or at one of the posters and introduced them to the appropriate technical or project management personnel to answer their questions.

DEQ communications staff facilitated media needs.

How Participants and DEQ/SC&A Personnel Used the Open House Resources

Posters:

- Most participants spent considerable time reading each poster, usually in the intended order.
- During the course of explaining the disposal plans, DEQ/SC&A technical staff frequently led participants from the photo of current DU storage in Poster 2 to the graphic of the proposed storage in Poster 3.
- Media representatives were particularly interested in the graphic in Poster 3 (the cross-section of the proposed facility); at least one media representative requested an electronic copy.
- KUTV used images of Posters 2 and 3 and the whiteboard overview in its November 13 10 p.m. news report on the Open House (http://www.kutv.com/news/top-stories/stories/vid_8134.shtml)

Personnel:

- Most participants spoke with DEQ/SC&A personnel.
- Around half of the participants did not actively approach DEQ/SC&A personnel but made use of the opportunity to speak to them when introduced.
- A few participants declined the offer to speak with DEQ/SC&A personnel.

- Film and radio reporters interviewed DEQ and SC&A personnel on video or audio for later broadcast. (For KUTV's use of these interviews for the 10 p.m. news that evening, see http://www.kutv.com/news/top-stories/stories/vid_8134.shtml)

Participants

Attendance comfortably filled the room without crowding (see DEQ Communications sign-up sheet for a conservative count).

Participants began arriving around 3:30 (half an hour before the formal start of the Open House) and continued until around 5:30.

Many participants stayed for at least 45 minutes.

Types of Participants

Participants represented a broad range of the public:[1]

- Residents of communities around the Energy*Solutions* facility in Clive, Utah
- Local officials, including county commissioners, from towns near Clive
- Member of Utah State legislature
- State employees (other than project staff)
- Media – radio & TV reporters
- Other interested Utah residents (not self-identified with towns near facility)

Participant Questions and Comments

Participants expressed a range of concerns, including both support for and opposition to the application. The following sections describe typical comments and questions alphabetically by topic.

Definitions

- What is DU? Some participants confused it with spent nuclear fuel.
- Participants were confused by various acronyms on the posters.
- What is the Compliance Review?
- What is a Safety Evaluation Report?

Environmental Impacts

- Is this method of storage safe in the long term? Often combined with various questions about the site geology.
- This is not safe in the long term.
- Why can't the DU go to some other state with safer geology?
- If DU gets more radioactive over time, how can they take it at all?
- Participants were typically disconcerted by the photos of current DU storage on Poster 2. At least one person thought they represented the proposed storage. Participants who were taken from Poster 2 to Poster 3 by DEQ/SC&A technical staff appeared to be impressed by the contrast.

[1] This list is based on conversations with participants during the Open House. The DEQ email sign-up sheet did not collect information about affiliation.

Facility

- How will the waste be stored?
- Questions about the storage science and reliability.
- One person was under the impression that the waste at the Clive site was just indiscriminately placed into open pits or on the ground without any sort of packaging.

Healthy Environment Alliance of Utah (HEAL) Meeting November 14, 2013

- Some participants had heard about the meeting scheduled with HEAL for the next day and were concerned that this environmental group in opposition to the project was getting special treatment.

Jobs

- Towns near the Clive facility need the new jobs that the proposed facility will provide.

Timeline/Schedule

- When did this process start?
- How long will the process take?
- What are the next steps in the process?
- Why has the process taken so long to get moving after the June 2011 performance assessment submittal by Energy*Solutions*? (a frequently asked question)
- The review process is taking too long.
- Will there be any other public meetings on this subject?
- Please have public meetings in the communities close to Clive.
- There was some confusion about which item in Poster 1 is DEQ's technical decision. One participant suggested DEQ add a flowchart to clarify.

2. Information Meeting with HEAL – November 14, 2013

Purpose

To give HEAL representatives the opportunity to collect the information that was available at the Open House and ask questions. Held because all members of the HEAL organization had a scheduled conflict with the Open House. Energy*Solutions* representatives also attended at their own request.

Information Provided by DEQ

The meeting took place seated around the table in a conference room in the DEQ offices.

Posters

The posters from the Open House were arranged around the walls of the room. During the meeting, the HEAL representatives took turns walking around and reading them while the other asked questions.

Personnel

- DEQ project management
- DEQ and SC&A technical staff.

HEAL Questions and Comments

The HEAL representatives focused on the GoldSim model and on when and how the process would allow HEAL's input. The group discussed the following topics (in alphabetical order):

GoldSim Model

- The public dashboard does not appear to allow adding scenarios. Is it possible to add scenarios? [DEQ/SC&A explained that the dashboard can't add scenarios but the full model can.]
- Will HEAL be able to suggest additional scenarios to be run in the model? [DEQ: Yes, if they are technically justified.]
- A technical discussion with DEQ/SC&A about what the full model can and cannot do.

Opportunities to Comment and Suggest GoldSim Scenarios

- How and when in the process can HEAL comment and suggest additional modeling scenarios? [DEQ provided information about the project schedule and emphasized that the earlier the technical staff can receive proposed scenarios, the better. All proposed scenarios must be technically justified by HEAL.]

SC&A

- Who is SC&A? How were they chosen?
- Does SC&A's work for the U.S. Department of Energy make them advocates for Energy*Solutions*? [Dr. Zeitoun explained that SC&A has well-established policies that ensure no conflict of interest at both corporate and individual staff levels.]

Appendices

Appendix A: Poster 1

DEPLETED URANIUM (DU) PERFORMANCE ASSESSMENT (PA) REVIEW

Performance Assessment

- A performance assessment (PA) is required in Utah for "any facility that proposes to land dispose of significant quantities of concentrated depleted uranium (more than one metric ton in total accumulation) after June 1, 2010."[1]
- DRC requires that the "performance assessment" demonstrate "that the performance standards specified in" Federal and State rules "will be met for the total quantities of concentrated depleted uranium and other wastes, including wastes already disposed of and the quantities of concentrated depleted uranium the facility now proposes to dispose. . . . the compliance period shall be a minimum of 10,000 years. Additional simulations shall be performed for the period where peak dose occurs and the results shall be analyzed qualitatively." [1]
- The PA evaluates (i) potential radioactive exposures to the general public or inadvertent intruders, and (ii) site stability. This is done through a site-specific model and an analysis that employ science and engineering approaches. The model and analysis are based on guidance from the Nuclear Regulatory Commission (NRC).
- A 960-page PA was submitted by the Licensee, Energy*Solutions* (ES), for disposal of depleted uranium (DU) waste at the Energy*Solutions*' Clive LLW Disposal Facility. It was developed with the assistance of the Licensee's consultants.

Completeness Review and Open House

- The DEQ/DRC completed a PA completeness review (CR) with the assistance of subject matter experts. Comments were 61 pages long.
- The Licensee is currently working on its response.

Interrogatories

- When responding to the CR, the Licensee should supply all missing or incomplete information to the DEQ/DRC.
- The DEQ/DRC will review the revised PA for technical accuracy and regulatory compliance. It will send a Round 1 Interrogatory with any concerns described in written form to the Licensee.
- Based on a review of the Round 1 response, the DEQ/DRC may submit a Round 2 Interrogatory to the Licensee.

DEQ/DRC Preliminary Decisions

- When the Interrogatory review is complete, then the DEQ/DRC will create a proposed Safety and Evaluation Report (SER), a proposed license amendment, and a proposed Director Determination (DD). The DEQ/DRC will post these on the Internet and share them with the public.

Public Participation Process and Final DEQ/DRC Determination

- A 45-day public comment period will then start. During this public comment period, a public meeting will be held to solicit public input.
- The DEQ/DRC will review all public comments, seek to resolve issues, and create a public participation summary (PPS).
- The DRC Director will determine whether to deny, approve, or approve with license/permit conditions the ES proposal for DU disposal.

Footnote: [1]Utah Administrative Code R313-25-5(a)

Appendix B: Poster 2

DEPLETED URANIUM (DU) WASTE

What is depleted uranium waste?

- Large quantities of depleted uranium (DU) waste are being considered for disposal at Energy*Solutions*' Low-Level Waste Disposal Facility at Clive, Utah. This DU waste is mildly radioactive uranium oxide produced as a waste product during uranium processing.
- DU has lower radioactivity in it than natural uranium (about 60%), and much lower radioactivity than the enriched uranium used in power reactors; this difference arises from the fraction of uranium isotopes (particularly U-235, and U-234) found in the different types of uranium:

Isotope	Natural Uranium	Enriched Uranium*	Depleted Uranium
U-234	0.0055%	0.05%	0.001%
U-235	0.72%	3-5%	0.2-0.3%
U-238	99.275%	95-97%	99.7-99.8%

An isotope is a form of an element that has the same chemical properties as other forms of the element but different physical properties. As seen above, natural uranium is estimated to contain about five to six times as much U-234 and two to four times as much U-235 as DU.

Ingrowth of DU Daughter Products

- Uranium decays and forms decay products that increase in radioactivity over time. This is called ingrowth.
- Uranium isotopes have long half-lives (e.g., millions or billions of years), so DU itself retains its radioactivity for very long times.
- As DU slowly decays, however, daughter products that it generates include thorium-230, radium-226 and radon.
- These daughter products initially grow and increase in radioactivity at a rate faster than they decay. The total daughter-product radioactivity will gradually increase over time until it peaks after about one to two million years. At that point, each daughter product will be decaying as fast as it is generated. Its radioactivity then will equal that of the long-lived uranium. This condition is called secular equilibrium.
- The radioactivity at the time of secular equilibrium may be about 14 times the initial radioactivity of the DU. Although waste classification is performed prior to shipment and disposal, radium-226 concentrations may increase beyond Class A and Class C values after a lengthy time.
- Since DU daughter products experience ingrowth, it is important for a Licensee to assess how much exposure risk may exist over that time as a result of potential environmental releases from a waste embankment. Environmental releases may potentially occur through air, water, soil or biota. The radiation dose that a representative person could potentially receive can be simulated or modeled with a computer to some extent. The modeling done here will be based on a probability approaches.

*Estimated values based on reported percentages for natural uranium and depleted uranium, and reported enriched uranium U-235 percentages. It is assumed that, as generally reported, 10 pounds of depleted uranium are produced per pound of enriched uranium produced.

What does a depleted uranium hexafluoride cylinder look like?

- A picture is worth a thousand words! The pictures below show typical depleted UF_6 storage cylinders. The picture on the left shows a new cylinder; the picture on the right shows cylinders that exhibit external corrosion from outdoor storage.

- Text and photos above retrieved 5 Nov 2013 from http://web.ead.anl.gov/uranium/faq/storage/faq14.cfm
- Note: a relatively small fraction of depleted uranium is also stored in smaller (e.g., 55-gal or 80-gal) metal drums.

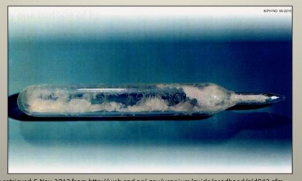
How are depleted uranium cylinders currently stored?

- Depleted uranium hexafluoride cylinders are generally stacked two high in concrete, outdoor yards for storage.

- Text and photo above retrieved 5 Nov 2013 from http://web.ead.anl.gov/uranium/guide/prodhand/sld042.cfm

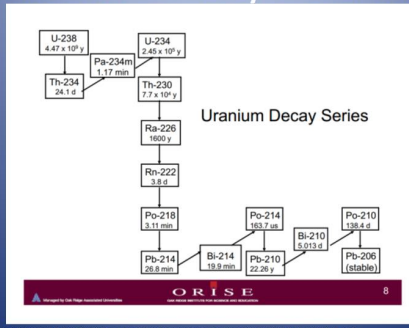
What substances are currently in the DU cylinders?

- Uranium hexafluoride [UF_6] is a white crystalline solid that resembles rock salt.



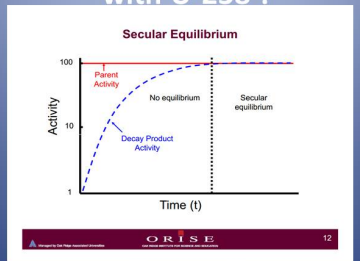
- Text and photo above retrieved 5 Nov 2013 from http://web.ead.anl.gov/uranium/guide/prodhand/sld042.cfm
- The uranium hexafluoride must be "deconverted" to uranium oxide before it can be disposed of in a low-level waste (LLW) disposal facility. Note: most drums from the Savannah River, SC Site and a small fraction of cylinders at the Portsmouth, OH and Paducah, KY sites contain other radioactive contaminants, some of which are long-lived and mobile, which must be assessed for suitability for shallow embankment burial.

What does DU decay to over time?



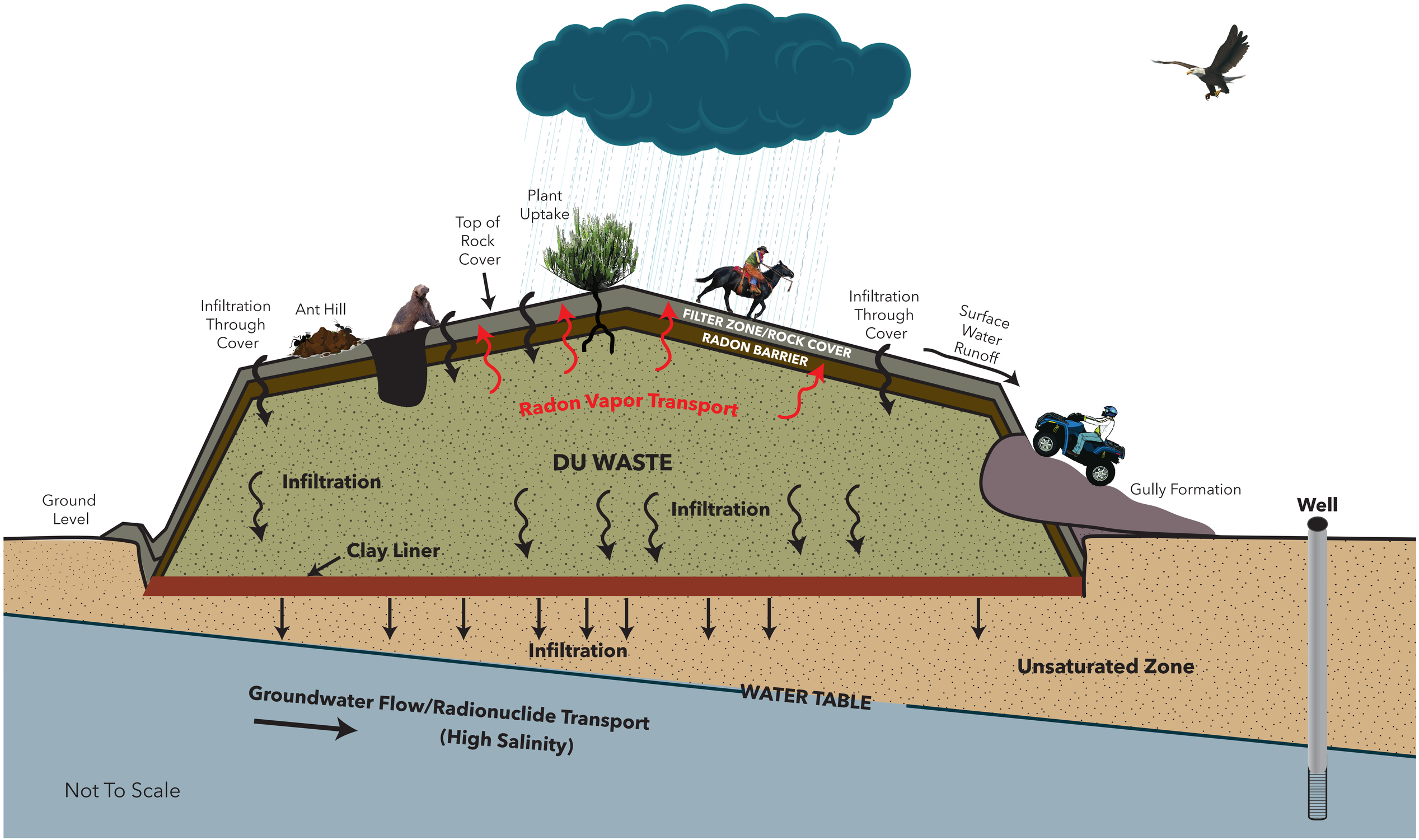
- Diagram retrieved 5 Nov 2013 from http://pbadupws.nrc.gov/docs/ML1122/ML11227A233.pdf
- The numbers represent half lives in microseconds (us), minutes (min), days (d), and years (y).

How long before secular equilibrium with U-238 ?



- Diagram retrieved 5 Nov 2013 from http://pbadupws.nrc.gov/docs/ML1122/ML11227A233.pdf
- The parent in the case of DU would largely be depleted uranium-238, and the representative decay product would be one of DU's daughter products. Secular equilibrium is not attained until about one or two million years. Note: at secular equilibrium, the activity of each daughter product equals that of the parent. There are over a dozen daughter products.

Conceptual Site Model for the Proposed Depleted Uranium Low Level Waste Facility



SELECTED MAJOR FINDINGS OF THE COMPLETENESS REVIEW OF THE CLIVE DEPLETED URANIUM PERFORMANCE ASSESSMENT SUBMITTED BY ENERGY*SOLUTIONS*

This review:

- Considered the submission's completeness when tested against cited Utah regulations and guidance.
- Noted cases of unclear text, inadequate references, or insufficient detail to support statements in text.
- Included general and specific comments on each part of the submission, as summarized below.

Energy*Solutions*, *Utah Low-Level Radioactive Waste Disposal License – Condition 35 (RML UT2300249) Compliance Report,* June 1, 2011

- Provide individual review of each technical issue, rather than using the 2008 license renewal application to justify limiting further consideration of numerous issues.
- Provide sufficient detail on the anticipated large-quantity DU disposal itself rather than relying on a discussion of past licensing activities to justify compliance.

Neptune and Company, Inc., *Final Report for the Clive DU PA Model version 1.0,* June 1, 2011

- Justify the use of values (dollar value per person-rem and discount rates) that differ from those recommended by the NRC to quantify impacts from exposure over many years.
- Provide the basis for using an approach to the inadvertent intruder that differs from NRC policies, in terms of whether the intruder "enters" or "occupies" the site.
- Justify the use of the minimum 10,000-year compliance period despite stated NRC and Utah DRC concerns.
- Provide a rationale for defining the long-term assessment period as 2.1 million years.
- Provide the basis for limiting presentation of sediment concentrations to U-238 and not including U-238 decay products, and for not applying 40 CFR Part 192 soil criteria to the long-term assessment.
- Justify the plan to dispose of material that will exceed the regulatory limits for Class A waste for Ra-226 after about 61,000 years.
- Provide the basis for not including in the PA Model "other wastes" and wastes already disposed of.
- Revise the statement of the intent of the PA to indicate that it is intended to demonstrate that the activity will meet Utah state requirements and NRC performance standards.
- Justify not using the NRC Performance Assessment Working Group's approach to defining a critical group where there are currently no residents living nearby by using an analogue site of comparable geology and climate.
- Provide the reason for not including an analysis of routine operations and likely accidents as required in Utah regulations.

Appendix 2, *Conceptual Site Model for Disposal of Depleted Uranium at the Clive Facility,* May 28, 2011

- Indicate how parameter variability was addressed in the uncertainty analysis.
- Provide the rationale for stating that there will only be non-potable water at the Clive site for 10,000 years.

Disposal and treatment facilities operated by Energy*Solutions*

SELECTED MAJOR FINDINGS OF THE COMPLETENESS REVIEW

- Indicate where canister degradation and corrosion, anthropogenic climate change, radon transport, and other noted topics are evaluated, as stated in the text.
- Clarify the discrepancy in the statement that the scope of the Conceptual Site Model is limited to the disposal of depleted uranium wastes, with the requirement in Utah regulations that the PA also include wastes already disposed of and other wastes.

Appendix 4, *Radioactive Waste Inventory for the Clive DU PA,* May 28, 2011

- Specify the material comprising a mass when citing a material mass.

Appendix 5, *Unsaturated Zone Modeling for the Clive PA,* May 28, 2011

- Provide the reason for not adjusting the distribution of recharge rates to include potential climatic changes (wetter) and subsequent impacts to precipitation, in light of other studies.
- Provide the basis for assuming that, after upper flow barriers are compromised, water will not collect above the clay liner and drive an increase in infiltration rates.
- Justify the exclusion of air-phase advection, in terms of predicting radon flux back to the surface.

Appendix 6, *Radionuclide Geochemical Modeling for the Clive DU PA,* May 28, 2011

- Use the most recent Yucca Mountain and Waste Isolation Pilot Plant studies to define solubilities.

Appendix 7, *Saturated Zone Modeling for the Clive DU PA,* May 28, 2011

- Provide the factors considered when developing the distribution of hydraulic gradients from off-normal conditions.
- Provide the basis for assuming that uniform mixing is likely to occur to a depth of 16 feet below the water table.

Appendix 10, *Erosion Modeling for the Clive PA,* May 28, 2011

- Clarify when gullies are instantaneously formed for the PA.
- Indicate whether the waste is buried only under the top slope for all three burial scenarios.

Appendix 11, *Dose Assessment for the Clive DU PA,* May 28, 2011

- Explain the basis for stating that the assumption that future land use and receptors will be similar to today's is likely conservative (i.e., protective).
- Justify the proposal to use a de minimis (i.e., below regulatory concern) dose value, given the language in the Energy Policy Act of 1992 revoking those NRC policies.
- Explain how "non-standard" receptors (e.g., teenagers, children, infants, pregnant women, Native Americans) were addressed.

Appendix 12, *Decision Analysis Methodology for Assessing ALARA Collective Radiation Doses and Risks,* May 30, 2011

- Ensure that the information in the appendix is consistent with ICRP publications on the ALARA concept.
- Reconsider the use of discount factors other than those recommended by the NRC to account for intergenerational consequences.

Appendix 15, *Sensitivity Analysis Methods ("Machine Learning for Sensitivity Analysis of Probabilistic Environmental Models"),* May 29, 2011

- Provide a discussion of the sensitivity index and partial dependence plots for specific parameters modeled in the DU PA, rather than a generic presentation describing various approaches to sensitivity analyses.

Appendix 16, *Model Parameters for the Clive DU PA Model version 1.0,* May 28, 2011

- Comply with NRC guidance by using 10,000 years as a minimum time frame for the compliance period rather than a maximum.