Regulatory and Technical Issues Associated with Disposal of Large Quantities of Depleted Uranium

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Background & History

- In 1982, the NRC promulgated 10 CFR 61, defining uranium as Class A LLW.
- Analysis supporting the rulemaking only considered the typical or expected types of waste in existence at that time.
- Only small quantities of depleted uranium (DU) generated at that time by the commercial sector prior to 1982.
- In 2003, Louisiana Energy Services (LES) proposed constructing the National Enrichment Facility near Eunice, New Mexico.
- Commissioners directed staff to determine whether or not DU could be safely disposed of in a near surface disposal facility.
Commissioners later directed staff to begin a rulemaking to specify requirements for a site-specific analysis to ensure safe disposal of large quantities of DU (SECY-08-1047).

NRC developed guidance for Agreement States to use if proposals for disposal of DU were requested by a licensee.

Guidance suggested that disposal of DU may be appropriate in a near surface disposal facility under certain conditions (i.e., robust engineered barriers and disposal at greater depths).
Activity Ratios & Period of Hazard

- The risk to public health related to disposal of DU is longer than other types of LLW due to the ingrowth of its progeny.
- The activity of some risk significant radionuclides increase by a much more significant amount than the overall activity.
  - $^{222}\text{Rn}$ and $^{210}\text{Pb}$
  - DU with recycled U also contains mobile radionuclides
- Arid sites generally perform better than humid sites.
- Depth of disposal and engineered barriers are key to protecting public health.
The NRC initiated rulemaking, establishing framework for disposal of large quantities of DU in 2008. The technical approach has changed several times.

- Limited to large quantities or certain long-lived radionuclides
- Determine proper waste classification for DU
- Performance Assessment and Intruder Analysis
- 1,000, 10,000, or a 20,000 year period of compliance
- One-tiered, two-tiered or three tiered compliance framework
- 10,000 years stability analysis
- Defense-in-Depth and Safety Case
Technical Basis: Site Characteristics

- Texas reviewed and approved major amendment authorizing disposal of DU in Andrews County in 2014
- Waste to be disposed in the low permeability clays:
  - 500 to 800 feet of red bed clays
  - Hydraulic conductivity of about $1 \times 10^{-09}$ cm/sec
- Water table 182 – 305 m (600 – 1000 ft) below grade
- Annual rainfall less than 15 inches per year
- Annual evapotranspiration potential of over 60 inches
- Ideal for isolating long-lived radionuclides from the environment
Texas regulations require compliance analysis for 1,000 years or peak dose, whichever is longer.

- A 10 m (33 ft) engineered cover
- A 0.3 m (1 ft) reinforced concrete barrier around the entire disposal unit
- Waste disposal at deepest depth possible
- Analysis demonstrated isolation of long-lived radionuclides possible in a well sited/engineered facility
Final Rulemaking

The Commission has approved the following substantive revisions to the draft final rule and its subsequent publication as a supplemental proposed rule for a 90-day public comment period. The associated guidance documents should also be revised and should be made publicly available, concurrent with the comment period on the supplemental proposed rule.

Specifically, prior to its publication as a supplemental proposed rule, the draft final rule should be revised to incorporate the following changes:

1) Reinstate the use of a case-by-case basis (i.e., “grandfather provision”) for applying new requirements to only those sites that plan to accept large quantities of depleted uranium for disposal;

2) Reinstate the 1,000 year compliance period from the proposed rule with a specific dose limit of 25 mrem/yr and adopt a longer period of performance assessment (the period of which would be based on site-specific considerations and a “reasonable analysis,” as defined in 10 CFR 61.44); and (Proposed Rule: “Proposed Rule: Low-Level Radioactive Waste Disposal (10 CFR Part 61) (RIN 3150-A192)”) and apply the 1,000 year compliance period to the inadvertent Intruder performance objective in 10 CFR 61.42 and the site stability performance objective in 10 CFR 61.44;

3) Clarify that the safety case consists of the quantitative performance assessment, as supplemented by consideration of defense-in-depth measures, and

4) Modify the draft final rule text addressing defense-in-depth to narrow its consideration solely to providing additional assurance in mitigating the effects of large uncertainties that are identified during the performance assessment;

5) Be informed by broader and more fully integrated, but reasonably foreseeable, costs and benefits to the U.S. waste disposal system resulting from the proposed rule changes, including pass-through costs to waste generators and processors.

The revised Federal Register notice prepared as a result of the direction in the staff requirements memorandum for this paper should be provided to the Commission for its information no later than 10 business days prior to its transmittal for publication.
Conclusions

- Characteristics of DU differ and present additional challenges when compared to disposal of LLRW containing different radionuclides.
- A well-sited radioactive waste disposal facility located in an arid environment is more than capable for complying with a very stringent regulatory disposal requirements.
- Texas approval of a major amendment demonstrates that disposal of long-lived radionuclides in a well-sited and engineered facility is capable of protecting public health for long periods of time into the future.