

## Status of the NRC's Decommissioning Program

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### **ABSTRACT**

On July 21, 1997, the U.S. Nuclear Regulatory Commission published the final rule on Radiological Criteria for License Termination (the License Termination Rule) as Subpart E to 10 CFR Part 20. NRC regulations require that materials licensees submit Decommissioning Plans to support the decommissioning of its facility if it is required by license condition, or if the procedures and activities necessary to carry out the decommissioning have not been approved by NRC and these procedures could increase the potential health and safety impacts to the workers or the public. NRC regulations also require that reactor licensees submit Post-shutdown Decommissioning Activities Reports and License Termination Plans to support the decommissioning of nuclear power facilities. This paper provides an update on the status of the NRC's decommissioning program. It discusses the status of permanently shut-down commercial power reactors, complex decommissioning sites, and sites listed in the Site Decommissioning Management Plan. The paper provides the status of various tools and guidance the NRC is developing to assist licensees during decommissioning, including a Standard Review Plan for evaluating plans and information submitted by licensees to support the decommissioning of nuclear facilities and the DandD Screen software for determining the potential doses from residual radioactivity. Finally, it discusses the status of the staff's current efforts to streamline the decommissioning process.

### **INTRODUCTION**

U.S. Nuclear Regulatory Commission (NRC) regulations at 10 CFR Parts 30, 40, 70, and 72 require that a Decommissioning Plan (DP) be submitted by a materials licensee to support the decommissioning of its facility when it is required by license condition, or if the procedures and activities necessary to carry out the decommissioning have not been approved by NRC and these procedures could increase the potential health and safety impacts to the workers or the public. The objective of the decommissioning plan is to describe the activities and procedures that the licensee intends to undertake to remove residual radioactive material at the facility to levels that meet NRC criteria for release of the site and termination of the radioactive materials license.

NRC regulations at 10 CFR Part 50 require that, prior to, or within 2 years following permanent cessation of operations, reactor licensees provide NRC with a post-shutdown decommissioning activities report (PSDAR). The purpose of the PSDAR is to provide NRC and the public with a general overview of the proposed decommissioning activities. 10 CFR Part 50 also requires that nuclear power reactor licensees submit a License Termination Plan (LTP) at least 2 years before termination of the license. The purpose of the LTP is to describe the radiological condition of the site, provide a dose assessment for the site, identify the remaining decommissioning

activities, and provide the final survey plan for the site. NRC regulations at 10 CFR Part 20, Subpart E(1) describe the criteria for the release of sites for unrestricted and restricted use and is applicable to all NRC licensees.

## **BACKGROUND**

“Decommission” is defined in NRC’s regulations at 10 CFR 20.1003 as “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 the termination of the license (2).

NRC’s decommissioning program encompasses the decommissioning of all NRC licensed facilities, ranging from routine license terminations for sealed source users, to the oversight of complex sites and those on the Site Decommissioning Management Plan (SDMP), as well as power and non-power reactors. Approximately 300 materials licenses are terminated each year. Most of these license terminations are routine and the sites require little, if any, remediation to meet the NRC’s unrestricted release criteria. However, a number of SDMP sites are expected to request license termination under the restricted-use provisions of 10 CFR 20.1403 (3), while others present complex technical and policy challenges which will require large expenditures of staff resources. For example, for many sites, site-specific dose assessments, including complex groundwater modeling, will be required, while at others requesting release with restrictions on future site use, “durable institutional controls,” as specified in 10 CFR 20.1403(e), (4) will need to be provided to ensure protection of the public health and safety.

Decommissioning program activities include: (1) developing regulations and guidance to assist staff and the regulated community; (2) conducting research to develop data, techniques, and models used to assess public exposure from the release of radioactive material resulting from site decommissioning; (3) reviewing and approving decommissioning plans and license termination plans; (4) reviewing and approving license amendment requests; (5) inspecting licensed and non-licensed facilities undergoing decommissioning; (6) developing environmental assessments (EAs) and environmental impact statements (EISs) to support the NRC’s reviews of DPs and LTPs; (7) reviewing and approving final site survey reports; and (8) conducting confirmatory surveys.

The NRC’s decommissioning program is administered through NRC’s Offices of Nuclear Material Safety and Safeguards (NMSS), Nuclear Reactor Regulation (NRR), and Nuclear Regulatory Research (RES), as well each of the NRC’s Regional offices. Because of the cross-Agency nature of the decommissioning program, the staff has instituted several initiatives to ensure that decommissioning activities are integrated and coordinated within the Agency, including tracking decommissioning activities in the Agency Operating Plan and providing management oversight and coordination of decommissioning activities, policies and efforts through the Decommissioning Management Board.

## POWER REACTOR DECOMMISSIONING

NMSS and NRR signed a Memorandum of Understanding (MOU) on March 10, 1995, which delineates the transfer of responsibilities for power reactor decommissioning from NRR to NMSS. In accordance with the MOU, NRR will be responsible for regulatory project management, oversight, and inspection support for a reactor undergoing decommissioning until all spent fuel is permanently transferred from the spent fuel pool. After the spent fuel is permanently transferred from the spent fuel pool, NMSS assumes responsibility for project management and oversight. The MOU gives NMSS responsibility for LTPs, and preparing related safety evaluation reports, environmental assessments and license termination orders or amendments. NMSS is also responsible for confirmatory surveys and license termination activities, including assurance that appropriate site release criteria have been met.

Two power reactors (Shoreham and Ft. Saint Vrain) have been decommissioned and their licenses have been terminated. Currently, NRR has regulatory project management responsibility for 17 power reactors. The licensees have submitted PSDARs for these power reactors. Regulatory project management responsibility for two power reactors (Fermi 1 and Peach Bottom Unit 1) has been transferred from NRR to NMSS. NMSS staff completed the review of the LTP for the Trojan facility in December 2000 and is currently reviewing the LTPs for the Saxton, Maine Yankee, and Connecticut Yankee facilities.

Based on the results of the reviews of these LTPs, the NRC staff has developed a list of “lessons learned” which should be considered by licensees as they prepare their LTPs. These are:

1. **Communications** - Early and frequent consultations between NRC staff and licensees are needed and encouraged during the planning and scoping phase supporting the preparation of the DPs or LTPs.
2. **Groundwater** - There is not likely to be enough operational environmental monitoring of groundwater to enable adequate site characterization and dose assessments.
3. **Data Quality Objectives** - In developing the final survey design, the licensee needs to identify all appropriate data quality objectives in planning and designing the final status survey plan.
4. **Inspections** - In-process inspections are more efficient than one-time confirmatory surveys.
5. **Flexibility** - Continued communications between NRC staff and the licensee during the staff’s review is needed to ensure that the licensee is able to take full advantage of the inherent flexibility in NUREG-1575, “Multi-Agency Radiation Survey and Site Investigation Manual.” (5)

6. **Modeling Issues** - The derivation of derived concentration guideline levels should include the assumptions and justification for parameters used.
7. **Decommissioning Cost Estimate** - There needs to be a clear relationship between the planned decommissioning activities and the associated cost estimate.
8. **Records** - Old records are often inadequate or inaccurate and should not be relied on as the sole source of information for the historical site assessment/site characterization.
9. **Environmental Assessments** - Environmental impact reviews need to address non-radiological impacts of the proposed action.
10. **Classifications of Survey Units** - Submittal of the LTP should occur only after sufficient site characterization has occurred.
11. **Embedded Piping** - LTPs and DPs should include a discussion of the methodology the licensee plans to use when conducting surveys of embedded piping planned to be left behind.
12. **Minimum Detectable Concentrations** - LTPs and DPs should include discussion describing the methodologies the licensee plans to implement to scan minimum detectable concentrations of mixtures of radionuclides that may remain in given survey areas/units.

Further, the staff is expanding its acceptance review process for DPs and LTPs (typically an administrative review) to include a limited technical review before a DP or LTP will be docketed. An expanded acceptance review should facilitate the identification of significant technical deficiencies early in the review process. This limited technical review will focus on those areas in which experience has shown to be some technical deficiencies in licensee's submittals. In general, these areas are:

- Site characterization (hydro-geological and radiological);
- Dose modeling;
- Final radiation survey;
- Cost estimates; and
- Institutional controls (applicable only to restricted release).

The staff plans to develop additional guidance addressing the above listed lessons learned.

## **SDMP AND COMPLEX SITES**

NRC created the SDMP in March 1990 in an effort to develop a comprehensive strategy for achieving closure of decommissioning issues in a timely manner, and to develop a list of

contaminated sites in order of cleanup priority. The major objectives of the SDMP are to identify and manage specific problem sites through the decommissioning process and to resolve decommissioning policy issues. The original criteria used by the staff for placing sites on the SDMP were: (1) problems with the financial viability of responsible parties or organizations; (2) the presence of large volumes of contaminated soil, sludge, or slag, or onsite burials; (3) long-term presence of contamination in unused facility buildings; (4) previously terminated license that exceeded the existing unrestricted release criteria; and (5) contamination or potential contamination of groundwater from on-site waste.

In the context of a comprehensive decommissioning program, the SDMP has become a management tool to track site-specific progress at complex decommissioning sites. In the future, adding a new site to the SDMP will not necessarily indicate that the site is a “problem” site. Current criteria for listing a site on the SDMP are: (1) all restricted-use sites; and (2) complex unrestricted-use sites that require: (a) detailed site-specific dose modeling; (b) sites subject to heightened public, State, or Congressional interest; and/or (c) sites with questionable financial viability.

There are currently 26 SDMP and complex decommissioning sites undergoing decommissioning. Twenty-three sites have been removed from the SDMP after successful remediation. In addition, 11 sites have been removed from the SDMP by transfer to an Agreement State or the U.S. Environmental Protection Agency. NRC is currently committed to removing one site from the SDMP in fiscal years 2002 and 2003.

In addition to regulating the cleanup of SDMP and complex decommissioning sites, the decommissioning program is responsible for overseeing the cleanup of contaminated sites identified under the Oak Ridge National Laboratory (ORNL) Terminated License Review Project. As a result of the ORNL review, and subsequent follow-up by the Regions, a total of 40 formerly licensed sites were found to have residual contamination levels exceeding NRC’s criteria for unrestricted release. Eighteen of these sites have been re-released after successful remediation, and 11 have been closed by transfer to Agreement States or a Federal entity, 8 are in the process of decommissioning and 3 are under NRC review.

In August 2000 the staff provided the Commission with an analysis of issues to facilitate remediation of decommissioning sites in non-Agreement States. The analysis considered both formerly licensed sites and currently licensed sites where future funding of decommissioning might be difficult. The staff also provided options to address these difficulties, and the Commission directed the staff to pursue some of the recommended options.

One of the principle options approved by the Commission was for the staff to pursue an agreement with the U.S. Department of Energy (DOE) to provide long-term control, for a limited number of SDMP and complex sites using the the restricted release option under Part 20, as authorized under section 151(b) of the Nuclear Waste Policy Act (NWPA) (6). NRC and DOE management signed an Agreement in Principle in March 2001 (7) to seek development of a

Memorandum of Understanding (MOU) that would define the criteria and process that each agency would use to make determinations regarding the potential transfer of a site consistent with section 151(b) of NWPA. The staff is currently working with the DOE staff to develop the MOU.

The Commission also tentatively approved the staff's recommendation to request authorization and appropriations for State-directed remediation at formerly licensed sites in non-Agreement States where there is insufficient funding available. The Commission requested the staff to better define the number of sites, potential costs for remediation, and willingness of the States to direct remediation with appropriated funds. Staff from both Headquarters and the Regions are working on a response to be provided to the Commission in April 2002, after reviews of remaining terminated license sites are completed. Similarly, the Commission also requested the staff to provide further information about currently licensed sites undergoing decommissioning that might have insufficient funds to decommission the facility. The staff is estimating remediation costs for both restricted and unrestricted release, evaluating financial viability, and determining the willingness of States or another Federal agency to direct remediation. The staff will provide this information to the Commission in April 2002. Finally, the staff has prepared a response to the Commission's request to further develop the option of increasing financial assurance requirements.

The staff continues to implement the Commission's direction to explore ways to improve the decommissioning process (8). Three facilities (Westinghouse Cheswick Pump Repair Facility, Viacom/CBS Forest Hill Laboratory, Phillips Petroleum Radiation Laboratory) took part in a pilot study to perform decommissioning without the submittal of a DP. All three facilities have now completed decommissioning. On March 7, 2001, NRC authorized release of the Westinghouse Pump Repair Facility for unrestricted use (9). Region 1 has approved final site survey reports for the Viacom/CBS Forest Hill Laboratory and awaits the amendment request to release the site for unrestricted use. Region IV transferred the license docket for Phillips Petroleum Radiation Laboratory to the State of Oklahoma in September 2000, after the decommissioning was completed, but before receiving the license amendment requesting release of the laboratory for unrestricted use. Staff is currently finalizing the evaluation of the Pilot Program.

## **GUIDANCE AND REGULATIONS**

On July 21, 1997, NRC published the final rule on "Radiological Criteria for License Termination" (the License Termination Rule) as Subpart E to 10 CFR Part 20 (10). NRC regulations require that materials licensees submit decommissioning plans (DPs), to support the decommissioning of their facility, if it is required by license condition, or if the procedures and activities necessary to carry out the decommissioning have not been approved by NRC and these procedures could increase the potential health and safety impacts on the workers or the public. NRC regulations also require that reactor licensees submit Post-shutdown Decommissioning Activities Reports (PSDARs) and License Termination Plans (LTPs) to support the

decommissioning of nuclear power facilities. In September 2000, the NRC staff published NUREG-1727, "NMSS Decommissioning Standard Review Plan" (11) to aid the staff in reviewing and evaluating plans and information submitted by licensees to support the decommissioning of nuclear facilities.

In July and September 2000, the Commission directed the staff to develop a Rulemaking Plan to address the entombment option for power reactors (12). In June 2001, the staff forwarded SECY-01-0099, "Rulemaking Plan and Advance Notice of Proposed Rulemaking: Entombment for Power Reactors" (13) which contained three options for proceeding with entombment. The first option is to continue with the current approach and handle entombment requests on a case-by-case basis. The second option is to conduct rulemaking to add flexibility to 10 CFR 50.82 to amend the 60-year time frame for completion of decommissioning and to clarify the use of engineered barriers for reactor entombments. The third option is to conduct rulemaking to establish performance objectives and licensing requirements for entombment.

On March 23, 2000, the staff provided the Commission with recommendations on issues concerning the control of solid materials at licensed facilities (14). In an SRM, dated August 18, 2000, the Commission decided to defer a final decision on whether to proceed with rulemaking and directed the staff to proceed with a National Academies (NAS) study on possible alternatives for control of solid materials, and to continue the development of a technical information base to support a Commission policy decision in this area (15). The staff expects to have the NAS report in early 2002 and, as also directed by the SRM, will provide its recommendations on how best to proceed to the Commission approximately three months after completion of the NAS study.

The staff prepared a rulemaking plan to standardize the process for allowing the partial site release of a reactor facility or site prior to approval of the LTP. The plan was approved by the Commission on April 26, 2000(16). The Advisory Committee on Nuclear Waste (ACNW) was briefed on the proposed rule in March 2001, and the proposed rule package was sent to the Commission on May 9, 2001. The staff issued the proposed rule in September 2001.

The staff published final Regulatory Guide 1.191, "Fire Protection Program for Nuclear Power Plants During Decommissioning and Permanent Shutdown," in May 2001 (17). The Regulatory Guide describes methods acceptable to the staff for complying with NRC's regulations regarding fire protection programs for power reactors that have permanently ceased operations.

In addition, the staff continues to support the development of the rulemaking for the recycling/reuse of radioactively contaminated materials.

The Office of Nuclear Regulatory Research (RES) provides data and models to NMSS to support assessments of public exposure to environmental releases of radioactive material from site decommissioning. In 2001, RES developed: (1) data on degradation of archeological slags that will be used as the basis for assessing long-term performance of slags as a source of radioactive contamination; (2) documentation of unsaturated zone-monitoring strategies for use in review of

monitoring proposals for licensing actions concerning decommissioning and waste disposal facilities in unsaturated media; (3) a technical basis to support selection of site-specific parameter values for estimating flux and transport in dose-assessment codes; (4) a probabilistic version of RESRAD; (5) a final user's guide on probabilistic version of D and D software; (6) a draft technical report on test application of methodology for selecting and testing conceptual models with respect to a specific site; (7) verification and validation testing of 4SIGHT (computer code for predicting performance of barriers); (8) a draft report on the uncertainty methodology for hydrologic parameter uncertainties; and, (9) a NUREG/CR on radionuclide solubilities that will be used in assessments at slag sites.

In 2001 the staff initiated a decommissioning guidance consolidation project. The project involves review and consolidation of all existing NMSS decommissioning guidance documents, decommissioning technical assistance requests, decommissioning licensing conditions, and all decommissioning generic communications issued over the past several years. The goal is to produce consolidated NMSS decommissioning guidance that allows the NRC staff to evaluate information submitted by licensees in a timely, efficient, and consistent manner that protects public health and safety. The end result will be a streamlined multi-volume NUREG grouped into decommissioning functional categories. Further ease of use will be realized by making this a web-based document. The project team began developing the first NUREG volume in June 2001, and the goal is to complete drafts of the NUREG volumes by the end of FY2002. The overall project is scheduled to be completed by the end of FY2003. The updated, consolidated guidance will be provided to all users, both NRC and licensee in hard-copy and/or electronic media. Since each group will have access to the same guidance, the expected results are more complete license documents that will expedite the approval process for both applicants and reviewers. As a result, it is expected that this project will serve to improve the overall decommissioning process.

In 2001, the staff began an effort with the Nuclear Energy Institute (NEI) to develop a shared view of acceptable generic approaches for dealing with several license termination issues while ensuring that the requirements of the LTR will be met. This shared view should provide opportunities for standardized approaches of developing, reviewing, approving, and implementing license termination plans. In an effort to clarify existing guidance associated with the license termination rule (10 CFR 20, Subpart E), NRC and NEI have adopted an approach whereby the NEI License Termination Task Force generates questions and answers (Q&As), and submits them to NRC for review. The submittal is placed on NRC's web site for the public's awareness. NRC reviews the Q&As, provides comments to NEI, and either approves or disapproves the answer as an acceptable approach to the question. NRC's response to NEI is also placed on the web site. Disapproved Q&As can be addressed by the NEI and resubmitted, or withdrawn. Approved Q&As would be incorporated into the consolidated draft decommissioning guidance. The draft guidance, including Q&As, are released for public comment, and posted on NRC's web site. Any public comment on the Q&As are addressed by the NRC writing and review teams developing the consolidate guidance (discussed above). Final Q&As are published with the final consolidated guidance, released to the public, and posted on



NRC's web site. The need for further updating of the guidance (and Q&As) is evaluated by NRC every three years based on internal review and external public comments.

NEI submitted the first 10 Q&As on July 16, 2001(18). NRC reviewed and provided a response to NEI on September 28, 2001 indicating that none of the Q&As were found acceptable(19). NRC and NEI had an open meeting on December 4, 2001 to discuss each Q&A, clarify required information, and reach agreement on the contents of the NEI responses. The meeting also addressed how the Q&A development/review process could be improved for future submissions.

## **REBASELINING THE DECOMMISSIONING PROGRAM**

In 2000, the staff continued implementation of the rebaselining initiative that began in September 1999. The objective of rebaselining is to develop and implement a comprehensive integrated plan for successfully bringing SDMP and complex decommissioning sites to closure. Site status summaries are maintained, and updated monthly, for each SDMP and complex decommissioning site. These summaries describe the status of each site and identify the technical and regulatory issues impacting removal of the site from the SDMP or completion of decommissioning. The staff also developed and maintains Gantt charts for each site, which are updated quarterly, to guide the management of decommissioning activities. The Gantt charts identify all major decommissioning activities and schedules for completion. For those licensees that have submitted a DP, the schedules are based on the staff's assessment of the complexity of the DP review. For those licensees that have not submitted a DP, the schedules are based on other information available to the staff and the decommissioning approach anticipated by the staff.

As part of the rebaselining process, the staff is also implementing streamlining objectives such as: (a) assuming a more pro-active role in interacting with licensees undergoing decommissioning; (b) expanding the acceptance review process, to include a limited technical review, to reduce the need for additional rounds of questions; (c) ensuring that institutional controls and financial assurance requirements are adequate before a technical review of the DP; (d) implementing other procedures to reduce the number of requests for additional information; (e) conducting in-process/side-by-side confirmatory surveys; and (f) relying more heavily on licensees' quality assurance programs, rather than conducting large-scale confirmatory surveys. Furthermore, the staff is incorporating strategies to achieve the performance goals identified as part of the Agency's strategic planning process and Strategic Plan for FY2000 - 2005. Examples of strategies being incorporated include: focusing on resolving key issues such as institutional control for restricted release; partial site release; conducting stakeholder workshops to seek licensee, industry, and public input; updating, consolidating and risk informing/performance orienting decommissioning guidance; and working with industry to identify and resolve technical and policy issue associated with decommissioning; and developing a stakeholder database and website.

In addition to the staff's rebaselining initiatives, in March 2001 the staff developed an integrated Communication Plan to ensure that all decommissioning stakeholders are aware of the staff's

activities and are afforded the opportunity to participate in the decommissioning process. The plan includes specific strategies to increase public participation in the regulatory process, communicate more clearly with stakeholders, enhance NRC's accountability and credibility and foster an environment where safety issues can be identified without fear of retribution. Development and implementation of this plan is one of the mechanisms the NRC staff is using to achieve the NRC's goal of increasing public confidence in the manner in which NRC regulates the use of source, special nuclear and byproduct material. The staff is currently developing site-specific communications plans and is scheduled to complete the implementation of the plans in June 2002.

## **CONCLUSION**

The NRC's decommissioning program includes oversight and management of a wide variety of simple and complex facilities and includes the development of guidance and rules to facilitate the safe and timely decommissioning of these facilities. Recent improvements in the program, the publication of several guidance documents for NRC staff and licensees managing decommissioning projects as well as several rulemaking initiatives currently underway should result in a program that allows licensed facilities to be decommissioned safely while reducing the regulatory burden on licensees.

Future challenges for the decommissioning program include: implementing and identifying improvements for the processes and guidance in the decommissioning SRP; the consolidation of all decommissioning guidance into a single NUREG document; finalizing procedures for releasing portions of sites prior to license termination; developing approaches for long-term institutional controls for sites that may not be able to adequately provide for the controls; improving our communications with the public and other stakeholders; and, ensuring that all NRC requirements and guidance are based on the principal of providing an appropriate level of safety, while not imposing undue burdens on the regulated community.

## **REFERENCES**

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- (3) U.S. Nuclear Regulatory Commission, U.S. Code of Federal Regulations 10 CFR Part 20.1403 "Criteria for license termination under restricted conditions" Federal Register , Vol. 62, July 21, 1997, 39058.

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- (14) U.S. Nuclear Regulatory Commission, SECY-00-0070 "Control of Solid Materials: Results of Public Meetings, Status of Technical Analyses, and Recommendations for Proceeding" March 23, 2000
- (15) U.S. Nuclear Regulatory Commission, Staff Requirements Memorandum on SECY-00-0070 "Control of Solid Materials: Results of Public Meetings, Status of Technical Analyses, and Recommendations for Proceeding" August 18, 2000

(16) U.S. Nuclear Regulatory Commission, Staff Requirements Memorandum on SECY-00-0023 "Rulemaking Plan to Standardize the Process for Allowing a Licensee to Release Part of its Reactor Facility or Site for Unrestricted Use before Receiving Approval of its License Termination Plan

(17) USNRC Regulatory Guide 1.191 "Fire Protection Program for Nuclear Power Plants During Decommissioning and Permanent Shutdown" U.S. Nuclear Regulatory Commission, Washington, DC, May 2001.

(18) Letter from P.H. Genoa, Nuclear Energy Institute, dated July 16, 2001 to L.W. Camper U.S. Nuclear Regulatory Commission :Re: Project Number 689"

(19) Letter from L. W. Camper U.S. Nuclear regulatory Commission to P.H. Genoa, dated September 28, 2001, "Subject Nuclear Energy Institute License Termination Task Force Guidance Clarification Question and Answer (Q&A) Initiative, Qs&As 1-10"