



REGULATORY GUIDE
OFFICE OF NUCLEAR REGULATORY RESEARCH

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REGULATORY GUIDE 1.184

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DECOMMISSIONING OF NUCLEAR POWER REACTORS

A. INTRODUCTION

Purpose

This regulatory guide provides guidance on the actions required of U.S. Nuclear Regulatory Commission (NRC) licensees to decommission nuclear power reactors licensed under the provisions of Part 50 (Ref. 1) and Part 52 (Ref. 2) of Title 10 of the *Code of Federal Regulations* (10 CFR).

Applicable Rules and Regulations

- 10 CFR Part 50 provides for the NRC's domestic licensing of production and utilization facilities.
 - 10 CFR 50.2 provides definitions.
 - 10 CFR 50.4 provides the requirements for written communications.
 - 10 CFR 50.54 provides the conditions for a license.
 - 10 CFR 50.75 provides the requirements for reporting and recordkeeping for decommissioning planning.
 - 10 CFR 50.82 provides the requirements for termination of a license including a requirement for nuclear power reactor licensees to submit a Post-Shutdown Decommissioning Activities Report (PSDAR).
- 10 CFR Part 51 (Ref. 3) provides the requirements for environmental protection regulations for the NRC's domestic licensing and related regulatory functions.

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- 10 CFR Part 52 governs the issuance of early site permits, standard design certifications, combined licenses, standard design approvals, and manufacturing licenses for nuclear power facilities licensed under Section 103 of the Atomic Energy Act of 1954, as amended (68 Stat. 919), and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242).

Related Guidance

- Regulatory Guide (RG) 4.21, “Life Cycle Planning for Decommissioning” provides guidance to license applicants on the steps that can be taken to minimize contamination and facilitate decommissioning in the context of a risk-informed approach (Ref. 4).
- RG 4.22, “Decommissioning Planning During Operations” provides guidance on implementation of the Decommissioning Planning Rule (Ref. 5).

Purpose of Regulatory Guides

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This regulatory guide contains information collection requirements covered by 10 CFR Part 50, 10 CFR Part 51, and 10 CFR Part 52 that the Office of Management and Budget (OMB) approved under OMB control number 3150-0011, 3150-0021, and 3150-0151, respectively. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Reason for Change

Since the issuance of RG 1.184 in 2000, several licensees have submitted PSDARs for NRC review. As a result of these reviews, the NRC staff has found common areas that require clarification including the need for early communication, insufficient information in environmental assessments, the need for early detection of spills, and estimates of decommissioning costs. This revision is to address lessons learned since the first issuance of RG 1.184 in 2000.

Regulatory Background

As defined by 10 CFR 50.2, “decommission” means to remove a nuclear facility 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 NRC license. On June 27, 1988, the NRC issued in the *Federal Register* general requirements for decommissioning that contained technical and financial criteria and addressed planning needs, timing, funding mechanisms, and environmental review requirements (53 FR 24018). These requirements were codified in 10 CFR Sections 50.75, 50.82, 51.53, and 51.95.

On July 29, 1996, the NRC published in the *Federal Register* a final rule amending the regulations on decommissioning procedures (61 FR 39278). The rule amended 10 CFR Part 2, “Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders”; 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities”; and 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” This rule clarified the regulations for decommissioning nuclear power facilities. The rule reflected the experience and knowledge gained during actual facility decommissioning, industry- and Government-sponsored workshops, and conferences on decommissioning. The rule clarified ambiguities in the previous regulations, reduced unnecessary requirements, provided additional flexibility, and codified procedures and terminology that had been used on a case-by-case basis. In addition, the rule increased the opportunities for the public to learn about a licensee’s decommissioning activities. The 1996 rule established a level of NRC oversight commensurate with the level of NRC-regulated activities expected during decommissioning. Subsequent revisions (72 FR 49493, August 28, 2007; 73 FR 22787, April 28, 2008) specified environmental reporting requirements. The 1996 rule extended the use of 10 CFR 50.59, “Changes, Tests, and Experiments,” to allow licensees to make changes to facilities undergoing decommissioning by using the process described in that regulation. On

June 17, 2011, the NRC promulgated the Decommissioning Planning Rule (DPR) (76 FR 35512). The DPR requires all licensees to establish operational practices to minimize site contamination and perform reasonable subsurface radiological surveys and sets forth new financial assurance requirements that require more detail in the cost estimate submitted with the PSDAR than the estimates done for the financial assurance requirements of 10 CFR 50.75. The ultimate goal of the DPR is for licensees to have sufficient funds to conduct site remediation and terminate their licenses effectively and efficiently.

The revised regulations require power reactor licensees that were engaged in decommissioning at the time the 1996 rule became effective to convert to and comply with the rule. All licensees are required to comply with the decommissioning procedures specified in the rule, and no “grandfathering” considerations are applicable.

Risk Informed Application

Reactors that have permanently ceased operations and have no fuel in the reactor vessel present a significantly reduced risk to public health and safety than operating reactors. The July 29, 1996, decommissioning rule specifies applicable requirements for such facilities by eliminating, revising, or extending operating reactor requirements commensurate with their importance to the safety of permanently shut down reactors.

Scope of this Regulatory Guide

This regulatory guide, in conjunction with others, describes methods and procedures that are acceptable to the NRC staff for implementing the requirements of the 1996 rule that relate to the initial activities and the major phases of the decommissioning process. This regulatory guide does not contain guidance on the license termination process. Guidance on the license termination plan requirements in 10 CFR 50.82(a)(9) is provided in Regulatory Guide 1.179, “Standard Format and Content of License Termination Plans for Nuclear Power Reactors” (Ref. 6), and related information is found in NUREG-1700, “Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans” (Ref. 7). This regulatory guide does not contain guidance on the management or funding for the storage of spent reactor fuel. Requirements for the storage and management of spent fuel, and for financial assurance are separate from site decommissioning activities and are contained in 10 CFR 50.54(bb). Requirements for

the licensing and decommissioning of facilities for the independent storage of spent nuclear fuel are likewise separate from site decommissioning activities and are addressed in 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste." This regulatory guide does not address the shipment of these materials or disposal of low-level, high-level, or greater-than-Class-C waste; shipment is covered in 10 CFR Part 71, "Packaging and Transportation of Radioactive Material," and disposal is addressed in 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," and Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

This regulatory guide applies only to power reactor licensees. The regulations for nonpower reactor licensees appear in 10 CFR 50.82(b). The NRC staff discusses the procedures for decommissioning nonpower reactors in NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors" (Ref. 8).

Decommissioning Phases

To facilitate understanding of the decommissioning process, the NRC staff has divided the decommissioning activities for power reactors into three phases. The first phase of decommissioning includes the initial activities, starting on the effective date of permanent cessation of operations and encompassing the activities before the licensee either places the power reactor in a storage mode or begins major decommissioning activities. The second phase encompasses activities during the storage period or during major decommissioning activities (i.e., decontamination and dismantlement), or some combination of the two. The third phase consists of the rest of the activities that the licensee undertakes to terminate the license. The amendments to 10 CFR Part 2 and 10 CFR Part 51 in the 1996 rule pertain to this third phase of decommissioning.

Supplement 1 to NUREG-0586, "Final Generic Environmental Impact Statement [GEIS] on Decommissioning of Nuclear Facilities," issued November 2002 (Ref. 9), evaluates the environmental impact of three methods for decommissioning. The supplemental information to the 1988 decommissioning rule (53 FR 24019) also discusses the three decommissioning methods. A summary of the three methods follows:

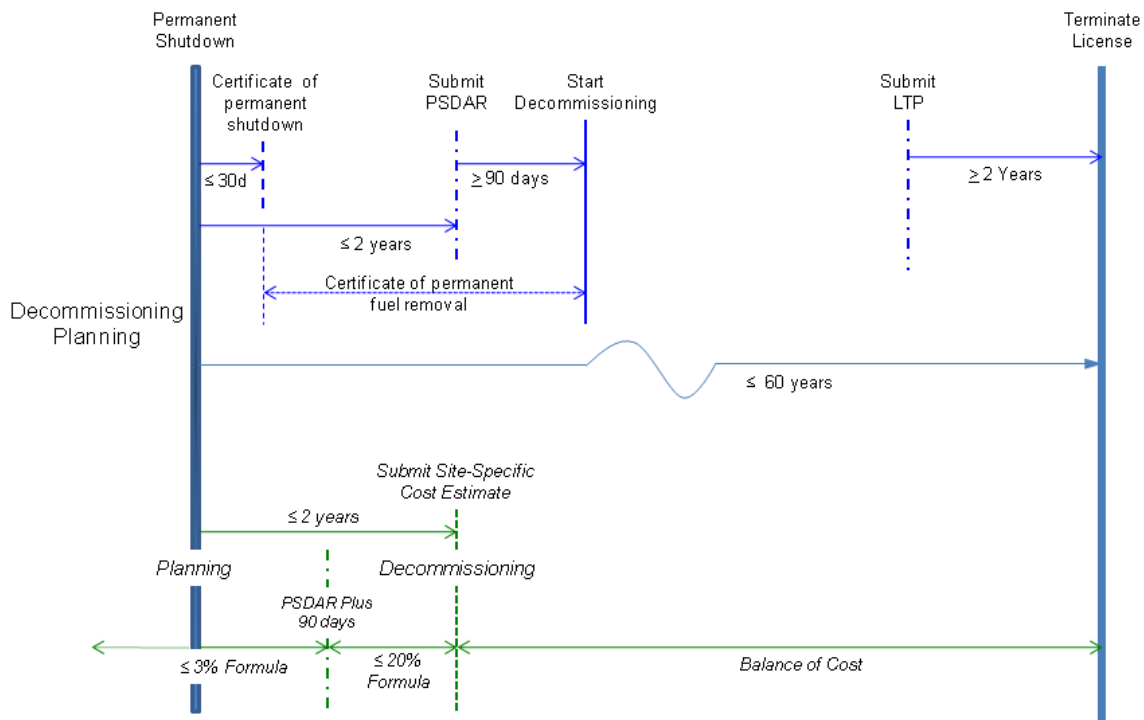
1. **DECON:** The equipment, structures, and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that permits termination of the license after cessation of operations. The GEIS found DECON to be an acceptable decommissioning method.
2. **SAFSTOR:** The facility is placed in a safe, stable condition and maintained in that state until it is subsequently decontaminated and dismantled to levels that permit license termination. During SAFSTOR, a facility is left intact, but the fuel has been removed from the reactor vessel and radioactive liquids have been drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thus reducing the levels of radioactivity in and on the material and, potentially, the quantity of material that must be disposed of during decontamination and dismantlement. The GEIS found SAFSTOR to be an acceptable decommissioning method.
3. **ENTOMB:** ENTOMB involves encasing radioactive structures, systems, and components (SSCs) in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license. Because most power reactors will have radionuclides in concentrations exceeding the limits for unrestricted use even after 100 years, this

option will generally not be feasible. However, this option might be acceptable for reactor facilities that can demonstrate that radionuclide levels will decay to unrestricted use levels in about 100 years. If the ENTOMB method is used, the provisions in Subpart E, “Radiological Criteria for License Termination,” of 10 CFR Part 20, “Standards for Protection against Radiation,” related to unrestricted or restricted use still apply. The GEIS found ENTOMB to be an acceptable decommissioning method.

The NRC recognizes that some combination of the first two methods would also be acceptable. For example, the licensee could conduct a partial decontamination of the plant followed by a storage period, followed by the completion of the decontamination and dismantlement.

Figure 1

SIMPLE DECOMMISSIONING TIMELINE



As shown in Figure 1, regulations require a licensee to submit written certification to the NRC within 30 days of permanent shutdown. Before or within two years after permanent cessation of operations, the licensee is required to submit a PSDAR. No major decommissioning activities may be performed until 90 days after the NRC has received both the PSDAR and the certification that fuel has been permanently removed from the reactor. Decommissioning must be completed within 60 years of permanent cessation of operations. The licensees may use 3% of the Table of minimum amounts (corrected for inflation from January 1986 dollars) required to demonstrate reasonable assurance of funds for decommissioning by reactor type and power level in MWt, for planning before submitting the PSDAR and an additional 20% for decommissioning activities before it submits a site-specific decommissioning cost estimate.

Decommissioning Funding

The decommissioning rule of July 1996 changed the licensee's ability to access the trust funds set aside for radiological decommissioning as required by 10 CFR 50.75, "Reporting and Recordkeeping for Decommissioning Planning." The licensee's ability to use the trust funds set aside for decommissioning depends on reaching certain milestones in the decommissioning process. This limitation on the accessibility of the decommissioning funds is designed to ensure that sufficient trust funds are always available to place the facility in a safe, stable condition that ultimately leads to decommissioning and license termination. The licensee may use up to 23 percent of the amount (specified in 10 CFR 50.75) of the decommissioning trust funds for decommissioning activities before submitting a site-specific decommissioning cost estimate. Included in this 23 percent is an initial 3 percent that the licensee can use, even before permanent cessation of operation, for planning the decommissioning. The licensee may use the remaining 20 percent for actual decommissioning or readying the facility for long-term storage. This 20 percent may be used only after the licensee has submitted the certifications specified by 10 CFR 50.82(a)(1) and after the 90-day period following the submission of the PSDAR. The remaining decommissioning trust funds would be available for decommissioning activities after the licensee submits a site-specific decommissioning cost estimate to the NRC. In 10 CFR 50.82(a)(8)(iii) the NRC requires the licensee to submit the site-specific cost estimate no later than 2 years after permanent cessation of operation.

Information in the following documents may be helpful in developing the site-specific cost estimate: NUREG/CR-0672, "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station" (including Addenda 1 through 4) (Ref. 11); NUREG/CR-0130, "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station" (including Addenda 1 through 4) (Ref. 12); NUREG/CR-5884, "Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station" (Ref. 13); and NUREG/CR-6174, "Revised Analyses of Decommissioning for the Reference Boiling Water Reactor Power Station" (Ref. 14).

The staff recognizes that during planning for decommissioning, it is necessary to consider activities leading to license termination and the storage of spent fuel; therefore, the staff's interpretation of the appropriate use of these planning funds will permit planning for all issues related to the decommissioning of the facility. Funding for spent fuel maintenance and storage required by 10 CFR 50.54(bb) may be commingled in the same trust fund that is used for decommissioning but the licensee must be able to identify and track the amounts in the trust fund applicable for decommissioning activities and the amounts set aside for spent fuel management and other uses. This is because funds collected and set aside in the decommissioning trust for decommissioning are exclusively for radiological decommissioning as defined in 10 CFR 50.2. Therefore, the amount set aside for radiological decommissioning as required by 10 CFR 50.75 should not be used for: (1) the maintenance and storage of spent fuel in the spent fuel pool, (2) the design, construction, or decommissioning of spent fuel dry storage facilities directly related to permanent disposal, (3) other activities not directly related to, radiological decontamination, or dismantlement of the facility or site.

Harmonization with International Standards

IAEA Safety Standards WS-R-5 "Decommissioning of Facilities Using Radioactive Material," (Ref. 15), and WS-G-2.1 "Decommissioning of Nuclear Power Plants and Research Reactors" (Ref. 16), provide useful information on decommissioning and their principles have been incorporated into this guide. The difference between this guide and the IAEA safety standards is that the latter are generic in nature whereas this guide provides direct linkage to NRC regulations.

C. STAFF REGULATORY GUIDANCE

1. Applicability

This regulatory guide applies to all power reactor licensees. The fact that a licensee ceased operations and removed the fuel from the reactor vessel does not reduce or alter the licensee's requirement to comply with applicable regulations, its NRC license, and its Technical Specifications. Some regulations automatically no longer apply because the licensee is no longer authorized to operate. If a licensee wishes to reduce its regulatory burden for those requirements that still apply, it must do so by requesting an exemption or specific license or technical specification amendment in accordance with 10 CFR 50.90, or by changes evaluated according to 10 CFR 50.59.

2. Certification of Permanent Cessation of Operations

As stated in 10 CFR 50.82(a)(1)(i), when a licensee has decided to permanently cease operations, the licensee must submit a written certification to the NRC within 30 days of that determination. Note that the rule requires submission of the certification within 30 days of the decision to cease operations, rather than within 30 days of facility shut down. The NRC considers that the 30-day clock starts on the day the licensee publicly announces the date the facility will permanently cease operations. When the facility has been shut down for a time, the date of permanent cessation of operations would correspond to the day the decision is made not to return to power generation operations. If the NRC issues an order to permanently cease operations, the certification would be required within 30 days of the effective date of the order.

According to 10 CFR 50.4(b)(8), the certification must state the date on which power generation operations permanently ceased, or will permanently cease. The signed and notarized certification must be submitted by the licensee to the Document Control Desk, Nuclear Regulatory Commission, Washington, DC 20555-0001. This certification is deemed to have already been submitted for licensees whose licenses were permanently modified before the effective date of the 1996 rule to allow possession, but not operation of the facility, as stated in 10 CFR 50.82(a)(1)(iii).

Following submission of the certification for permanent cessation of operations, the facility license continues in effect beyond the expiration date until the NRC notifies the licensee in writing that the license has been terminated (10 CFR 50.51(b)). No amendment to extend the expiration date of the license is required for a permanently shut down facility.

The NRC deems receipt of the certification of permanent cessation of operation as a commitment by the licensee to cease operations on the specified date. Following submission of the certification of permanent cessation of operations, or at any time during the decommissioning process, if the licensee desires to operate the facility again, the licensee must notify the NRC of its intentions in writing. The NRC would handle approval to return the facility to operation on a case-by-case basis, and the approval would depend on the facility status at the time of the request to reauthorize operation.

3. Certification of Permanent Removal of Fuel

Once the licensee removes the fuel permanently from the reactor vessel, 10 CFR 50.82(a)(1)(ii) requires the licensee to submit written certification to the NRC, consistent with the requirements in 10 CFR 50.4(b)(9), stating the date that the fuel was permanently removed from the reactor vessel and stating the disposition of the fuel. For example, the licensee should state whether the spent fuel was transferred to another 10 CFR Part 50 licensee, or placed in the facility's spent fuel pool, or stored in an

independent spent fuel storage installation. This certification should be signed and notarized, and the original submitted to the Document Control Desk, Nuclear Regulatory Commission, Washington, DC 20555-0001.

Although the licensee can submit the certification for permanent cessation of operation before the facility has ceased operation, the licensee can submit the certification of permanent removal of fuel only after all the fuel has been removed from the reactor. In 10 CFR 50.2, permanent fuel removal for a nuclear power reactor facility is defined as “a certification by the licensee to the NRC that it has permanently removed all fuel assemblies from the reactor vessel.”

This certification will be deemed to have already been submitted for licensees whose licenses were permanently modified before the effective date of the 1996 rule to allow for possession, but not operation, of the facility, as stated in 10 CFR 50.82(a)(1)(iii).

There are no requirements on the time interval between the decision to permanently cease operations and the submittal of the certification of permanent fuel removal. However, until the NRC has received the certification of permanent fuel removal, the licensee does not qualify for the removal of those regulatory requirements that are no longer necessary to protect public health and safety as a result of the nonoperational status of the facility or for a reduction in the fees required by 10 CFR 171.15, “Annual Fees: Reactor Licenses and Independent Spent Fuel Storage Licenses.”

The NRC staff expects to receive the certification to permanently cease operations before the certification of permanent fuel removal, although it would also be acceptable to the NRC staff to receive a combined certification, for instance, if the core had been offloaded before the licensee decided to permanently cease operations. According to 10 CFR 50.82(a)(2), upon docketing of both the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, or when a legally effective order to permanently cease operations has come into effect, the 10 CFR Part 50 license no longer authorizes the operation of the reactor or placement of fuel into the reactor vessel.

4. Post-Shutdown Decommissioning Activities Report

Before or within 2 years after permanent cessation of operations, 10 CFR 50.82(a)(4)(i) requires the licensee to submit a PSDAR to the NRC and to send a copy to the affected States. Regulatory Guide 1.185 provides guidance on the contents of the PSDAR.

The PSDAR should include a description of the planned decommissioning activities, a schedule for the completion of these activities, an estimate of expected costs, and a discussion of the reasons for concluding that the environmental impacts associated with the site-specific decommissioning activities will be bounded by appropriate, previously issued EISs.

5. Public Meeting

The NRC will place a notice of receipt of the PSDAR in the *Federal Register* and make the PSDAR available for public comment on the agency Web site, <http://www.nrc.gov>, through the NRC Library, and in the Public Document Room. The NRC will also schedule a public meeting in the vicinity of the licensee’s facility, pursuant to the requirements in 10 CFR 50.82(a)(4)(ii). To the extent possible, the public meeting should be held within 90 days of the NRC’s receipt of the licensee’s PSDAR submittal. Normally, the NRC will hold the meeting at least 30 days before the 90-day period ends. The NRC will publish notice of this public meeting in the *Federal Register* and in a place or places readily

available to individuals near the site, such as a local newspaper. The notice will include the date, time, and location of the meeting, as well as a brief description of the purpose of the meeting.

The public meeting will be informational and should be chaired by a local official. During the public meeting, NRC will invite the licensee to present its plans for decommissioning. NRC staff will discuss the regulatory process for decommissioning the facility. The NRC will offer a representative from each affected State the opportunity to discuss any State regulations or oversight roles. Other representatives from the affected States, local officials, and the general public will be invited to comment on the licensee's PSDAR. Comments received by the NRC staff on the PSDAR will be addressed at the public meeting, and a question and answer period will follow the presentations. A written transcript of the meeting will be prepared and made available to the public through the Electronic Reading Room and in the Public Document Room.

6. Initial Decommissioning Activities

The licensee may not perform any major decommissioning activities, as defined in 10 CFR 50.2, until 90 days after the date that the NRC receives the licensee's PSDAR submittal and until the certifications of permanent cessation of operations and permanent removal of fuel from the reactor vessel have been submitted, as stated in 10 CFR 50.82(a)(5). The NRC staff may use this 90-day period to conduct any pre-decommissioning inspections necessary to verify that the licensee's programs and controls are adequate to ensure that decommissioning activities are conducted safely and the environment is protected. After 90 days, the licensee may proceed with major decommissioning activities allowed under 10 CFR 50.82 unless the NRC formally notifies the licensee of any deficiency in the PSDAR within the initial 90-day period.

Licensees may opt to submit the PSDAR before permanent cessation of operations or permanent removal of fuel to minimize any delay in decommissioning activities resulting from the 90-day waiting period. However, the certifications for permanent cessation of operations and permanent removal of fuel must be submitted before major decommissioning activities can be initiated.

7. Major Decommissioning Activities

As long as fuel remains in the reactor core, facility modifications pursuant to 10 CFR 50.59 must be consistent with continued facility operation. Once the licensee certifies that the facility has permanently ceased operation and the fuel has been permanently removed from the reactor vessel, and the 90-day period has passed, decontamination and dismantlement under the provisions of 10 CFR 50.59 and 10 CFR 50.82 may commence. In addition, as stated in 10 CFR 50.82(a)(6), licensees of permanently shut down reactors may not perform any decommissioning activities that would foreclose the release of the site for possible unrestricted use, would result in significant environmental impacts that have not previously been reviewed, or would result in there no longer being reasonable assurance that adequate funding is available for decommissioning.

8. Technical Regulations

The NRC regulations explicitly extend requirements for specific parts of the technical specifications that will cover decommissioning activities. Decommissioning technical specifications will be developed on a case-by-case basis as stated in 10 CFR 50.36(c)(6). The licensee will review the operational technical specifications and determine which specifications are no longer applicable and which should remain in force. The licensee will make the appropriate submittals to request changes to the technical specifications as required by the regulations.

Technical specifications for effluent releases are specified in 10 CFR 50.36a, “Technical Specifications on Effluents from Nuclear Power Reactors.” In addition to complying with the applicable provisions of 10 CFR 20.1301, “Dose Limits for Individual Members of the Public,” the licensee would develop technical specifications requiring that operating procedures be established and followed for the control of effluents as given in 10 CFR 50.34a(c) and would maintain and use the radioactive waste system pursuant to 10 CFR 50.34a(a). The regulation in 10 CFR 50.36a(a)(1) requires the licensee to retain these operating procedures as a record until the NRC terminates the license, and to keep all superseded revisions to the procedures for 3 years from the date they were superseded.

Licensees must continue to meet the requirements of 10 CFR 50.36a(a)(2) to submit an annual report to the NRC that specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents during the previous 12 months. The report must include any other information that the NRC may require to estimate maximum potential annual radiation doses to the public resulting from effluent releases. The time between submittal of the reports must be no longer than 12 months. If quantities of radioactive materials released during the reporting period are significantly greater than the design objectives for the facility when it was operating, the report must specifically address the reasons for this variation. The NRC will use these reports, along with additional information, to require the licensee to take actions the NRC deems appropriate. Licensees may continue to use the values in Appendix I, “Numerical Guides for Design Objectives and Limiting Conditions for Operation To Meet the Criterion ‘As Low As Is Reasonably Achievable’ for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents,” to 10 CFR Part 50, which provides numerical guidance for meeting the requirements for radioactive materials in effluents released to unrestricted areas. Additional requirements for the licensee during the period of major decommissioning activities include those described below.

8.1 The Maintenance Rule

The maintenance rule, 10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” requires monitoring the performance or condition of certain SSCs that could affect safety. For licensees that have submitted the certifications for cessation of operation and for permanent fuel removal specified in 10 CFR 50.82(a)(1), this section applies only to the extent the licensee monitors the performance or condition of the SSCs associated with the storage, control, and maintenance of spent fuel in a safe condition. The monitoring must be sufficient to provide reasonable assurance that such SSCs are capable of fulfilling their intended functions as specified in 10 CFR 50.65(a)(1).

8.2 Keep the Final Safety Analysis Report Current

The Final Safety Analysis Report (FSAR), or other comparable document, provides a licensing-basis document for the evaluation of licensee activities under 10 CFR 50.59. This licensing basis will have to be updated to cover decommissioning activities. According to 10 CFR 50.71(e)(4), subsequent revisions updating the licensing basis must be filed with the NRC at least every 24 months by nuclear power facilities that have submitted certifications for permanently ceasing operations and for permanent removal of fuel. Specific sections of the FSAR that the licensee should continue to update periodically include those described below.

8.2.1 Facility Description

The facility status will be described at the time the facility is shut down, before any decommissioning or dismantlement activities occur. Only the descriptions of those facility SSCs that are included in the technical specifications or that directly affect the safe storage of irradiated

fuel should be updated in detail. However, during decommissioning, general updates to the FSAR to reflect the current condition of SSCs that were in the operating plant version of the FSAR are needed to maintain an overall understanding of the configuration basis of the plant. The updates should identify changes as systems are decontaminated, inactivated, mothballed for later use, or reconfigured to support changes to their previous functions. Even though SSCs may no longer have a safety function, there is an overall safety benefit to documenting the status or design function of these SSCs while the plant is in a decommissioning phase. For example, a cooling water system may no longer be required to provide a safety-related heat sink. However, if the system continues to be functional, it is entirely possible that by operating the wrong valve, or by system fault or breakage, or misalignment of interfaces to this system, accidents such as flooding, personnel injury, or flushing of potentially radioactive material into an uncontaminated location could result. As a minimum, the FSAR should be maintained at a level of detail that provides the status of all the operating licensing-basis SSCs until the systems are no longer mechanically or electrically active, are no longer radioactively contaminated, have no fluid content or other materials that require special handling considerations, or have been physically removed during the dismantlement process.

8.2.2 Licensee Organization

The FSAR or comparable document should include a description of the licensee's corporate and site organization during decommissioning. It should describe the structure, functions, and responsibilities of the onsite organization established to decommission the facility.

8.2.3 Radioactive Waste Management

The scope remains the same as in the operating phase FSAR.

8.2.4 Radiation Protection

The scope remains the same as in the operating phase FSAR.

8.2.5 Conduct of Operations

The scope remains the same as in the operating phase FSAR.

8.2.6 Site Characteristics

The licensee should update any sections of the FSAR that could affect the safe storage of fuel or could directly affect the design basis of the facility.

8.2.7 Accident Analysis

The licensee should evaluate any new or different design-basis accidents identified during a 10 CFR 50.59 evaluation of a planned change and include them in FSAR updates if appropriate (for example, consideration of accidents involving a newly installed gas pipeline within or near the facility). Conversely, as decommissioning progresses, any design-basis accidents that are no longer possible may be removed from the FSAR or comparable document (e.g., the design basis of a facility that has transferred its spent fuel from the spent fuel pool to an independent spent fuel storage installation would be significantly changed, and the FSAR should be updated to reflect this).

8.3 Fire Protection Requirements

The fire protection regulations in 10 CFR 50.48(f) require licensees that have certified the permanent cessation of operations and the removal of fuel from the reactor vessel to maintain a fire protection program to address the potential for fires that could result in a radiological hazard. The objectives of the fire protection program, delineated in 10 CFR 50.48(f)(1), are to (1) reasonably prevent such fires from occurring, (2) rapidly detect, control, and extinguish fires that could result in a radiological hazard, and (3) minimize the risk of fire-induced radiological hazards to the public, environment, and plant personnel. Further, 10 CFR 50.48(f)(2) requires licensees to assess the fire protection program on a regular basis and revise it, as needed, throughout the various stages of facility decommissioning. The requirements of 10 CFR 50.48(f)(3) permit licensees to make changes to the fire protection program without NRC approval if these changes do not reduce the effectiveness of fire protection for facilities, systems, and equipment that could result in a radiological hazard, taking into account the conditions and activities of decommissioning at the facility. Regulatory Guide 1.191, "Fire Protection Program for Nuclear Power Plants During Decommissioning and Permanent Shutdown," issued May 2001 (Ref. 17), presents additional guidance.

8.4 Actions by Certified Fuel Handlers

For nuclear power reactor licensees that have certified that they have ceased operations and permanently removed the fuel from the reactor vessel, and upon the NRC's review and approval of a licensee's certified fuel handler training program, 10 CFR 50.54(y) states that either a certified fuel handler or a licensed senior operator may, in an emergency, take reasonable actions that may depart from a license condition or technical specification.

9. Changes to the PSDAR

Ninety days after submitting the PSDAR, the licensee may begin major decommissioning activities. For any decommissioning activity that is not consistent with or could be considered to be a change from the actions or schedules described in the PSDAR, 10 CFR 50.82(a)(7) requires the licensee to notify the NRC in writing and send a copy to the affected States. The NRC staff will use the PSDAR, and any written notification of changes required of a licensee, to schedule inspections and provide regulatory oversight of decommissioning activities. Licensees must also notify the NRC of changes that would significantly increase the decommissioning costs and send a copy of this notification to the affected States.

10. Use of Funds

For a power reactor facility that is not prematurely shut down and is nearing the expiration of its license, 10 CFR 50.75(f)(2) requires that, at or about 5 years before the projected end of operations, licensees submit a preliminary decommissioning cost estimate that includes an up-to-date assessment of the major factors that could affect the cost to decommission. For prematurely shut down facilities, 10 CFR 50.82(a)(8)(iii) requires licensees to submit a site-specific decommissioning cost estimate within 2 years after permanent cessation of operations if such an estimate has not previously been submitted.

The use of decommissioning trust funds is specified in 10 CFR 50.82(a)(8). Funding for spent fuel maintenance and storage required by 10 CFR 50.54(bb) may be commingled in the same trust fund that is used for decommissioning, but the licensee must be able to identify and track the amount in the trust fund applicable for reactor decommissioning activities and the amounts set aside for spent fuel management and other uses. This is because funds collected and set aside in the decommissioning trust

for decommissioning are exclusively for decommissioning activities as currently defined in 10 CFR 50.2. The amounts of the decommissioning trust funds that the licensee can use are limited during the initial phase of decommissioning—prior to the PSDAR—to provide reasonable assurance that adequate funding will remain to fully decommission the facility. The expenditures should not reduce the value of the decommissioning trust fund to below the amount necessary to place and maintain the reactor in safe storage. Because interest on the fund can be used to meet the required value of the trust fund, withdrawals from the trust fund should not adversely affect the licensee’s ability to fully fund the decommissioning trust. Funds must be available to ultimately release the site and terminate the license.

The licensee is allowed by 10 CFR 50.82(a)(8)(ii) to use 3 percent of the generic amount of the decommissioning funds specified in 10 CFR 50.75 for decommissioning planning, including that which occurs while a facility is still operating. Appropriate activities for the use of the initial 3 percent of the decommissioning funds include engineering designs, work package preparation, and licensing activities. Activities that would not be appropriate uses for these planning funds include decontamination, draining of systems, removal of filters, and projects designed to demonstrate the feasibility of a particular decommissioning activity. Likewise, the decontamination of a building that is no longer in use and would ultimately have to be decontaminated before license termination is not an appropriate use of planning funds.

After the licensee has submitted the certifications required by 10 CFR 50.82(a)(1), and 90 days after the NRC has received the PSDAR, the licensee may use an additional 20 percent of the decommissioning funds prescribed in 10 CFR 50.75. The withdrawals may not adversely affect the licensee’s ability to fully fund the decommissioning trust. The licensee must ensure the availability of funds to ultimately release the site and terminate the license.

The licensee is prohibited from using the remaining 77 percent of the generic decommissioning funds until it submits a site-specific decommissioning cost estimate to the NRC. This estimate must be submitted within 2 years following permanent cessation of operations (10 CFR 50.82(a)(8)(iii)). Site-specific cost estimates should include an outline of the expected costs for activities specified in the PSDAR. As an example of the appropriate level of detail, the licensee would be expected to include costs for radiological decommissioning (planning, large-component removal, decontamination activities, low-level radioactive waste disposal, final radiological survey, and decommissioning finance costs).

Licensees may provide site-specific cost estimates sooner than 2 years after permanent cessation of operations. For facilities that submitted a preliminary cost estimate about 5 years before the projected end of operations, the licensee could expand and update the preliminary cost estimate and submit it as the site-specific cost estimate. The site-specific cost estimate could also be submitted with the PSDAR. If submitted with the PSDAR, it should be appropriately identified as a site-specific cost estimate. This approach would eliminate the 23-percent hold point for spending the decommissioning funds. Licensees that plan to begin major decommissioning activities shortly after permanent cessation of operations should consider an early submission of the site-specific cost estimates with the PSDAR.

If the licensee’s PSDAR specifies a delayed completion of decommissioning, the licensee must provide a means of adjusting cost estimates and associated funding levels over the storage or surveillance period to ensure that the appropriate amount of funding will be available to terminate the license (10 CFR 50.82(a)(8)(iv)). Additional guidance for decommissioning cost estimates is in NUREG-1713, “Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors” (Ref. 19). This guidance specifies the level of detail required for the financial plan to adjust cost estimates and associated funding levels.

D. IMPLEMENTATION

The purpose of this section is to provide information on how licensees¹ may use this guide and information regarding the NRC's plans for using this regulatory guide. In addition, it describes how the NRC staff complies with 10 CFR 50.109, "Backfitting" and any applicable finality provisions in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

Use by Licensees

Licensees may voluntarily² use the guidance in this document to demonstrate compliance with the underlying NRC regulations. Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations. Current licensees may continue to use guidance the NRC found acceptable for complying with the identified regulations as long as their current licensing basis remains unchanged.

Licensees may use the information in this regulatory guide for actions that do not require NRC review and approval such as changes to a facility design under 10 CFR 50.59, "Changes, Tests, and Experiments." Licensees may use the information in this regulatory guide or applicable parts to resolve regulatory or inspection issues.

Use by NRC Staff

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this regulatory guide. The NRC staff does not expect any existing licensee to use or commit to using the guidance in this regulatory guide, unless the licensee makes a change to its licensing basis. The NRC staff does not expect or plan to request licensees to voluntarily adopt this regulatory guide to resolve a generic regulatory issue. The NRC staff does not expect or plan to initiate NRC regulatory action that would require the use of this regulatory guide. Examples of such unplanned NRC regulatory actions include issuance of an order requiring the use of the regulatory guide, requests for information under 10 CFR 50.54(f) as to whether a licensee intends to commit to use of this regulatory guide, generic communication, or promulgation of a rule requiring the use of this regulatory guide without further backfit consideration.

During regulatory discussions on plant specific operational issues, the staff may discuss with licensees various actions consistent with staff positions in this regulatory guide, as one acceptable means of meeting the underlying NRC regulatory requirement. Such discussions would not ordinarily be considered backfitting even if prior versions of this regulatory guide are part of the licensing basis of the facility. However, unless this regulatory guide is part of the licensing basis for a facility, the staff may not represent to the licensee that the licensee's failure to comply with the positions in this regulatory guide constitutes a violation.

If an existing licensee voluntarily seeks a license amendment or change and (1) the NRC staff's consideration of the request involves a regulatory issue directly relevant to this new or revised regulatory guide and (2) the specific subject matter of this regulatory guide is an essential consideration in the staff's determination of the acceptability of the licensee's request, then the staff may request that the licensee either follow the guidance in this regulatory guide or provide an equivalent alternative process that

¹ In this section, "licensees" refers to licensees of nuclear power plants under 10 CFR Parts 50 and 52.

² In this section, "voluntary" and "voluntarily" mean that the licensee is seeking the action of its own accord, without the force of a legally binding requirement or an NRC representation of further licensing or enforcement action.

demonstrates compliance with the underlying NRC regulatory requirements. This is not considered backfitting as defined in 10 CFR 50.109(a)(1) or a violation of any of the issue finality provisions in 10 CFR Part 52.

If a licensee believes that the NRC is either using this regulatory guide or requesting or requiring the licensee to implement the methods or processes in this regulatory guide in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfit appeal with the NRC in accordance with the guidance in NUREG-1409, "Backfitting Guidelines" (Ref. 20) and the NRC Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection" (Ref. 21).

REFERENCES³

1. *U.S. Code of Federal Regulations*, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," Part 50, Title 10, "Energy."
2. *U.S. Code of Federal Regulations*, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Part 52, Title 10, "Energy."
3. *U.S. Code of Federal Regulations*, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," Part 51, Title 10, "Energy."
4. U.S. Nuclear Regulatory Commission (NRC), "Life Cycle Planning for Decommissioning," RG 4.21, Washington, DC.
5. NRC, "Decommissioning Planning During Operations," RG 4.22, Washington, DC.
6. NRC, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors," Regulatory Guide 1.179, Washington, DC.
7. NRC, "Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans," NUREG-1700.
8. NRC, "Part 2, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," NUREG-1537, Washington, DC, February 1996, ADAMS Accession No. ML042430048.
9. NRC, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," Volumes 1 & 2 of Supplement 1, NUREG-0586, Washington, DC, November 2002, ADAMS Accession No. ML023470327 and ML023500310.
10. NRC, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report," Regulatory Guide 1.185, Washington, DC.

³ Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public Web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. The documents can also be viewed on-line or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone (301) 415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail pdr.resource@nrc.gov.

11. NRC, "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station," NUREG/CR-0672, Prepared for the U.S. Nuclear Regulatory Commission by H.D. Oak, et al., Pacific Northwest Laboratory, Richland, WA, June 1980 (Addendum 1, July 1983; Addendum 2, September 1984; Addendum 3, July 1988; Addendum 4, December 1990), Legacy Library Accession No. 8006250171.
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14. NRC, "Revised Analyses of Decommissioning for the Reference Boiling Water Reactor Power Station," NUREG/CR-6174, Prepared for the U.S. Nuclear Regulatory Commission by R.I. Smith et al., Pacific Northwest National Laboratory, Richland, WA, July 1996, Legacy Library Accession No. 9608210240.
15. International Atomic Energy Agency (IAEA), "Decommissioning of Facilities Using Radioactive Material, Safety Requirements Series WS-R-5, October, 2006⁴ .
16. IAEA, "Decommissioning of Nuclear Power Plants and Research Reactors," Safety Guide WS-G-2.1, December 1999.
17. NRC, "Fire Protection Program for Nuclear Power Plants During Decommissioning and Permanent Shutdown," Regulatory Guide 1.191, Washington, DC.
18. NRC, "Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities," Volume 1, NUREG-1496, Washington, DC, July 1997, ADAMS Accession No. ML042310492.
19. NRC, "Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors," NUREG-1713, Washington, DC, December 2004, ADAMS Accession No. ML043510113.
20. NRC, "Backfitting Guidelines," NUREG-1409, Washington, DC, ADAMS Accession No. ML032230247.
21. NRC, "Management of Facility-specific Backfitting and Information Collection," NRC Management Directive 8.4.

⁴ Copies of International Atomic Energy Agency (IAEA) documents may be obtained through their Web site: WWW.IAEA.ORG/ or by writing the International Atomic Energy Agency P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria. Telephone (+431)2600-0, Fax (+431) 2600-7, or Email at Official.Mail@IAEA.org