Design Basis of UMTRCA Disposal Cells

Workshop on Engineered Barrier Performance Related to Low-Level Radioactive Waste, Decommissioning, and Uranium Mill Tailings Facilities

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August 3, 2010

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LM UMTRCA Title I, Title II, and CERCLA/RCRA Sites

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Introduction and Background

Introduction

- DOE is directed by the Uranium Mill Tailings Radiation Control Act (UMTRCA) to implement remedies in accordance with EPA regulation 40 CFR 192, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” concerning final disposal of uranium mill tailings
- EPA requires:
  - Control of residual radioactive materials (RRM)/radon through approved design; and
  - Fulfillment of approved groundwater protection plans by monitoring and characterization of groundwater at disposal sites.

Background

- No post-construction monitoring is required for RRM designs [40 CFR 192.02 (a)(b) – see footnote 1]
- Groundwater must be monitored at the point-of-compliance to verify success of the groundwater protection plan [40 CFR 192.02 (c)]

Control of RRM/Radon

- RAECOM computer code is used to predict radon (Rn-222) release from a disposal cell design
- Lower-activity materials are placed over higher-activity materials to decrease radon emissions and thickness of barrier
- Final radon barrier thickness is determined to limit Rn-222 release to 20 pCi/m2/s

Control of RRM/Radon (continued)

Field and laboratory data needed for RAECOM

- Layer thickness (design)
- Dry-bulk density (from in-situ data or compaction testing)
- Porosity (computed from dry-bulk density)
- Long-term moisture content (from pressure-plate testing or field conditions)
- Radon emanation coefficient (laboratory test)
- Radon diffusion coefficient (laboratory test)
- Ra-226 concentration of tailings (field survey)

Control of RRM/Radon (continued)

Monitoring performed

- Monitoring for radon-222 in ambient air at UMTRCA sites is performed before and during construction using alpha-track detectors located at site boundaries
- During disposal cell construction and after completion of the radon barrier, radon measurements were taken on the surface using large-area activated charcoal canisters (LAACCs)
- LAACC monitoring procedures in conformance with EPA standards to verify RAECOM modeling results
- No post-construction radiological performance assessment verifications are routinely performed
- However, post-construction radiological measurements have been taken at the Lakeview, Oregon, and at the Shiprock, New Mexico, disposal cells. Measurements indicate both sites were well within performance regulations.

Groundwater Protection Plans

Plans must contain

- List of hazardous constituents that are likely derived from RRM (listed in 40 CFR 192.02)
- List of constituent concentration limits, either maximum concentration limits or alternate concentration limit
- Description of the protection strategy, i.e., how concentration limits will be met at the point-of-compliance (POC) for each constituent
- Description of the POC for the uppermost aquifer at the disposal site

Groundwater Protection Plans (continued)

Groundwater monitoring required by 40 CFR 192.03

Groundwater protection strategies at Gunnison and Rifle, Colorado, disposal sites illustrate monitoring requirements

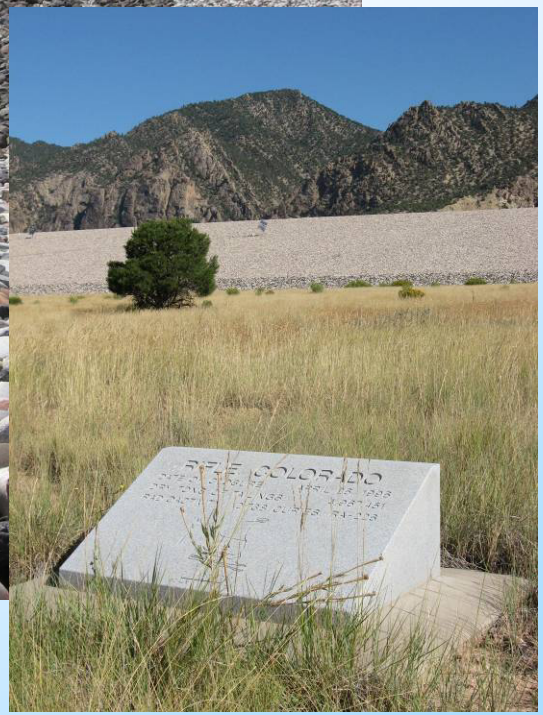
- Gunnison
  - Multi-component disposal cell cover limits rainfall infiltration
  - Contaminated materials placed at low-moisture content to limit transient drainage
  - Favorable geochemical attenuation in foundation soils
  - Uppermost-used aquifer 100 feet below disposal cell; closest downgradient user approximately 7,500 feet from site
  - Annual sampling of POC well for 10 years, every 5 years thereafter

Gunnison, Colorado, Disposal Cell

Groundwater Protection Plans (continued)

- Rifle
  - Multi-component disposal cell cover limits rainfall infiltration
  - Transient drainage modeled prior to construction, removed from disposal cell to prevent lateral migration of leachate until cessation of transient drainage
  - Limited-use groundwater exists beneath the site that is neither a current nor a potential source of drinking water because:
    - Total dissolved solid concentration exceeds 10,000 mg per liter;
    - Existing widespread ambient contamination is unrelated to processing activities, and the contamination cannot be cleaned up using treatment methods reasonably employed in public water supply systems; and
    - Quantity of water available is less than 150 gal (570 L) per day.
  - Groundwater monitoring of the uppermost aquifer at the Estes Gulch disposal cell is not required due to the limited-use classification (40 CFR192.11(e)(1))

Rifle, Colorado, Disposal Cell



Lakeview Studies

- Previous work provided evidence of saturated tailings
- Concern about seismic stability
- Recent geoprobe work
  - Two lines of boreholes penetrated tailings at various depths (total 8 holes)
  - Evidence of perched water in tailings in one hole at approximately 16 feet below ground surface (water column is approximately 7 feet thick); may be transient drainage
  - Holes were all abandoned and sealed
  - Only very low levels of radiation detected
- Conclusion regarding cell
  - Concern about stability greatly reduced.

LM Surveillance and Maintenance

- LM performs inspections and maintenance as required by NRC-approved long-term surveillance plans which serve as licensing documents
- LM has collected data on disposal cells for the past 20 years including inspections and groundwater and limited radon monitoring, as well as other studies
- LM will evaluate performance as additional data is gathered
- Concern about long-term water balance condition of some disposal cells has prompted studies to evaluate and provide alternatives if ever deemed necessary to remain protective
- Rifle and Lakeview seismic calculations performed to ensure ongoing stability
- Initiated studies, such as the Renovated Evapotranspiration Cover Assessment Project (RECAP), to look at alternatives if cell covers need renovation

LM RECAP Study

- Constructed a test facility (two identical lysimeters) at the Grand Junction Disposal Site (GJDS) to evaluate inexpensive methods to renovate cell covers, if needed, for long-term protection
- LM is testing methods to convert conventional covers to evapotranspiration (ET) covers if it is ever decided to be advantageous
- ET cover would limit percolation and also reduce cost of spraying weeds
- Current tests include leaving one half-cell lysimeter intact to mimic existing GJDS cover, while ripping the cover materials, mixing the rock and soil, and planting shrubs on the second half-cell lysimeter
- Lysimeters will be monitored for a minimum of 3 to 5 years to observe soil-forming processes and plant sustainability

Conclusion

- Control of RRM and release Rn-222 is demonstrated though approved designs, no post-construction monitoring is required
- Approved groundwater protection plans needed, monitoring of groundwater at POC required to verify groundwater protection, where required by the plan
- Performance of 40 DOE, UMTRA, and CERCLA disposal facilities located across the country in varying climates are all within EPA regulations, thus protective of human health and the environment
- DOE is ready to respond to problems if they occur