
INSPECTION PROCEDURE 89010

DISPOSAL CELL CONSTRUCTION AT URANIUM RECOVERY AND 11e.(2) BYPRODUCT MATERIAL FACILITIES

PROGRAM APPLICABILITY: 2602 and 2801

89010-01 INSPECTION OBJECTIVES

01.01 To establish the inspection program for disposal cell construction activities at conventional uranium mills, in situ recovery uranium mills, 11e.(2) byproduct material disposal sites, and other 11e.(2) byproduct material sites licensed and regulated under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 40. For the purposes of this inspection procedure (IP), the term disposal cell includes tailings impoundments, heap leach pads, and evaporation or storage ponds.

01.02 To ensure that the licensee effectively manages construction activities to minimize the potential for releases of radioactivity to the environment.

01.03 To ensure that construction activities comply with U.S. Nuclear Regulatory Commission (NRC) license and regulatory requirements.

89010-02 INSPECTION REQUIREMENTS

This IP provides the requirements and guidance for inspection of disposal cell construction activities at sites licensed under 10 CFR Part 40. Because this IP applies to a variety of licensees, some of the inspection requirements and inspection guidance provided in this IP may not be applicable to all sites.

02.01 Inspection Requirements to Meet Objectives. To meet the objectives of this IP, the inspector shall conduct the following minimum inspection activities:

- a. Prepare for the inspection in the office before the onsite inspection. This effort should include a review of the license and license application requirements for construction activities. The inspector should be familiar with industry practices including quality control measures. If the inspection is an announced inspection, the inspector should request electronic copies of the licensee's manuals or procedures prior to the onsite inspection. The inspector should also request documentation of significant changes that have been made to the construction program since the last inspection.
- b. Conduct one or more site tours to verify that the licensee is managing construction activities in accordance with license and regulatory requirements. The observed activities could include construction activities in progress, management of cell leakage, stockpiling of material, excavation of material from borrow areas, and interim erosion

protection features. Observe all areas of the cell and other construction areas for signs of subsidence, slumping, erosion, and other deformations.

- c. Observe one or more critical activities such as material compaction, synthetic liner installation, quality control testing, radon flux measurement, and/or moisture density test. The inspector should conduct independent radiological surveys, including soil sampling, to verify that the radiological aspects of the construction material are being maintained by the licensee.
- d. Interview licensee's staff to determine how well employees know their work activities and to ascertain whether qualified staff are available for all phases of construction work.
- e. Determine if the records or work activities indicate that any problems such as erosion, berm failures, subsidence, or slumping have occurred since the last inspection to ensure that the licensee responded to the events in accordance with commitments provided in the license and site procedures. Ensure the licensee reported any events to the NRC as required by the license and regulations.
- f. Verify through a records review that the licensee continues to implement the construction program in accordance with license and procedural requirements. In general, the inspector should review only the construction records that were developed since the last inspection of this program area.
- g. If there have been any significant changes in the construction program, ensure that the changes have been appropriately evaluated and implemented by the licensee through its performance-based license.

02.02 Performance-based/Risk-informed Inspections. In accordance with Commission policy (SECY-98-144), inspectors must conduct performance-based inspections with an emphasis on risk-significant activities that have an impact on safety and the environment. A performance-based inspection emphasizes the observation of activities and results of the licensees' programs over the review of procedures or records. The risk-informed inspection approach considers risk insights together with other factors to focus inspection activities commensurate with the risks associated with the implementation of the licensee's NRC-approved programs.

The higher risk construction-related activities include disposal cell construction, installation of pond or cell liner systems, disposal cell cover construction and associated radiological testing, spill response due to embankment failures, and long-term environmental risks such as potential or actual groundwater contamination, tailings management, and radon emissions, as well as implementation of procedures and training for these risks.

In summary, the inspector shall verify compliance primarily through observations of site conditions, observations of work activities, interviews with workers, demonstrations by workers, and reviews of critical records. The inspector shall focus attention on the most important, risk-significant activities and the results of the licensee's efforts.

The emphasis of this inspection effort is to ensure that the licensee has established and implemented critical programs and procedures to manage onsite construction activities. Depending on the site, the construction requirements will be specified in the license application, reclamation plan, closure plan, or technical specifications. These documents provide the NRC-approved instructions that must be implemented to demonstrate compliance with Appendix A to 10 CFR Part 40.

This IP applies to activities such as preparation of land for construction of a disposal cell, construction of the base of the cell, placement of contaminated material within the cell, and closure of the cell. This IP generally applies to the construction and closure of heap leach piles. In addition, this IP applies to construction of storage or evaporation ponds that are used to contain liquid 11e.(2) byproduct material. Finally, this IP provides inspection guidance for any onsite activity that involves movement of soil, installation of synthetic liners, and installation of rocks/riprap including construction of berms, diversion channels, and drainage pathways.

Due to the unique technical aspects of this type of inspection, this IP should be implemented by trained and qualified NRC staff that may include geotechnical engineers, geologists, hydrologists, or health physicists, depending on the areas being reviewed.

The inspection should include direct observations of activities as much as possible but may include documentation reviews as needed. This section includes guidance for inspection of the following areas:

- Regulatory requirements applicable to construction
- Programs and procedures review
- Records review
- Construction activities
- Other routine and non-routine inspection activities
- Routine and non-routine reports
- Routine audits and program reviews

03.01 Regulatory Requirements. The following regulatory requirements apply to construction activities:

- 10 CFR 40.32(c) states, in part, that an application for a specific license will be approved if the applicant's proposed equipment, facilities, and procedures are adequate to protect health and minimize danger to life or property. For uranium recovery and 11e.(2) byproduct material sites, these proposed equipment, facilities, and procedures include license requirements for design and construction of disposal cells and heap leach piles, and evaporation ponds.

- 10 CFR Part 40, Appendix A, Criterion 5A through 5D, 6, and 6(A), provide the design requirements for 11e.(2) waste and uranium byproduct material disposal cells. Criterion 8 and 8(A) provide the operational requirements including control of dusting from tailings cells and ore pads and routine site inspections.

03.02 Programs and Procedures Review. The goal of this inspection effort is to determine if the licensee continues to implement the construction program in accordance with license and regulatory requirements. The inspector should:

- Verify that site procedures have been developed for all aspects of the program. The goal of this review is to ensure that procedures have been developed to implement the NRC-approved requirements for construction.
- Verify that the licensee has established an administrative program for managing construction records. This information will be needed for development of the construction completion report that the licensee will have to submit to the NRC upon closure of the site. Experience has shown that when the licensee does not maintain good recordkeeping, it will have trouble developing the construction completion report.
- Verify that changes to construction-related programs were made in accordance with the performance-based license. Ensure the changes do not require prior NRC approval. Verify that site staff were trained on the program changes.
- Observe licensee staff implementing procedures during site tours. Verify that the procedures are usable by site staff, equipment specified in the procedures is available, and updated copies of the procedures are available in the field for licensee staff use.
- Review events that have occurred since the last inspection involving the construction program. Ensure that the licensee evaluated the event, reported the event as necessary, and took corrective actions appropriate to the significance of the event.
- Ensure that the licensee is implementing the work in general conformance with the construction schedule that was proposed to the NRC. If the licensee cannot meet scheduling requirements, discuss with the NRC project manager whether the schedule should be revised accordingly. The level of NRC involvement will depend on whether the schedule is a license requirement or a commitment to the NRC.
- Verify that the licensee has implemented the federal or state-required dam safety program for areas of the site that meet the criteria. In general, this program affects all water-impounding structures in excess of either 7.62 meters (25 feet) in height or 61,674 cubic meters (50 acre-feet) in impoundment capacity. The inspector should refer to Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities," for additional details about the dam safety program.

03.03 Records Review. Due to the uniqueness of this program area, a records review is necessary to complete the objectives of this IP. The inspector should examine selected construction records to:

- Confirm that the material characteristics and other specification requirements were met. For example, ensure that the licensee has verified the physical and engineering properties of borrow material, underlying material beneath the cell, other material being used in the construction work such as synthetics, and material being disposed.
- Confirm that these materials were placed or installed in accordance with specifications.
- Indicate that adequate corrective actions were taken for non-conformances and deviations.
- Confirm that construction-related inspections and tests were performed at the required frequencies.
- Confirm that quality assurance and inspection personnel are adequately qualified for their assigned duties and responsibilities.
- Verify that any field measurements of parameters used in the radon barrier analysis are consistent with parameters presented in the license application and/or license. Commonly, the licensee must notify the NRC if deviations are noted and the license must be amended to incorporate a new analysis before the radon barrier is completed.

03.04 Construction Activities. The inspector must ensure that site construction activities are implemented in accordance with license and regulatory requirements. The licensee's failure to correctly implement the construction program could result in future settlement, structural failure, or unplanned effluent releases. The risk-significant activities to be observed during an inspection are site-specific and depend on the work in progress. Additional instructions for critical construction activities are provided in the Appendix to this IP. During the onsite inspection, the inspector should verify through visual observation that:

- Work is being conducted in the sequence provided in the construction plan using generally accepted construction practices. For example, verify that methods for excavating, hauling, stockpiling, and placing contaminated and non-contaminated material within the disposal cell are consistent with commonly accepted engineering practices for earthen work. Also verify that methods for installation of synthetics are consistent with commonly accepted engineering practices.
- Material placement and compaction procedures are adequate to achieve the desired moisture content, placement density, and permeability. For example, bulky material may have to be cut into smaller pieces for disposal. Ensure material is properly sized for disposal.
- If materials are mixed, the mixture process complies with construction plan requirements. For example, licensees may add bentonite to affix material in place or mix different types of wastes to homogenize and lower radioactive concentrations.

- In situ testing and quality assurance sampling programs are used to verify the engineering properties of underlying material, borrow area material, synthetics, and tailings. Ensure these sampling and testing programs are implemented using industry standards.
- Rock and bedding material meet the criteria for size, shape, etc. The inspector should refer to NUREG-1623, "Design of Erosion Protection for Long-Term Stabilization," for details on rock quality and placement of rock.
- Road construction and use of clean fill material within the construction area is consistent with license requirements and general construction practices.
- Interim erosion protection and water management programs are used to manage rainwater during construction activities.
- Disposal cell drainage and leachate pathways have been established (or will be established), and licensee has plans to manage potentially radioactive wastewater.
- Methods and schedules for emplacing the vegetative cover are reasonable, and that seeds for the planned vegetation are compatible with the local climate.

For construction activities such as placement of contaminated materials or cover materials, the licensee should establish the specific radiation safety procedures and occupational monitoring program for workers, and the licensee should implement controls to mitigate impacts to the environment such as dust control. Therefore, it is important for the inspector to ensure that workers are following these procedures or controls and have adequate personal protective equipment and monitoring equipment for the work in progress.

03.05 Other Routine and Non-Routine Inspection Activities. Using a risk-informed approach, the inspector may conduct reviews of construction-related activities at other locations than the disposal cell itself:

- When visiting onsite or offsite borrow areas, the inspector should ensure that the licensee has established, and continues to implement, testing programs to ensure that the material meets the criteria for use in construction activities. As noted in Regulatory Guide 3.11, fill material should be free of roots, stumps, wood, rubbish, stones greater than six inches, frozen material, and any other objectionable material.
- When visiting rock quarries, the inspector should ensure the quarry has the capability to provide rock that meets the recommendations provided in NUREG-1623 and has sufficient quantity of rock for completion of the project.
- When observing the construction of diversion channels, the inspector should ensure the work is being conducted in accordance with the construction plan and site drawings.
- As part of the inspection program, the inspector should verify that monitor wells have been installed around the construction site in accordance with commitments provided in the license and application.

03.06 Routine and Non-routine Reports. Depending on site-specific license requirements and application commitments, some licensees may be required to report certain activities to the NRC. Commonly, licensees are required to submit annual reports. These annual reports would include copies or summaries of the annual engineer's inspection of embankments, ponds, and impoundments. Licensees also routinely report results of radon flux measurements and changes to the license application using the performance-based license.

10 CFR 40.60 provides the reporting requirements for certain events. These types of events are rare and include berm or embankment failures. Additional reporting requirements may be provided in the license and may include events such as liner leaks that exceed a certain limit, liquid spills above a certain volume, excessive quantities of leak detection fluid, and monitor well exceedances.

The inspector should review these routine and non-routine reports during the inspection. The inspector should pay close attention to any construction-related problems identified and corrected by the licensee and any changes that were made using the performance-based license.

03.07 Routine Audits and Program Reviews. The routine audit and program review requirements vary by site. At a minimum, licensees are required to perform routine checks of the condition of any retention systems and to evaluate their structural and operational adequacy. Many sites have procedures for daily site inspections and annual engineering inspections. Regulatory Guide 3.11, Section 4, "Inspection and Maintenance," provides the recommended inspection programs. As noted in RG 3.11, special or non-routine site inspections should be conducted by the licensee in response to earthquakes, tornados, floods, intense rainfalls, or other unusual events.

The licensee should have established a program for documentation of routine site inspections. Most records, such as daily inspections, will be maintained onsite for review during the inspection. The annual engineering inspection report may be presented to the NRC as part of the license-required annual report. The radiological aspects of site activities should be included in the annual radiation protection program review specified in 10 CFR 20.1101(c). Some licensees may commit to additional audits and reviews, such as quality assurance program or management reviews.

The inspector should verify that construction activities are routinely reviewed as required by regulation, license condition, and license application commitments. The inspector should also confirm that the licensee's staff who conduct routine site inspections are qualified to conduct the inspections.

89010-04 RESOURCE ESTIMATE

The level of technical expertise needed to conduct this inspection will depend on the complexity of the licensee's construction program. Most inspections will be conducted by specialized staff from the NRC's program office. Some activities can be conducted by regional inspectors, including health physics related activities. Inspections of this program typically would involve one inspector and would require 1-2 days (8-16 hours) to complete, depending on the complexity of the program.

89010-05 PROCEDURE COMPLETION

This IP is complete when the NRC inspection staff observe the activities, interview site staff, and review records as needed to satisfy the objectives of this IP. This IP should be completed at least once a year, during major construction activities, or at other frequencies as established in the Master Inspection Schedule.

89010-06 REFERENCES

Inspection Manual Chapter 2801, Uranium Recovery and 11e.(2) Byproduct Material Facility Inspection Program," October 8, 2021

NUREG-1620, "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978," Revision 1, June 2003

NUREG-1623, "Design of Erosion Protection for Long-Term Stabilization," September 2002

Regulatory Guide 3.11, Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities, Revision 3, November 2008

Staff Requirements SECY-98-144, "White Paper on Risk-informed and Performance-based Regulation," March 1, 1999

END

Appendix A: Key Construction Activities at Uranium Recovery and 11e.(2) Byproduct Material Facilities

Attachment 1: Revision History for IP 89010

INSPECTION PROCEDURE 89010 APPENDIX A

KEY CONSTRUCTION ACTIVITIES AT URANIUM RECOVERY AND 11e.(2) BYPRODUCT MATERIAL FACILITIES

PROGRAM APPLICABILITY: 2602 and 2801

89010-01 PURPOSE

This appendix provides a summary of key construction activities that should be reviewed during U.S. Nuclear Regulatory Commission (NRC) inspections at uranium recovery and 11e.(2) byproduct material sites. The information provided in this appendix can be used to support the inspection, but the information was not meant to replace NRC-approved construction documents.

89010-02 INSPECTION GUIDANCE

By direct observation of activities in progress, the inspector should ascertain whether the following activities are being controlled and accomplished in accordance with the requirements specified in the NRC-approved construction plans. Additional construction considerations are provided in Section 3 of Regulatory Guide (RG) 3.11, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities."

02.01 Test Fill Construction and Foundation/Subgrade Preparation.

- Verify that fill material was obtained from an approved, designated borrow area.
- Observe placement and compaction operations to ensure that procedural and equipment requirements are being followed.
- Visually check the barrier test zone to ensure proper thickness and material type.
- Observe gradation, bentonite amendment operations (if applicable), plasticity index, and moisture/density testing, and compare results of tests with specifications.
- Observe installation of instrumentation/testing/monitoring equipment, including infiltrometers where applicable.
- Review quality control plan and infiltration test results.
- Check to ensure that the subgrade is cleared of all vegetation and topsoil, shows no deterioration due to frost action or erosion, and exhibits no rutting from construction vehicles.

- Check to ensure that the subgrade exhibits no areas of subsidence, extreme surface drying, localized ponding, or overly wet areas.
- Observe proof rolling operations or density testing; if density testing is performed, compare results of tests observed in the field with specifications.

02.02 Placement of Capillary Break and Seepage Barrier/Liner.

- Proper subgrade preparation is necessary for installation of the liner. Observe placement and compaction operations to ensure that procedural and equipment requirements are followed.
- Observe capillary break zone to verify proper thickness and material type, and to ensure that segregation of materials has not occurred.
- Observe gradation and/or moisture/density testing and compare results of tests observed with specifications.
- Visually check the liner zone to ensure proper thickness and material type. Observe seaming process if synthetics are used.
- Ensure liner material meets the requirements provided in the construction plan. Synthetic liner seaming should be conducted under supervision of experienced personnel. Seams should be tested for integrity along the entire length using manufacturer's recommendations. Additional guidance for liner installation is provided in RG 3.11.

02.03 Placement of Contaminated Materials into Disposal Cell.

- Observe placement and compaction operations to ensure that procedural and equipment requirements are being followed. This includes checking the loose-lift thickness during placement against specifications.
- Visually check the quantity, maximum size, and distribution of foreign material, and the distribution of organics against the allowable specifications. Also, note if non-homogeneous areas exist.
- Observe moisture/density testing and compare results of tests observed with specifications. Note any ponding, runoff, or dust conditions.
- Observe radiological monitoring including personal health and safety, as well as radionuclide concentration measurement.

02.04 Construction of Radon Cover and Frost Protection Layer.

- Observe placement and compaction operations to ensure that procedural and equipment requirements are being followed. This includes checking required loose-lift thickness and proper blending of any additives, and if method specifications for density have been established by test fill, verification of number of equipment passes.

- Visually check cover layers to ensure proper material type and final thickness for each layer.
- Observe gradation, plasticity index, and/or moisture density testing and compare test results with specifications.
- Visually check frost protection cover layer to ensure proper thickness and material type.

02.05 Placement of Bedding Layer and Cover (Rock and/or Soil).

- Observe placement and compaction operations to ensure that procedural and equipment requirements are being followed. For the rock cover and other riprap layers, this includes checking that placement techniques are conducted in a manner that prevents material degradation, assures uniform distribution, and minimizes voids.
- Visually check the bedding zone and riprap layers to ensure proper thickness and material type for each zone, measuring as necessary. If possible, excavate by hand to a depth to verify thickness.
- Visually check riprap for approximate size (maximum, average). If possible, excavate by hand to verify size of underlying rocks, measuring as necessary.
- Observe gradation testing to assure that representative samples are being tested.
- Observe gradation testing of filter and rock layers and compare results of gradation and durability tests observed with specifications.

02.06 Other Construction Observations.

- Check operations at borrow areas and quarries. Verify that any procedures for moisture control are properly conducted. Visually check that material type(s) are consistent with specifications and are representative of materials actually being placed.
- Check layout of diversion ditches for conformance to design configuration and riprap requirements.
- Check overlap and integrity of geotextile separators if used.
- If an approved vegetative cover is used in place of rock cover, check to ensure uniform seeding, use of specified seed type, seed density, etc.
- Check overall site grading to assure that cut and fill procedures will not result in grading which would be susceptible to future surface erosion.
- Observe verification soil sampling and Opposed Crystal System (OCS) analysis.
- Observe radon flux testing and gamma surveying for compliance with the limits specified in Appendix A to 10 CFR Part 40.

02.07 Monitoring Well Observations.

- Check locations of existing wells. Verify that the field locations correspond to the location depicted onsite drawings. Verify that the well is properly and permanently labeled.
- Verify that existing well locations are adequately marked with flagging or some other identification placard to avoid inadvertent destruction by heavy equipment.
- Verify that the outer protective casing, padlock, concrete pad, and other surface expressions are in good repair. Verify that well caps are secure to minimize inadvertent dust invasion inside the well casing. Note any irregularities, such as bent or damaged casing, animal burrows, or erosion around the well, and proximity of equipment tracks.
- Check the locations of previously abandoned monitoring wells. Verify the field locations with respect to the site drawings. Verify that the surface expression has been completed in accordance with the Monitoring Well Abandonment Specification. Note any irregularities, such as concrete shrinkage, surface depressions, or exposed well pipe.

02.08 Completion of Disposal (Closeout Inspection).

- Review draft construction completion report for completeness.
- Verify that a final survey has been conducted for the area to be released or will be turned over to the U.S. Department of Energy.
- Verify that the site appears to be ready for turnover or release.
- Ensure that monitor wells have been abandoned or will remain in service for future use.

END

Attachment 1: Revision History for IP 89010

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public Information)
N/A	ML21202A327 10/08/21 CN 21-034	New inspection procedure originally based on IP 88001, On-Site Construction	n/a	ML21202A325