

AUDIT REPORT

Audit of NRC's Oversight of
Decommissioned Uranium Recovery Sites and
Sites Undergoing Decommissioning

OIG-12-A-06 December 13, 2011



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**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

**OFFICE OF THE
INSPECTOR GENERAL**

December 13, 2011

MEMORANDUM TO: R. William Borchardt
Executive Director for Operations

FROM: Stephen D. Dingbaum */RA/*
Assistant Inspector General for Audits

SUBJECT: AUDIT OF NRC'S OVERSIGHT OF DECOMMISSIONED
URANIUM RECOVERY SITES AND SITES UNDERGOING
DECOMMISSIONING (OIG-12-A-06)

Attached is the Office of the Inspector General's (OIG) audit report titled, *Audit of NRC's Oversight of Decommissioned Uranium Recovery Sites and Sites Undergoing Decommissioning*.

The report presents the results of the subject audit. Agency comments provided at the November 22, 2011, exit conference have been incorporated, as appropriate, into this report.

Please provide information on actions taken or planned on each of the recommendations within 30 days of the date of this memorandum. Actions taken or planned are subject to OIG followup as stated in Management Directive 6.1.

We appreciate the cooperation extended to us by members of your staff during the audit. If you have any questions or comments about our report, please contact me at 415-5915 or Sherri Miotla, Team Leader, Nuclear Materials & Waste Safety Team, at 415-5914.

Attachment: As stated

EXECUTIVE SUMMARY

BACKGROUND

The Nuclear Regulatory Commission (NRC) regulates uranium recovery operations. Through the 1980s, commercial uranium recovery mills operated in support of both a fledgling nuclear power industry and U.S. defense programs. The waste from the mills (uranium mill tailings) caused environmental contamination that the Federal Government continues to address.

In 1978, Congress enacted the Uranium Mill Tailings Radiation Control Act (UMTRCA) to provide for the disposal, long-term stabilization, and control of uranium mill tailings in a safe and environmentally sound manner, to minimize or eliminate radiation health hazards to the public. UMTRCA defines two categories of uranium mill tailings sites (Title I and Title II) and assigns differing responsibilities to three Federal agencies.

Under Title I, the Federal Government assumed responsibility for cleanup at abandoned, inactive uranium milling sites. Once decommissioning is complete, the Department of Energy's (DOE) Office of Legacy Management accepts the site for long-term care and maintenance under a general license from NRC.

Title II places responsibility for cleanup of sites with the licensees that were operating in 1978 or licensed by NRC or an Agreement State after 1978. Licensees must conduct cleanup activities according to an NRC-approved reclamation plan. Once cleanup activities are complete, NRC terminates the license and approves site transfer to DOE.

NRC, the Environmental Protection Agency (EPA), and DOE have distinct responsibilities under UMTRCA.

NRC Responsibilities

NRC's responsibility is to ensure that decommissioning at both Title I and Title II sites meets the standards for protecting human health and the environment.

EPA Responsibilities

EPA's responsibility is to set the standards for air and water quality. Additionally, EPA is responsible for administering the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA), which impacts two uranium recovery sites undergoing decommissioning. EPA and NRC entered into memorandums of understanding (MOUs) regarding oversight of two sites. The MOUs outline EPA and NRC obligations to coordinate distinct regulatory responsibilities.

DOE Responsibilities

DOE's responsibility under UMTRCA is to remediate Title I sites and provide long-term custody for both Title I and Title II sites.

OBJECTIVE

The audit objective was to determine the effectiveness of NRC's regulatory oversight of decommissioned uranium recovery sites and sites undergoing decommissioning.

RESULTS IN BRIEF

NRC's oversight of Title I and Title II uranium recovery decommissioning is largely effective. In particular, recent NRC initiatives to improve knowledge management have addressed self-identified areas of inefficiency and have enhanced the agency's oversight efforts. However, the Office of the Inspector General has identified two opportunities for more effective oversight of uranium recovery decommissioning by:

- Improving compliance with the terms of the site-specific MOUs with EPA.
- Reducing reliance on DOE's inspection program to alert NRC to problems at decommissioned uranium recovery sites in DOE custody.

NRC Does Not Fully Comply With NRC-EPA CERCLA Site MOUs

NRC does not fully comply with the conditions of the MOUs with EPA for uranium recovery sites subject to CERCLA. NRC agreed to conditions in the MOUs that would promote effective and efficient regulatory oversight. However, NRC lacks controls to ensure compliance with the terms of the MOUs. Therefore, NRC approaches oversight of remediation activities in a way that increases the risk that these activities will not occur in an effective and timely manner.

NRC Relies on DOE's Inspection Program

NRC relies on DOE's inspection program at decommissioned uranium recovery sites in DOE custody. Although inspections are a key component of NRC's oversight, NRC has chosen not to inspect the sites transferred to DOE. As a result, NRC may not know if all regulatory requirements are met regarding the protection of public health and safety and the environment.

RECOMMENDATIONS

This report makes two recommendations to improve the agency's oversight of decommissioned uranium recovery sites and sites undergoing decommissioning. A consolidated list of these recommendations appears in Section IV of this report.

AGENCY COMMENTS

An exit conference was held with the agency on November 22, 2011. At this meeting, agency management provided supplemental information that has been incorporated into this report as appropriate. As a result, agency management stated their general agreement with the findings and recommendations in this report and opted not to provide formal comments for inclusion in this report.

ABBREVIATIONS AND ACRONYMS

ACL	alternate concentration limit
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act, as amended
CFR	Code of Federal Regulations
DOE	Department of Energy
EPA	Environmental Protection Agency
FSME	Office of Federal and State Materials and Environmental Management Programs
MOU	memorandum of understanding
NRC	Nuclear Regulatory Commission
OIG	Office of the Inspector General
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
ABBREVIATIONS AND ACRONYMS.....	iv
I. BACKGROUND.....	1
II. OBJECTIVE	6
III. FINDINGS.....	6
A. NRC DOES NOT FULLY COMPLY WITH NRC-EPA CERCLA SITE MOUS	7
B. NRC RELIES ON DOE'S INSPECTION PROGRAM	11
IV. CONSOLIDATED LIST OF RECOMMENDATIONS.....	17
V. AGENCY COMMENTS.....	17
APPENDIX	
A. CONTAMINATION FROM URANIUM MILL TAILINGS.....	18
B. CONVENTIONAL URANIUM RECOVERY MILLING OVERVIEW	19
C. SITES DECOMMISSIONED AND UNDERGOING DECOMMISSIONING	20
D. OBJECTIVE, SCOPE, AND METHODOLOGY	21

I. BACKGROUND

The Nuclear Regulatory Commission's (NRC) mission is to regulate the Nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.

As part of its mission, NRC regulates uranium recovery operations. Through the 1980s, commercial uranium recovery mills operated in support of both a fledgling nuclear power industry and U.S. defense programs. The waste from the mills (uranium mill tailings) caused contamination that the Federal Government continues to address (see Appendix A for additional information on contamination).



The Rio Algom uranium mill tailings site in Grants, NM
Source: Office of the Inspector General (OIG), NRC

Uranium Mill Tailings

Uranium mill tailings are primarily the waste material created during conventional uranium recovery processing (see Appendix B for a process overview) and deposited in a mill tailings impoundment. The mill tailings contain heavy metal constituents and emit radon from the decay of radium, itself a decay product of uranium, thus creating potential adverse health and environmental effects. Uranium mill tailings impoundments are large, ranging in size from 4 to 370 acres. Each uranium

mill tailings site has unique characteristics determined by factors such as the composition of the tailings and the specific topography, geology, and hydrology of the area. NRC and Agreement States¹ regulate approximately 200 million metric tons of uranium mill tailings, while the Department of Energy (DOE) oversees 26 million metric tons.

The Uranium Mill Tailings Radiation Control Act

Studies of the environmental impacts of uranium mill tailings during the early 1970s revealed potentially significant health hazards. The lack of regulations for managing and decommissioning² the resulting waste reflected the limited knowledge of the hazards involved. As a result, Congress enacted the Uranium Mill Tailings Radiation Control Act (UMTRCA) in 1978, giving NRC important responsibility in the oversight of uranium mill decommissioning and site remediation.

UMTRCA provides for the disposal, long-term stabilization, and control of uranium mill tailings in a safe and environmentally sound manner, to minimize or eliminate radiation health hazards to the public. UMTRCA defines two categories of uranium mill tailings sites (Title I and Title II) and assigns differing responsibilities to three Federal agencies.

Categories of Uranium Mill Tailings Disposal Sites

Under Title I, the Federal Government assumed responsibility for cleanup at abandoned, inactive uranium milling sites. Once decommissioning is complete, DOE's Office of Legacy Management accepts the sites for long-term care and

¹ Agreement States are States that have entered into an agreement assuming regulatory authority from NRC. In accordance with Section 274 of the Atomic Energy Act, as amended, NRC may relinquish its authority to regulate byproduct, source, and limited quantities of special nuclear material to States. These States must first demonstrate that their regulatory programs are adequate to protect public health and safety and are compatible with NRC's program.

² *Decommission* means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits (1) release of the property for unrestricted use and termination of the license or (2) release of the property under restricted conditions and termination of the license.

maintenance under a general license from NRC. As of June 2011, decommissioning had been completed at 21 Title I sites.



A decommissioned Title I uranium mill tailings site in Canonsburg, PA
Source: OIG, NRC

Title II places responsibility for cleanup of sites with the licensees that were operating in 1978 or licensed by NRC or an Agreement State after 1978. Licensees must conduct cleanup activities³ according to an NRC-approved reclamation plan. Licensees must then provide funding for long-term surveillance, including annual inspections and environmental monitoring, in order for NRC to terminate the license and approve site transfer to DOE. As of June 2011, decommissioning had been completed at six Title II sites, which are now in long-term DOE custody. Decommissioning is underway at 11 other NRC regulated Title II sites. Appendix C of this report lists sites decommissioned and sites undergoing decommissioning.

Federal Agency Responsibility

NRC, the Environmental Protection Agency (EPA), and DOE have distinct responsibilities under UMTRCA.

³ These activities may include wind blown mill tailings retrieval, dewatering or the removal of freestanding liquids, and final radon barrier construction.

NRC Responsibilities

NRC's responsibility under UMTRCA is to ensure that decommissioning at both Title I and Title II sites meets the standards for protecting human health and the environment. Specifically,

- Title I sites: NRC is required to evaluate DOE's site design and implementation and, following remediation, to concur that the site meets established standards.
- Title II sites: NRC (or an Agreement State as appropriate) is required to oversee licensees' operations and decommissioning, and conduct inspections and license reviews.

NRC's uranium recovery decommissioning inspectors are located in Region IV, and project managers overseeing license and technical reviews are located in the Office of Federal and State Materials and Environmental Management Programs (FSME) in NRC headquarters. Region IV has three qualified uranium recovery inspectors. FSME has budgeted approximately 5.5 full-time equivalents to the oversight program for fiscal year 2012.

EPA Responsibilities

EPA's responsibility under UMTRCA is to set the standards for air and water quality. For air, the primary concern is radon gas, and for groundwater, the concerns are uranium and associated heavy metal constituents. EPA's regulations were incorporated into NRC's regulations in 10 Code of Federal Regulations (CFR) Part 40, Appendix A. Additionally, EPA is responsible for administering the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA),⁴ which impacts two uranium recovery sites undergoing decommissioning. EPA and NRC entered into memorandums

⁴ CERCLA was enacted in 1980 to provide for remedial action at chemically and radiologically contaminated sites. EPA initiates a multiphase evaluation and cleanup process when it identifies a site requiring remediation under CERCLA authority.

of understanding (MOUs) regarding oversight of two sites. The MOUs outline EPA and NRC obligations to coordinate distinct regulatory responsibilities.



The Church Rock uranium mill tailings site in Gallup, NM
Source: OIG, NRC

DOE Responsibilities

DOE's responsibility under UMTRCA is to remediate Title I sites and provide long-term custody for both Title I and Title II sites. Specifically,

- DOE's Title I remediation actions must meet EPA standards with review and concurrence by NRC.
- DOE develops and NRC approves a long-term surveillance plan for Title I and Title II sites where reclamation is complete.
- DOE takes possession of the sites for long-term custody under a general license. Long-term custody includes monitoring, maintenance, and emergency measures necessary to protect public health and safety. There is no termination of this unique general license.

II. OBJECTIVE

The audit objective was to determine the effectiveness of NRC's regulatory oversight of decommissioned uranium recovery sites and sites undergoing decommissioning. Appendix D contains information on the audit scope and methodology.

III. FINDINGS

NRC's oversight of Title I and Title II uranium recovery decommissioning is largely effective. In particular, recent NRC initiatives to improve knowledge management have addressed self-identified areas of inefficiency and have enhanced the agency's oversight efforts. However, OIG has identified two opportunities for more effective oversight of uranium recovery decommissioning by:

- Improving compliance with the terms of the site-specific MOUs with EPA.
- Reducing reliance on DOE's inspection program to alert NRC to problems at decommissioned uranium recovery sites in DOE custody.

A. NRC Does Not Fully Comply With NRC-EPA CERCLA Site MOUs

NRC does not fully comply with the conditions of the MOUs with EPA for uranium recovery sites subject to CERCLA. NRC agreed to conditions in the MOUs that would promote effective and efficient regulatory oversight. However, NRC lacks controls to ensure compliance with the terms of the MOUs. Therefore, NRC approaches oversight of remediation activities in a way that increases the risk that these activities will not occur in an effective and timely manner.

NRC Compliance With MOU Conditions

Federal internal control standards⁵ require agencies to establish and monitor internal controls and performance measures to assure effectiveness and efficiency of agency operations and the use of resources. Additionally, the standards require that managers compare actual performance to planned or expected results and analyze significant differences.

Internal controls are integral components of an organization's management that provide reasonable assurance of effectiveness and efficiency of operations. Internal control comprises the plans, methods, and procedures, to include performance measures, used to meet missions, goals, and objectives.

NRC and EPA jointly developed and agreed to MOUs for promoting effective and efficient regulation of two uranium recovery sites in New Mexico undergoing decommissioning: (1) Church Rock and (2) Homestake. NRC and EPA regulate remediation activities at these sites through authorities given to both agencies in UMTRCA. EPA also possesses additional regulatory authorities through CERCLA. The objective of the MOUs is to promote effective regulation and assure that site remediation activities occur in an effective and timely manner.

⁵ Office of Management and Budget Circular A-123, *Management's Responsibility for Internal Control*, and U.S. Government Accountability Office *Standards for Internal Control in the Federal Government*.

NRC has several obligations under the MOUs. One is to provide site remediation progress reports on a quarterly basis for Church Rock and on a semiannual basis for Homestake. Another responsibility is to conduct an annual review of the MOUs. These two responsibilities are part of several conditions in the MOUs intended to ensure long-term effectiveness of oversight and promote mutual communication.



The Homestake uranium mill tailings site in Grants, NM
Source: OIG, NRC

NRC Does Not Fully Comply With NRC-EPA CERCLA Site MOUs

NRC does not fully comply with the conditions of the jointly developed and agreed upon MOUs with EPA for uranium recovery CERCLA sites. NRC has not provided required progress reports to EPA or conducted required annual reviews of the MOUs.

NRC Has Not Provided Progress Reports to EPA

NRC has not met its responsibility to provide EPA with quarterly progress reports on site remediation for the Church Rock site

and semiannual progress reports for the Homestake site. An NRC senior manager acknowledged that NRC is not meeting this requirement.

NRC Has Not Conducted an Annual Review of the MOUs

NRC has not met its responsibility to conduct an annual review of the MOUs. Conditions in the MOUs require NRC to review the MOUs annually in order to make modifications based on changes in regulatory authorities or priorities. NRC senior managers stated that agency staff never reviewed the MOUs.

NRC Lacks Controls To Ensure Compliance With the MOUs

NRC does not fully comply with the MOUs for uranium recovery CERCLA sites because NRC does not have internal controls or performance measures in place to provide reasonable assurance that NRC is fulfilling its obligations.



A water treatment plant at the Homestake site in Grants, NM
Source: OIG, NRC

FSME is responsible for ensuring NRC compliance with the MOUs for uranium recovery CERCLA sites. FSME has baseline performance measures and an internal control plan to ensure that programs achieve intended results, resources are used

consistently with the agency's mission, and laws and regulations are followed. However, neither the performance measures nor internal control plan include controls to provide reasonable assurance that NRC fully complies with and meets its obligations under the MOUs.

NRC Risks Hindering Effective Oversight

Because NRC is not in full compliance with the conditions of the MOUs with EPA for uranium recovery CERCLA sites, effective and efficient oversight may be hindered. NRC not providing progress reports on site remediation and the lack of annual MOU reviews have contributed to an approach to oversight of remediation activities in a way not outlined in the MOUs. For example, NRC and EPA senior managers recently exchanged letters agreeing that the objective of the Homestake MOU is to ensure site remediation activities occur in an effective and timely manner, but staff from both agencies disagreed with the other agency's approach to overseeing the activities at the site.

NRC's current approach to oversight of remediation activities in a way not outlined in the MOUs increases the risk that these activities will not occur in an effective and timely manner. Furthermore, because the MOUs have not been reviewed, they have not been updated.

Recommendation

OIG recommends that the Executive Director for Operations:

1. Establish performance measures to ensure compliance with the NRC-EPA CERCLA site MOUs.

B. NRC Relies on DOE's Inspection Program

NRC relies on DOE's inspection program at decommissioned uranium recovery sites in DOE custody. Although inspections are a key component of NRC's oversight, NRC has chosen not to inspect the sites transferred to DOE. As a result, NRC may not know if all regulatory requirements are met regarding the protection of public health and safety and the environment.



Rock cover testing at the Umetco uranium mill tailings site in Gas Hills, WY
Source: NRC

Inspection Is a Key Component of NRC Oversight

Inspections constitute a key component of NRC's regulatory process. The Atomic Energy Act of 1954, as amended, firmly establishes inspection of licensees as a primary monitoring tool. The act requires the agency to "insure that the management of any byproduct material . . . is carried out in such a manner as the Commission deems appropriate to protect the public health and safety and the environment" and authorizes the agency to conduct inspections. NRC regulations require licensees to provide for inspections as may be necessary for NRC to ensure that licensees meet existing regulatory requirements.

General License Terms Allow Inspection

After a facility has been decommissioned, the site is transferred to DOE for long-term custody under the general license.⁶ The general license terms allow for inspection by NRC. Specifically, the regulation states that the “the long-term care agency under the general license ... shall [g]uarantee permanent right-of-entry to Commission representatives for the purpose of periodic site inspections.”⁷ This allows NRC to inspect the uranium mill tailings sites in DOE long-term custody under the general license.

NRC Relies on DOE's Inspection Program

A DOE contractor conducts annual inspections of all uranium mill tailings sites in DOE long-term custody. Depending on site conditions and compliance requirements, these inspections may include the following: visual inspection and photographic documentation of conditions, routine maintenance, surveys to detect settlement of the mill tailings impoundment, groundwater monitoring, and rock quality monitoring. The contractor compiles the observations into separate reports on the Title I and Title II sites, and then DOE submits the inspection reports to NRC.

Technical Challenges Revealed by DOE Inspections

DOE's inspection program has revealed technical challenges at some sites, particularly in groundwater conditions and durability of covers and erosion protection structures.

Groundwater

Uranium mill tailings contaminated the groundwater at numerous sites. For such sites, the approved reclamation plan must include the post-remediation groundwater quality goal. The approach for addressing EPA standards depends on site conditions. In cases where the EPA standard for drinking water

⁶ The general license is established and its terms are set forth in 10 CFR 40.27 and 10 CFR 40.28.

⁷ The inspection reference appears in 10 CFR 40.27(c)(4) for Title I sites and 10 CFR 40.28(c)(4) for Title II sites, using identical language.

is not practicable with available remediation techniques, a licensee may apply for approval of alternative standards known as alternate concentration limits (ACLs) for one or more contaminants.



Loose erosion fabric at the Shiprock uranium mill tailings site in New Mexico
Source: DOE

Groundwater contaminant standards should be set at a level where normal fluctuation of concentration levels will not exceed the approved limits. However, groundwater contaminant levels at some sites transferred to long-term custody have shown consistent increases (e.g., Bluewater) or broad fluctuations (e.g., Falls City and Tuba City). At one Title II site (Shirley Basin South) transferred to DOE custody, alternative standards have been exceeded. Another Title II site (Bear Creek) has had its “final inspection” by NRC, but the pending transfer to DOE is delayed because of similar exceedences.

Durability

Uranium mill tailings are compacted into engineered disposal cells.⁸ To be approved, a site’s reclamation plan must include a site-specific design for the disposal cell that takes into account

⁸ Disposal cells are engineered to encapsulate the mill tailings, reduce radon emanation, and prevent the movement of water through the tailings.

the characteristics of the uranium mill tailings and site topography, among other factors. The goals are to prevent radon emissions and dispersion of the uranium mill tailings. The cell design specifies not only the dimensions of the impoundment, radon barrier, and rock cover, but also the structures for erosion control that will protect the disposal cell from surface runoff after construction.

According to regulations, these engineered disposal cells should be effective for at least 200 years. However, several sites in DOE long-term custody have had problems with covers or with erosion control measures within less than 25 years of construction. In addition, a Title II site that has received its “final inspection” in preparation for transfer to DOE has already experienced durability problems. Table 1 lists the sites with technical challenges.

Table 1: Sites with Technical Challenges

Site Name, State	UMTRCA Title	Year of Transfer to DOE	Year cell built	Technical Challenge
Falls City, TX	I	1997	1994	<i>Groundwater</i> —uranium fluctuations
Lakeview, OR	I	1995	1989	<i>Durability</i> —rock degradation
Rifle, CO	I	1998	1996	<i>Durability</i> —slopes, drainage
Salt Lake City, UT	I	1997	1989	<i>Durability</i> —rock degradation
Tuba City, AR	I	1996	1990	<i>Durability</i> —erosion <i>Groundwater</i> —broad fluctuations
Bear Creek, WY	II	n/a *	1999	<i>Groundwater</i> —ACL exceeded
Bluewater, NM	II	1997	1995	<i>Groundwater</i> —rise in radium levels
L-Bar, NM	II	2004	2000	<i>Durability</i> —erosion
Shirley Basin South, WY	II	2005	2001	<i>Groundwater</i> —ACL exceeded
Umetco Gas Hills, WY	II	n/a *	2002	<i>Durability</i> —erosion

Source: OIG, compiled from NRC and DOE site documents.

* n/a: Pending transfer to DOE.

NRC Does Not Inspect

NRC does not conduct inspections at the uranium recovery sites in DOE long-term custody under the general license. When a site is transferred to DOE long-term custody there is no formal

mechanism for further inspection, and NRC oversight shifts from the regional inspection branch to project managers at headquarters.

Project managers in FSME described their oversight activities as reviewing the DOE-submitted inspection reports and groundwater monitoring reports where applicable. They may follow up with DOE's Office of Legacy Management if they have a question, but the primary contacts with DOE staff are in quarterly conference calls to review technical issues. Project managers sometimes visit the sites in DOE custody, but they clearly stated that such visits are not formal inspections. For example, one project manager reported recently touring a few sites in order to become more familiar with site-specific issues.



The Maybell West uranium mill tailings site in Colorado
Source: DOE

NRC Chooses Not To Inspect Sites Transferred to DOE for Long-Term Surveillance

NRC has chosen not to inspect sites transferred to DOE for long-term surveillance. NRC managers explained that the agency conducts extensive oversight during decommissioning so that the sites will not require scrutiny after transfer. They

contended that when regulatory requirements are met during decommissioning, NRC can certify that a site is stable and ready for closure with only minimal monitoring according to the long-term surveillance plan. The managers also concluded that DOE would be at least as effective in monitoring as NRC would be, and therefore NRC could rely on DOE to alert NRC to any problems and address them through the process of amending the long-term surveillance plan.

NRC May Not Know If Regulatory Requirements Are Being Met

Because NRC does not inspect sites transferred to DOE for long-term custody, NRC may not know if all regulatory requirements are being met regarding the protection of public health and safety and the environment. Some decommissioned uranium recovery sites have proven more dynamic than originally expected, and NRC may not have the best information regarding conditions at these sites. Transfer of all remaining Title II sites to DOE will result in approximately 226 million metric tons of radioactive and hazardous waste in DOE long-term custody. Given the current approach, NRC will not independently verify that these sites are meeting regulatory standards that protect public health and safety and the environment.

Recommendation

OIG recommends that the Executive Director for Operations:

2. Develop and document in inspection guidance a frequency for inspecting uranium recovery sites transferred to DOE for long-term surveillance.

IV. CONSOLIDATED LIST OF RECOMMENDATIONS

OIG recommends that the Executive Director for Operations:

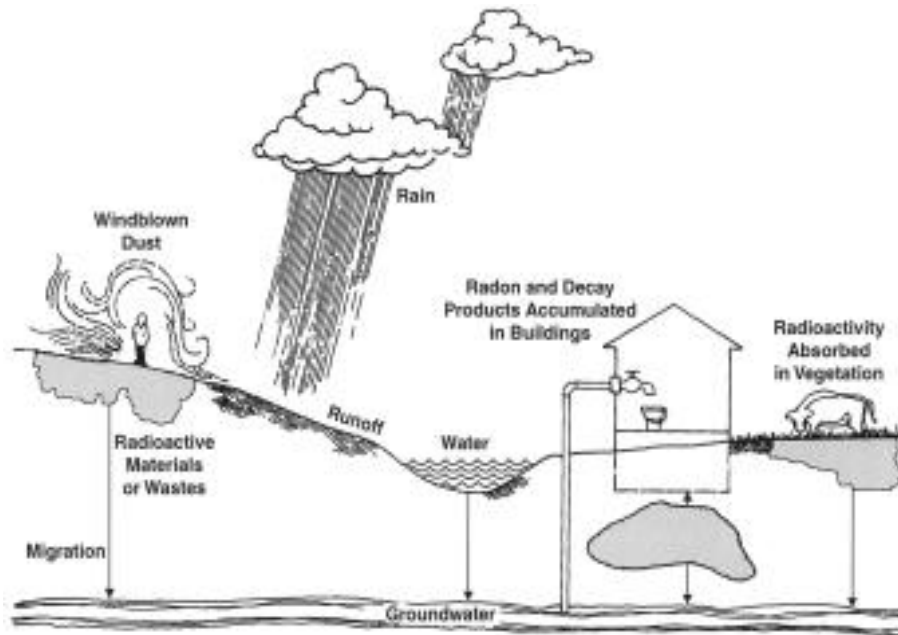
1. Establish performance measures to ensure compliance with the NRC-EPA CERCLA site MOUs.
2. Develop and document in inspection guidance a frequency for inspecting uranium recovery sites transferred to DOE for long-term surveillance.

V. AGENCY COMMENTS

An exit conference was held with the agency on November 22, 2011. At this meeting, agency management provided supplemental information that has been incorporated into this report as appropriate. As a result, agency management stated their general agreement with the findings and recommendations in this report and opted not to provide formal comments for inclusion in this report.

Contamination From Uranium Mill Tailings

Contamination occurs through five primary pathways: radon inhalation, dust migration, surface water runoff, ground seepage into aquifers, and radioactivity absorbed in vegetation and entering the food chain. The contamination pathways are illustrated below.

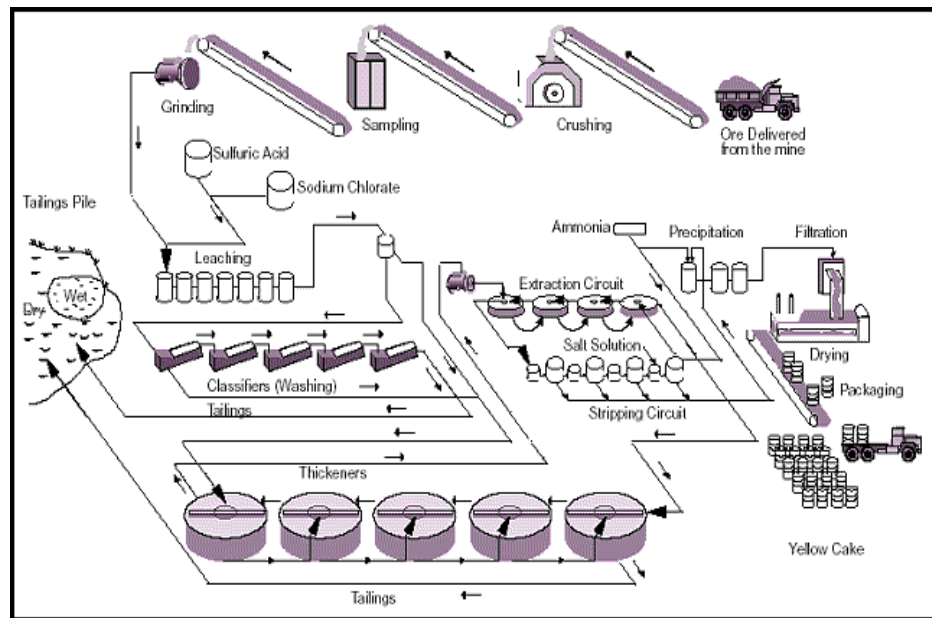


Source: *The Long Term Stabilization of Uranium Mill Tailings*, © IAEA, 2004, page 298

Conventional Uranium Recovery Milling Overview

Uranium recovery is the process of concentrating uranium from ore into a product called "yellowcake," which is later converted into fuel for nuclear reactors.

Conventional uranium mills crush the uranium ore, use an acid or alkaline solution to leach the uranium from the ore, and then concentrate the uranium from the solution into yellowcake. The uranium milling process is illustrated below.



Source: U.S. Energy Information Administration

Appendix C

Sites Decommissioned and Undergoing Decommissioning

Decommissioned Uranium Recovery Sites in DOE Long-Term Custody

	Title I		Title II	
	Site Name, State	Fiscal Year Transferred	Site Name, State	Fiscal Year Transferred
1	Ambrosia Lake, NM	1998	Bluewater, NM	1997
2	Burrell, PA	1994	Edgemont, SD	1996
3	Canonsburg, PA	1996	L-Bar, NM	2004
4	Durango, CO	1996	Maybell West, CO	2010
5	Falls City, TX	1997	Sherwood, WA	2001
6	Grand Junction, CO	1999	Shirley Basin South, WY	2005
7	Green River, UT	1998		
8	Gunnison, CO	1997		
9	Lakeview, OR	1995		
10	Lowman, ID	1994		
11	Maybell, CO	1999		
12	Mexican Hat, UT	1997		
13	Monument Valley, AZ	1997		
14	Naturita, CO	1999		
15	Rifle, CO	1998		
16	Riverton, WY	1991		
17	Salt Lake City, UT	1997		
18	Ship Rock, NM	1996		
19	Slick Rock, CO	1998		
20	Spook, WY	1993		
21	Tuba City, AZ	1996		

Source: DOE Office of Legacy Management, *Site Management Guide*, June 2011. According to this guide, the above listing is accurate as of September 30, 2010.

NRC Licensed Title II Sites Undergoing Decommissioning

NRC-Licensed Sites	
	Site Name, State
1	American Nuclear, WY
2	Bear Creek, WY
3	ExxonMobil Highlands, WY
4	Homestake, NM
5	Pathfinder–Lucky MC, WY
6	Pathfinder–Shirley Basin, WY
7	Rio Algom–Ambrosia Lake, NM
8	Sequoyah Fuels Corporation, OK
9	Umetco Minerals, WY
10	United Nuclear–Church Rock, NM
11	Western Nuclear–Split Rock, WY

Source: NRC's Web site, "NRC-Regulated Uranium Recovery Sites Undergoing Decommissioning," May 20, 2011

OBJECTIVE, SCOPE, AND METHODOLOGY

Objective

The audit objective was to determine the effectiveness of NRC's regulatory oversight of decommissioned uranium recovery sites and sites undergoing decommissioning.

Scope

The audit focused on reviewing the oversight of decommissioned uranium recovery sites and sites undergoing decommissioning. We conducted this performance audit at NRC headquarters and at uranium recovery sites in Gallup, NM; Grants, NM; Canonsburg, PA; Carbon County, WY; and Converse County, WY, from April 2011 through September 2011. Internal controls related to the audit objective were reviewed and analyzed. Throughout the audit, auditors were aware of the possibility or existence of fraud, waste, or misuse in the program.

Methodology

OIG reviewed relevant Federal legislation pertaining to NRC's regulatory authorities to oversee uranium recovery sites, including the *Atomic Energy Act of 1954, as amended*, and the *Uranium Mill Tailings Radiation Control Act of 1978*. OIG also reviewed agency guidance including office instructions, inspection manual chapters, and inspection procedures pertaining to the oversight of uranium recovery sites. Reports, briefings, presentations, and communications between NRC and representatives from both DOE and EPA that address the relevant aspects of uranium recovery oversight were also reviewed.

OIG interviewed NRC staff and managers from headquarters (Rockville, MD) and Region IV (Arlington, TX) who participate in activities related to uranium recovery oversight. OIG also interviewed licensees, and representatives from the DOE, EPA,

and the Navajo Nation. These interviews were conducted to obtain insights into NRC's oversight of uranium recovery decommissioning.

The audit team also observed the following inspection activities:

- An NRC safety inspection at the ExxonMobil-Highland uranium recovery site in Converse County, WY.
- An NRC safety inspection at the Pathfinder-Shirley Basin uranium recovery site in Carbon County, WY.

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

The audit work was conducted by Sherri Miotla, Team Leader; Robert Woodward, Audit Manager; Kevin Nietmann, Senior Technical Advisor; Levar Cole, Senior Management Analyst; and Amy Hardin, Auditor.