UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
WASTE MANAGEMENT & RADIATION CONTROL

EnergySolutions' Request for Exemption from R313-25-9(5)

What Does Energy*Solutions* Want?

- To dispose <u>more</u> than 1 metric ton of depleted uranium (DU) metal without doing a performance assessment specifically addressing DU metal

What Does EnergySolutions Have to Demonstrate to the Board to Receive an Exemption?

- That disposal of DU metal does not result in an undue hazard to:
  - Public health and safety
  - Environment
- That the performance objectives will be met

How Can EnergySolutions Show There Are No Undue Hazards Without a Specific DU Metal Performance Assessment?

What Has EnergySolutions Provided to the Board?

- Referenced eight previous technical documents / reports (EnergySolutions claimed to be performance assessments)
- Exemption request letter dated August 24, 2018
- Response to Division's questions dated September 11, 2018
- Presentation to the Board dated September 13, 2018
- Response to the Division's technical consultant's questions dated September 13, 2018
- Letter dated October 15, 2018

Eight Reports

- History and context
- Purpose
- Scope
- Relevance
- Applicability

Rogers & Associates 1990 EnergySolutions Document #1

- Contracted by the State of Utah
- Evaluation of potential health impacts associated with radioactive waste disposal at Clive
  - Included isotopic, diffuse uranium and diffuse DU (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal
  - Exclusive to LARW embankment (NORM-type waste, contaminated soil, structural material)
  - LARW embankment is closed with a final cover

Adrian Brown 1998
EnergySolutions Document #2

- Evaluation of infiltration of precipitation through LARW embankment and transport of contaminants in groundwater
  - Groundwater discharge permit renewal
  - Included isotopic, diffuse uranium (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal
  - Exclusive to LARW embankment (NORM and similar wastes)
  - LARW embankment is closed with a final cover

Whetstone LARW 2000 EnergySolutions Document #3

- Evaluation of infiltration of precipitation through Western LARW embankment and transport of contaminants in groundwater
  - Change in waste to be disposed: NORM to Class A LLRW
  - Included isotopic, diffuse uranium (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal
  - Used in the design for the original Class A embankment

Whetstone Class A, B, C Embankment 2000 EnergySolutions Document #4

- Evaluation of infiltration of precipitation through Class A, B, C embankment and transport of contaminants in groundwater
  - Change in waste to be disposed: to include Class A, B, and C
  - Included isotopic, diffuse uranium (U238, U235, U234) for Class A only
  - Did not address disposal of concentrated DU including DU metal
  - Embankment never constructed to dispose of Class B and C wastes
  - Used in the design for the Class A North embankment

Whetstone (2006)
EnergySolutions Document #5

- Evaluation of infiltration of precipitation through Class A Combined embankment (Class A with Class A North) and transport of contaminants in groundwater
  - Did include isotopic, diffuse uranium (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal
- Embankment application withdrawn prior to approval

Whetstone 2007
Energy*Solutions* Document #6

- Evaluation of infiltration of precipitation through Class A South embankment and transport of contaminants in groundwater
  - Hybrid disposal embankment for LLRW and uranium mill tailings (11e.(2)/LLRW)
  - Did include isotopic, diffuse uranium (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal

- No comprehensive review – withdrawn by Energy*Solutions*

Whetstone 2011
Energy*Solutions* Document #7

- Evaluation of infiltration of precipitation through Class A West embankment and transport of contaminants in groundwater
  - Combined (Class A and Class A North) disposal cells for Class A West proposing a new design
  - Did include isotopic, diffuse uranium (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal
- Revised and resubmitted as Whetstone 2012

Whetstone 2012
Energy*Solutions* Document #8

- Revised and resubmitted analysis of infiltration of precipitation through Class A West embankment and transport of contaminants in groundwater
  - Combined (Class A and Class A North) disposal cells for Class A West embankment
  - Did include isotopic, diffuse uranium (U238, U235, U234)
  - Did not address disposal of concentrated DU including DU metal
  - **"The CAW Embankment LAR does not involve concentrated depleted uranium."** URS 2012 SER

Performance Objectives

- Protection of the general population from releases of radioactivity
- Protection of individuals from inadvertent intrusion
- Protection of individuals during operations
- Stability of the disposal site after closure

Performance Assessment Essential Elements

- Description of the site and engineered system
- Understanding of events likely to affect long-term facility performance
- Description of processes controlling the movement of radionuclides from LLW disposal units to the general environment
- Computation of doses to members of the general population
- Evaluation of uncertainties in the computational results

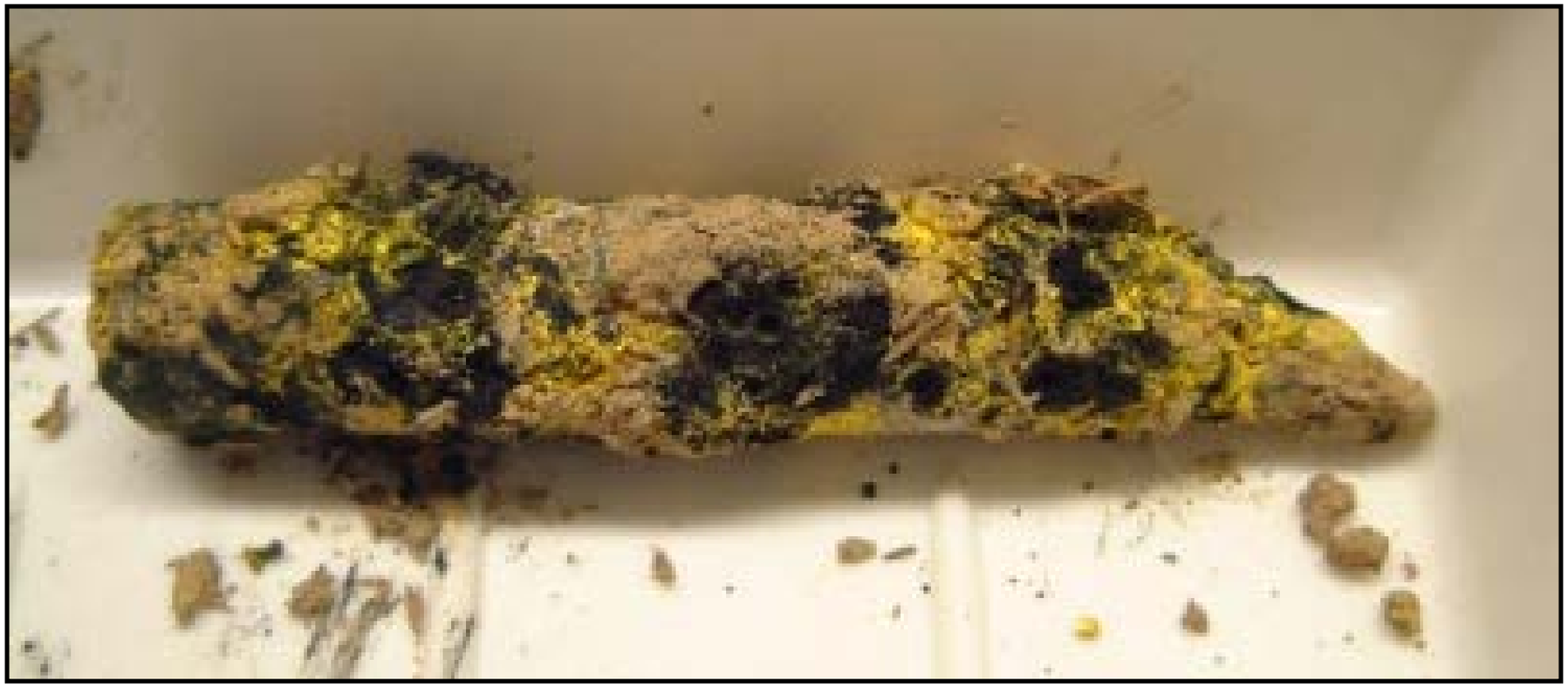
NRC (2000) NUREG 1573, p. I-6

Report	Site & Engineered System	Events Affecting Long-term Performance	Fate and Transport Modeling	Estimation of Dose to Population	Uncertainty Evaluation	Status of the Embankment
Rogers and Associates 1990 LARW	✓	X	GW and other Pathways	✓	X	Closed
Adrian Brown 1998 LARW	✓	X	GW Only	X	X	Closed
Whetstone 2000 LARW/Class A	✓	X	GW Only	X	X	LARW Closed Class A part of CAW
Whetstone 2000 Class A, B and C	✓	X	GW Only	X	X	Not built however design used for Class A North
Whetstone 2006 Class A Combined	✓	X	GW Only	X	X	Withdrawn
Whetstone 2007 Class A South	✓	X	GW Only	X	X	Withdrawn
Whetstone 2011 Class A West	✓	X	GW Only	X	X	Revised
Whetstone 2012 Class A West	✓	X	GW Only	X	X	Active

What Do We Know?

- DU metal is *geochemically unstable*
- DU metal is particularly *reactive* in a moist, *carbonate-rich environment*, such as at Clive
- In such an environment, DU metal can form relatively *soluble* carbonate compounds
- These soluble carbonate compounds or species tend to be relatively *mobile* in the subsurface
- DU metal can react to form *pyrophoric or explosive* substances
- At least two fires associated with handling depleted uranium took place at the Clive Waste Disposal Facility (2002, 2007)

DU Penetrators Can Disintegrate



Armor-piercing DU penetrator after three years in natural environment

https://www.hzdr.de/db/Cms?pOid=26451&pNid=0

DOE Analysis of DU Metal

U.S. Department of Energy Programmatic Environmental Impact Statement (PEIS) on land disposal of DU metal (EIS-0269) (DOE, 1999):

- Reacts with water
- Forms oxides
- Produces heat
- Swells
- Breaks down
- DOE did not allow the disposal of DU metal at its disposal sites

Unresolved Questions

- Is there a potential for DU-metal reaction with water or other waste, or create gases in the Clive embankment?
- Is there a potential for long-term erosion of the cover system and radon gas release?
- What are the uncertainties with the performance of disposal of DU metal in a Clive embankment?
- What are the doses to the general populations and site workers?
- How would fate and transport modeling fit actual disposal embankment conditions for concentrated DU metal and related soluble compounds?

Unresolved Questions

- How do the prohibitions of R313-15-1009(2)(a)(v) through (vii) and License conditions 16 B. through D., which address waste reactive and pyrophoric characteristics, apply to DU metal?
- Are there unresolved issues relative to the DU oxide performance assessment, currently under review, that are applicable to DU metal?
- Are there other unresolved legal issues?

In Order to Grant the Exemption, What Does the Board Need to Find?

- That Energy*Solutions* has provided sufficient technical evidence, without a specific DU metal performance assessment, to demonstrate that the performance objectives will be met
- That the disposal of DU metal will not create an undue hazard to public health and safety or the environment

Recommendation

- The Director recommends the Board deny the exemption request

Basis for Recommendation

- Energy*Solutions* has failed to demonstrate, without a specific DU metal performance assessment, that there are no undue hazards to public health and safety or the environment
- Energy*Solutions* has failed to demonstrate, without a performance assessment, that the performance objectives will be met
- There are significant data gaps in the information provided to the Board and the Director
- There are significant unresolved questions

QUESTIONS?