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## INSPECTION PROCEDURE 87654

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### URANIUM MILL, IN-SITU LEACH URANIUM RECOVERY, AND 11e.(2) BYPRODUCT MATERIAL DISPOSAL SITE DECOMMISSIONING INSPECTION

PROGRAM APPLICABILITY: 2801

#### 87654-01 INSPECTION OBJECTIVES

To determine if licensed decommissioning programs are being conducted in accordance with Nuclear Regulatory Commission requirements specified in individual licenses and the regulations. To provide assurance that site decommissioning activities are being performed appropriately to demonstrate compliance with the decommissioning regulations and guidelines, and in accordance with the approved reclamation plan. This procedure should be used in conjunction with Inspection Procedure (IP) 88104 and provides details specific to decommissioning uranium mill sites. This procedure is also applicable to in-situ leach uranium recover sites and 11e.(2) byproduct disposal sites licensed by the NRC that are not associated with a uranium mill; however, the inspector should confirm the regulatory requirements for the site as indicated in the site license.

#### 87654-02 INSPECTION REQUIREMENTS

A determination of compliance with NRC requirements will be based on direct observation of work activities, interviews with workers, demonstrations by workers performing tasks regulated by NRC, independent measurements of radiological conditions at the facility, and review of licensee records. The inspector should refer to Inspection Manual Chapters (IMCs) 2602, 2605, and 2801 for general policies and guidance.

The scope of the inspection of licensed activities will be commensurate with the scope and status of the licensee's decommissioning program and with previous inspection efforts. Most facility buildings are buried in a mill tailings disposal cell, but some buildings and structures may remain on site or be moved elsewhere. A primary decommissioning activity to be addressed is soil cleanup and cleanup verification (final status survey) to demonstrate compliance with Criterion 6(6) of 10 CFR Part 40, Appendix A. If the site final decommissioning plan was approved after June 11, 1999, the radium benchmark dose approach should be used to determine cleanup criteria for residual radiation in soil and building surface activity (NUREG 1620, Appendix H). However, inspection of the implementation of other radiological decommissioning requirements in Criterion 6, such as measurement of radon flux and gamma levels from the disposal cell cover, may be necessary and should be coordinated with the Headquarters health physicist. Ground-water compliance will be evaluated against Criteria 5B, 5C, 5D, 5E, 5G, and 13. Surface reclamation (includes disposal cell construction) compliance will be evaluated against Criteria 4 and 6, and is discussed in Inspection Procedure (IP) 88001. Applicable portions

of 10 CFR 40.42, such as the requirements for timely decommissioning, may need to be addressed, therefore the NRC Project Manager should be consulted when the site inspection plan is being developed.

This IP should be used as a checklist when developing a site-specific decommissioning inspection plan. The decommissioning inspection is not intended to duplicate the normal inspection for management organization and controls, radiation protection, radioactive waste management, and environmental monitoring, but to emphasize observation of key decommissioning activities being performed. If possible, implementation of this procedure should be initiated early in the decommissioning phase, to identify any program deficiencies and to gain confidence in the licensee's performance.

02.01 Preparation. The inspector should allow adequate time to prepare for the inspection. Preparation will include reviewing documents, making travel arrangements, coordinating with appropriate staff, notifying appropriate State agencies, and selecting necessary equipment. In particular, the inspector shall identify whether any license amendments have been issued since the last inspection, or whether the licensee has informed NRC of any major program changes since the last inspection. The inspector shall also review any event files to determine if the licensee had any incidents or events since the last inspection.

02.02 Entrance Briefing. When the inspector arrives at the licensee's facility, he/she will inform an available senior management representative of the purpose and scope of the inspection.

#### 02.03 General Overview

- a. Organization. Interview cognizant licensee representatives about the current organization of the decommissioning program. Examine the licensee's organization with respect to changes that have occurred in personnel, functions, responsibilities and authorities since the previous inspection. Identify the reporting relationship and management structure between the licensee's executive management and the Radiation Safety Officer (RSO).
- b. Scope of Program. Interview cognizant personnel to determine the scope of decommissioning activities, site status, staff size, etc.
- c. Management Oversight. In the course of interviewing cognizant personnel, determine if management oversight is sufficient to provide the licensee staff with adequate resources and authority to administer the decommissioning program.
  1. RSO - Determine whether the RSO has sufficient authority, and fulfills the appropriate duties commensurate with the size and scope of decommissioning activities.
  2. Audits - Verify that audits are performed as required. Verify that the results of the audit are reviewed and addressed as they relate to decommissioning.
  3. Determine that individuals who perform and/or supervise licensed activities are qualified and perform an appropriate level of supervision, as required by the license or regulations.
- d. Decommissioning Activities. The inspection should be scheduled so that decommissioning activities can be observed, unless it is to be the final decommissioning inspection (usually after the Final Status Survey Report is submitted and reviewed). Licensee decommissioning staff should be interviewed and relevant records on decommissioning activities reviewed.

- e. Site Orientation Tour. A brief site tour should be made. General observations should be noted on the condition of the facility and the decommissioning activities being performed.

02.04 Equipment and Procedures. Review the equipment and procedures used for decommissioning the site to determine if appropriate and approved equipment and methods were followed.

02.05 Final Status Survey. Verify the accuracy and reliability of the licensee's final survey data by reviewing the methods used and the final data, including QA/QC data.

02.06 Quality Assurance/Quality Control. Verify the adequacy of the licensee's quality assurance and control program.

02.07 Data Reduction and Management. Verify the way field data is documented and processed.

02.08 Personnel Training. Verify that appropriate training and instructions were/are given. Through discussions with workers, verify that licensee personnel understand and implement the established decommissioning procedures.

02.09 Confirmatory Survey. The survey by the inspector should include gamma scans (and alpha scans if applicable) and soil analysis using methods similar to those approved for use by the licensee. The inspector's survey data is used as an indication of whether or not the licensee properly implemented the approved procedures and complied with the decommissioning criteria.

02.10 Ground Water. Verify that the ground-water monitoring and/or corrective action program is being conducted (1) in compliance with Appendix A of 10 CFR 40 and (2) as required by applicable license conditions. Verify that the ponds are being monitored for leakage into the ground water as required by applicable license conditions.

02.11 Exit Meeting. When the inspection is over, there should be an exit meeting with the most senior licensee representative present, to discuss the preliminary inspection findings.

02.12 Post-Inspection Actions. After the inspection, the inspector shall summarize the findings with his/her supervisor. The inspector shall also contact Headquarters staff when any pertinent issues are raised during the inspection, when inspection findings impact on any licensing actions, or to give feedback on how the licensee has addressed recent licensing actions.

The inspection report should document what activities were observed, summarize the interviews with licensee personnel, and clearly indicate the evaluation of the licensee's decommissioning program.

## 87654-03 INSPECTION GUIDANCE

03.01 Preparation. Before the inspection, the inspector should be familiar with the guidance listed in the Appendix of this IP and a review of the following should be performed.

- a. Operating History. Review the history of each license to identify what types of work activities were performed, the types of buildings that existed, and the geographical location of each. Review the results of past operational radiological surveys that were used to demonstrate radiological control of the site/facility.

- b. Waste Disposal Practices and Radioactivity Releases. Verify waste disposal outside the tailings cell. Consider the potential for, or evidence of, contamination from spills, or other releases of radioactive material (such as haul routes) to compare with the soil cleanup boundary.
- c. Environmental Monitoring Data. Verify operational soil sampling, airborne emissions, and ground-water monitoring data, specifically for evidence of radiological contamination. Verify effectiveness of effluent controls, particularly during drying and packaging operations, and when air was exhausted from the yellowcake stack. Determine that the area where airborne contamination would likely be deposited has been investigated for residual contamination.
- d. Results of Previous Surveys. Verify the results of scoping, characterization, and remedial action support (excavation control) surveys performed by the licensee. Review the results of previous surveys for justification of the classification of mill site areas (e.g., mill site boundaries versus windblown areas). In particular, review data for the areas adjacent to the remediation of windblown contamination.
- e. Remedial Actions. Review the specific procedures that were used to decontaminate the process facilities and/or land areas. Consider the potential for incomplete remediation based on these remedial action techniques, particularly the potential for the remedial actions to produce areas of localized contamination within verification grids that were not represented in the gamma scan average value. Determine if the licensee has identified the need to remediate radionuclides other than radium-226 (Ra-226), (e.g., beneath acidic raffinate ponds) where thorium-230 (Th-230) could migrate farther than Ra-226 or where uranium ore residue or yellowcake contamination could be located.
- f. Guidelines Established. Review the guidelines that the licensee is using for indoor and outdoor areas and verify how the stated guidelines are being implemented; (e.g., use of surrogate measurements, presence of multiple contaminants, averaging conditions, and hot spots).
- g. Records. Review the site's previous inspection history, license conditions, and licensee's submittals concerning decommissioning, and the Technical Evaluation Reports for the related amendments, to be aware of follow-up inspection items, commitments made by the licensee, and assumptions or conclusions, made by licensing staff, related to decommissioning.
- h. Background Reference Areas. Identify the value that NRC licensing staff approved as the site Ra-226 soil background. Determine if any recent information might require a review of the background value to determine that its use for soil cleanup is adequate to protect long-term health and safety (e.g., soil cleanup extended into background locations).

03.02 Entrance Briefing. No specific guidance required.

03.03 General Overview. No specific guidance required.

03.04 Equipment and Procedures. The inspector shall verify the gamma surveys done by the licensee by reviewing the following:

- a. Instruments. Review the basis for the selection of instruments (e.g., based on potential contaminants and their associated radiations, types of media (soil, sludge, etc.) to be verified, and detection sensitivities). Typically, sodium iodide (NaI) scintillation detectors are used for land area surveys.

- b. Sensitivity. Review documentation pertaining to instrumentation sensitivity, particularly licensee statements to the effect that instrumentation will be sufficient to detect radiological contamination. The detection sensitivity should be below the appropriate guideline values. Also, verify the instrument scan sensitivity for exterior scan surveys (NUREG-1575, Section 6.7). Check the scan sensitivity in terms of the gamma soil cleanup guideline.
- c. Gamma-Radium Correlation. Confirm that the licensee checked the correlation of Ra-226 concentration to gamma levels during verification, and that an acceptable correlation was obtained to support the gamma guideline value.
- d. Methods. Verify the methods/procedures for exposure rate measurements and gamma scans, unless these were reviewed with the Reclamation/Decommissioning Plan. If possible, observe if the measurements and scans are performed according to the procedures and good health physics practices, such that reliable data are produced.
- e. Calibration. Verify the procedures for instrument calibration; (e.g., use of appropriate radionuclide calibration sources, source geometry, and appropriate consideration of environmental conditions). Check the calibration date of survey meters.
- f. Check-out. Review the operational check-out of survey instrumentation. Verify frequency of operational checks (both to calibration source and background) and if instrument response fell within predetermined acceptance criteria.

The inspector should verify the surface activity measurements of buildings, structures and equipment by reviewing the following:

- a. Instruments. Review the basis for the selection of instruments; (e.g., based on potential contaminants and their associated radiations, surface types to be verified, and detection sensitivities). Typically, Geiger Muller, gas proportional, or zinc sulfide detectors are used for building surface contamination surveys. Verify the energy dependence of the measurement instrument and determine if the licensee has appropriately addressed this issue. Remember that beta detectors are more sensitive to "old" yellowcake than alpha detectors.
- b. Sensitivity. Review documentation pertaining to instrumentation sensitivity, particularly licensee statements to the effect that instrumentation will be sufficient to detect radiological contamination. The detection sensitivity should be below the appropriate guideline values. Verify the instrument scan sensitivity for both the interior and exterior scan surveys of building surfaces (NUREG-1575, Section 6.7).
- c. Equations. Review the licensee's minimum detectable contamination equation for direct measurements on building surfaces and the conversion of counts to activity (should use the  $4\pi$  efficiency factor).
- d. Calibration. Verify the procedures for instrument calibration, e.g., appropriate radionuclide calibration sources, source geometry, and appropriate consideration of surface and environmental conditions.
- e. Methods. Verify the method for exposure rate measurements, unless it was part of the Reclamation/Decommissioning Plan. Normally, measurements are done 1 meter (3 feet) from the floor and at least 1 meter (3 feet) from a corner. Radiation measurements should also be taken where contamination is most likely to occur.

- f. Check-out. Review the operational check-out of survey instrumentation. Verify frequency of operational checks (both to calibration source and background) and if instrument response fell within predetermined acceptance criteria.

03.05 Final Status Survey. The inspector should verify the level of survey coverage for structures and land areas, based on the area classification (e.g., mill site or windblown area; affected or unaffected). The inspector should review the licensee's procedures for performing surface activity measurements and scans on building surfaces, for performing soil sampling, and ground-surface gamma scan. When possible, the inspector should observe implementation of the procedures to determine if the procedure is followed and performed in a manner reflecting good health physics practices. In particular, review the following:

- a. Measurements. Determine whether the type, location, and number of measurements and/or samples per area are sufficient to provide a good representation of the radiological contamination. NUREG-1575 should be consulted for general guidance.
- b. Boundaries. Ensure that the boundaries of the contaminated soil areas have been appropriately determined (review gamma data and perform spot-check gamma scans), and that any potential subsurface radioactive material deposits have been addressed.
- c. Follow-up. Determine the use of investigation levels for measurements results and if the licensee performed appropriate follow-up actions. For example, soil samples should be collected if the NaI scintillation detector readings exceed a specified investigation level.
- d. Soil Sampling and Analytical Procedures. Verify the licensee's sample collection and preparation techniques (e.g., mixing, drying, geometries used for gamma spectrometry on soil samples, ingrowth period for Ra-226 progeny, etc.). Review the licensee's analytical procedures for radiological analyses, particularly the analysis of soil samples by gamma spectrometry. If a contract laboratory was used, those procedures should be available for review, including sample chain-of-custody procedures.
- e. Instruments. Review the protocol the licensee uses to interpret the gamma spectrometry results, particularly the radionuclide peaks used to identify various contaminants. Review for drift checks, energy calibration, control charts, duplicate sample counts, split samples with outside laboratory, etc. Determine whether the survey meters and gamma spectrometer are maintained and operated in accordance with the manufacturer's recommendations and good health physics practices.
- f. Replaced Data. Review survey results for those areas where additional investigations have been conducted. If initial survey data have been replaced or supplemented as a result of the investigation, ensure that the replacement data are annotated as such. The annotation is intended to alert the reviewer that the initial data have been replaced.
- g. Survey data. Select a portion of completed survey data and review data for compliance with procedures and final survey plan. Review the documentation for scan surveys to determine how the licensee identified and investigated any elevated readings during the scan survey. Review survey results for specific processing areas that have been remediated, including buried raffinate lines, evaporation ponds, etc. Determine if results demonstrate compliance with

guidelines and whether any modifications to the general survey approach were necessary.

### 03.06 Quality Assurance/Quality Control

- a. Laboratory. Review the licensee's on-site laboratory and/or licensee's contracted off-site laboratory quality assurance/quality control procedures, including duplicates, blanks, and matrix spikes. Determine the frequency of analysis for each of the quality control (QC) checks. Determine whether the laboratory participates in cross-check of performance evaluation programs, such as those offered by the DOE Environmental Monitoring Laboratory and the U.S. Environmental Protection Agency.
- b. Final Data. Review the final status survey report data and discuss with the Headquarters health physicists, to ensure that the items listed below are adequately addressed either in the report or in the licensee's records:
  1. QC sampling and direct measurements, along with associated acceptance criteria and corrective actions, are adequate in number and location.
  2. Confirmation of radiation of survey measurement data quality assessment to determine adequacy of the collected data, for the intended use. Examples of data quality assessment include verification that the collected data are applicable to the statistical model used to reduce the data, and other data quality indicators, including completeness, comparability, representativeness, precision, and accuracy.
  3. Confirmation of computer calculations by manual calculation.

### 03.07 Data Reduction and Management

- a. Program Review. Perform a program review to determine if the licensee has set up a data reduction process with criteria stated in procedures, and if the licensee's computer software has data reduction features in the analysis, counting, and data reporting.
- b. Spot Check. Select a completed survey data package, the data reduction procedure, and verify implementation by performing the data reduction process under the direction of the licensee.
  1. Trace the path of data from their generation in the field or laboratory, to their final use.
  2. Review any checklist forms used for preventing loss of data during data reduction.
  3. Ensure that data reduction analysis information are reflected in the final survey results.

03.08 Personnel Training. Review the qualifications and training for radiation technicians and other decommissioning project personnel. If possible, question technicians about their knowledge of procedures and the frequency or detail of their training.

03.09 Confirmatory Survey. Determine the need for a confirmatory survey based on the criteria in IMC 2801. A confirmatory survey by the inspector and/or NRC contractor should only be necessary if there is significant doubt regarding the licensee's final survey results. The extent of the survey (e.g., gamma survey and soil analysis) should be determined with

input from the Headquarters health physicist who reviewed the Final Survey Status Report. Confirmatory analysis of archived soil samples may be included.

03.10 Ground Water. Verify that ground-water quality data were collected at the correct locations and frequency, as required by the license (NRC-approved radiological environmental monitoring program), were analyzed for the right constituents, and were verified to make a determination against established detection or compliance standards, as appropriate. Confirm that if ground-water quality data indicated detection or compliance standards (including compliance standards set by Alternative Concentration Limits) were exceeded, that the licensee appropriately notified NRC and took appropriate sampling and, if necessary, corrective actions. Visually verify that compliance wells are correctly located with respect to the most recent NRC-approved locations. If applicable, verify that ground-water corrective action programs were conducted in a timely manner. Also, verify that wells and boreholes that must be sealed under the approved reclamation plan, were correctly sealed and abandoned.

Visually verify that: (1) there are no failures or breaks in impoundment embankments, (2) that there are no obvious tears in impoundment liners, and (3) that there are no springs and seeps around impoundment embankments. If applicable, visually verify that the impoundment leak-detection and impoundment water-level monitoring systems are in place and operational. Verify that the licensee is conducting the appropriate level of visual inspections of impoundment integrity. If applicable, verify that the impoundment leak detection system is being monitored at an appropriate frequency and for the correct indicator parameters. Verify that appropriate monitoring, cleanup, corrective actions, and regulatory notifications were taken when impoundment fluids were found in the impoundment ground-water leak-detection system.

03.11 Exit Meeting. When the inspection is over, there should be an exit meeting with the most senior licensee representative present at the facility. If a senior management representative is unavailable for the exit meeting, the inspector may hold a preliminary exit meeting with appropriate staff on site.

03.12 Post Inspection Actions. The inspector will review inspection findings with his or her supervisor and discuss violations, items of concern, and unresolved items in sufficient depth for management to make appropriate decisions regarding enforcement actions, referral to other State and Federal agencies, and decisions on the scheduling of future inspections of the licensee's facility.

The inspector should also discuss inspection findings with the appropriate Headquarters staff to inform the staff about how the licensee has addressed (or failed to address) special license amendments or recent licensing actions. Licensing information requested by the licensee should also be discussed with the Headquarters staff.

Inspectors should be aware that NRC has entered into several memoranda of understanding, with other Federal agencies, that outline agreements on items such as exchange of information and evidence in criminal proceedings. The inspector should ensure that the exchange of information relevant to inspection activities is made in accordance with the appropriate memorandum of understanding.

## 87654-05 REFERENCES

The following NRC IMCs and related IPs should be used for guidance, in part, for the decommissioning inspection:

- IMC 1230 "Quality Assurance Program for Radiological Confirmatory Measurements," 10/1/83.

- IMC 2602 "Decommissioning Inspection Program for Fuel Cycle Facilities and Materials Licensees," 6/4/97.
- IMC 2605 "Decommissioning Procedures for Fuel Cycle and Materials Licensees," 11/12/96.
- IMC 2801 "Uranium Mill and 11e.(2) Byproduct Material Disposal Site and Facility Inspection Program," 8/25/00.
- IP 88001 "On-Site Construction," 4/15/94.
- IP 88104 "Decommissioning Inspection Procedure for Fuel Cycle Facilities," 6/4/97.

Applicable portions of the following NRC documents should be used for guidance:

- NUREG-1507 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions," June 1998.
- NUREG-1569 Revision 1, "Standard Review Plan for In-Situ Leach Uranium Extraction License Applications," Draft Report for Comment, January 2002.
- NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" Revision 1, June 2000.
- NUREG-1620 Revision 1, "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," Draft Report for Comment, January 2002 (Section 5.2).
- NUREG-1727 "NMSS Decommissioning Standard Review Plan," September 2000 (Appendix D, ALARA).
- NUREG/BR-0241 "NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees" March 1997

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