Plan for the Long-Term Update of the Waste Confidence Rule

Overview of the Plan

Based on the direction in Staff Requirements Memorandum (SRM)-COMSECY-10-0007 and SRM-SECY-09-0090, the staff is integrating activities into an extended storage and transportation (EST) Regulatory Program with two main goals: (1) update the WC decision and rule to ensure the continued long-term stability of the generic safety and environmental findings in the rule by developing a NEPA analysis (in this case an EIS) that continues to be informed by current circumstances and scientific knowledge, and (2) enhance the technical and regulatory basis of the existing regulatory framework for the regulation of spent nuclear fuel (SNF) for extended periods. The staff will transform the current EST project plan into a high-level EST Regulatory Program with the integrated goals and activities for the WC update and EST[1]. The following describes the specific plan for achieving the first goal of updating the WC rule.

The plan for the WC update consists of three key activities: (1) develop the technical information needed to understand the significant safety issues and environmental impacts of extended storage and transportation; (2) develop an environmental impact statement (EIS) and updated WC decision (generic safety findings) for 300 years of storage and handling of SNF; and (3) revise the WC rule to reflect the updated WC decision and the conclusions of the EIS as appropriate. Table 1-1 shows the general sequence of these activities for the major stages of development.

The staff will plan the technical analyses, EIS development, and WC rulemaking to be completed in FY 2016. The scope and depth of the WC update will depend on the extent and quality of the supporting technical basis, which will be developed through research and analyses. During this time, the staff will pursue the highest priority research activities over a period of two and a half years to provide a basic technical basis for the WC update. Additional research and analyses would continue beyond the two and a half year timeframe to further inform the regulatory basis for extended aging management. The staff will incorporate any changes to the SNF storage and transportation regulations in approximately FY 2018. The following discussion describes the key activities of the plan for the WC update.

Technical Analyses

The staff expects that significant effort will be needed over multiple years to develop the research, analyses, and supporting technical basis for the WC update. The existing safety record of storage facilities, existing research and analyses, and past storage demonstration projects provide a foundation for the safe and secure storage of fuel for several decades However, the existing technical data limits staff's ability to conduct a longer-term analysis of the aging mechanisms and performance of dry cask and wet storage systems. To bolster these analyses, the staff will need to perform studies to identify the state of technical information and

[1] The "current EST project plan" refers to the staff's "Project Plan for Regulatory Program Review to Support Extended Storage and Transportation of Spent Nuclear Fuel," dated June 15, 2010 (ADAMS Accession No. ML101390216). Staff is currently implementing this plan, as partially approved by the Commission in SRM-COMSECY-10-0007. The EST Regulatory Program will supersede the current EST project plan (as referenced here within) and is under development.

develop testing, methods, and analytical plans to obtain additional data. These studies could result in additional experiments (if feasible within the established schedule) or focused studies to increase the understanding and characterization of important aging phenomena, safety-significant uncertainties, monitoring capabilities and needs, and environmental impacts over longer periods of time. The staff will continue the integrated EST and WC gap assessment, which will identify any additional research and analysis needed to support the objectives of the WC update. This will include environmental scoping assessments for the different types of storage facilities and sites that the EIS may need to address (see Enclosure 2 for further information).

The staff will perform a technical analysis of a combination of wet and dry storage for up to 300 years. This time period may identify scenarios and timeframes where significant aging management actions (e.g., repackaging of SNF) may be needed to address long-term aging. The staff will also focus on increasing its understanding of extended aging issues and the implications of aging management for extended license renewal periods. This would include potential storage operations, which may significantly influence the environmental impacts in areas such as human health (e.g., worker dose and accident risk), socioeconomics (e.g., costs of aging mitigation and cask replacements), and infrastructure (e.g., construction of new facilities to unload degraded casks and repackage SNF). For example, the staff needs to obtain additional data and complete further analysis of the long-term behavior of steel and concrete overpacks in adverse environmental conditions, and the generic impacts of significant aging management practices, including the repackaging of spent fuel.

The staff will perform independent research and analyses, and will leverage and coordinate with the research performed by other entities, as appropriate. This coordination includes future research by the U.S. Department of Energy (DOE) and international entities with similar cask technologies. The extent to which information from external domestic initiatives can be leveraged will depend on the scope and timing of initiatives that DOE and industry pursue after the publication of the Blue Ribbon Commission on America's Nuclear Future (BRC) recommendations.

Environmental Impact Statement

The staff plans to develop the EIS to assess the impacts from approximately the years 2050 to 2250. This initial timeframe is consistent with a goal of assessing whether there continue to be no significant environmental impacts and ensuring the continued safety of SNF and high-level waste (HLW) storage beyond the "at least 60 years" considered in the 2010 WC rule.[2] This preliminary timeframe (2050-2250) considers the 300 years of aging evaluated in the technical analysis. The staff selected 2050 as the starting point for the analysis because it represents when some SNF will begin to reach the minimum storage periods contemplated in the current Waste Confidence rule (60 years after the expiration of licensed life). An end-date of 2250 was selected because that is approximately when the oldest fuel would approach 300 years of

[2] The current WC findings and final rule (10 CFR 51.23, "Temporary Storage of Spent Fuel after Cessation of Reactor Operation—Generic Determination of No Significant Environmental Impact) were published on December 23, 2010. (See *Federal Register,* Volume 75, pages 81032-81076.) Finding 4 states that the Commission finds reasonable assurance that SNF generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor. The NRC has identified Dresden 1, licensed in 1959, as the earliest licensed power reactor: for Dresden 1, 60 years beyond the licensed life for operation is 2059.

storage. The scope also addresses the potential cumulative environmental impacts of the handling and storage of SNF and HLW for 300 years.

The WC update will consider the extended management of SNF fuel that is currently stored at reactor pools and in dry cask storage, as well as future types of SNF. The EIS will use the environmental impact analyses and safety findings developed for the 2010 WC rule as the foundation for characterizing the affected environment in 2050. As with the current WC rule and decision, the WC EIS will generically analyze potential impacts. However, it will not be a substitute for specific EISs or environmental assessments required for site-specific licensing actions (e.g., approval of new storage facilities) or major rule changes (e.g., enhancement of regulations). The long analytical timeframe for the WC update will require that some impacts be assessed in a more qualitative manner for the extended periods. The Appendix to this enclosure describes the preliminary EIS scenarios and major scoping assumptions that may be considered in the EIS.

The EIS analyses may be conducted using a framework of discrete periods of time (e.g., 2050–2150, 2150–2250). The analyses may show that some environmental impacts can be more easily characterized or graded according to different time periods. It may also facilitate the binning of time-dependent uncertainties in the technical and environmental impact analyses that may change in magnitude over time. For example, this analytical approach may allow significant changes in impacts from aging-related issues (e.g., need for fuel repackaging) to be distinguished between major time periods. In addition, this approach may allow the staff to consider the potential application of any reprocessing and alternative disposal capabilities that may become available in the future. The staff intends to define the specific time periods within the segmented approach after performing internal scoping assessments, considering insights from short-term research on aging effects, and considering initial stakeholder input.

The staff will develop the EIS in accordance with the U.S. Nuclear Regulatory Commission's (NRC's) requirements in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," and NRC National Environmental Policy Act (NEPA) guidance documents, as appropriate. The schedule and scope of the EIS will depend to some extent on the progress and results of the supporting technical analyses of long-term aging phenomena. The variety of cask technologies, storage scenarios (time and location), SNF handling activities, representative site characteristics, and long-term aging phenomena, add complexity to the required scope of the technical analyses and structure of the EIS. The environmental analyses and generic safety findings will require a well-justified consideration and identification of patterns, trends, storage characteristics, and aging impacts to develop conclusions about the potential environmental impacts of extended storage. In addition, the breadth of the EST regulatory and WC update activities may generate widespread interest among stakeholders. The staff will establish a communication strategy to ensure stakeholder participation in enhancing the EST regulatory framework and developing the WC update.

Waste Confidence Decision and Rule

The staff will develop a proposed WC rule as it finishes preparing the draft EIS. As directed in SRM-SECY-09-0090, the staff will send the proposed rule and draft EIS to the Commission as a Notation Vote Paper. If the Commission approves publication of the proposed rule and draft EIS, the staff will publish the draft EIS, proposed update to the WC decision, and proposed rule for stakeholder comment (the updated WC decision will be an appendix to the EIS). After the conclusion of the public comment period, the staff will develop and publish the final EIS, final

WC decision, and final rule. The staff will also consider changes to the WC decision's current "five findings" structure as part of the draft EIS and proposed rule.

If the Commission decides to go forward with this effort and promulgates a final WC rule, the rule would be in place well before 2059, when spent nuclear fuel from the first licensed power reactor (Dresden 1) will have been stored for 60 years beyond that reactor's licensed life for operation.

Adjustments to the Plan and Scope of the Waste Confidence Update

The scope and timing of the WC update is influenced by the extent and quality of the supporting information that can be developed for aging effects on dry cask storage systems and associated aging management issues (e.g., monitoring needs); the time needed to develop the EIS in accordance with NEPA and NRC requirements; and consideration of stakeholder input in the update. This estimated effort and time will also evolve as a result of the gap assessments, the progress of NRC research, and the external research that can be leveraged, with available resources.

In cases where sufficient technical information is not available to meet the FY 2016 schedule, the staff will make bounding assumptions in the EIS or reduce the scope of the overall assessments (e.g., scenarios and timeframes). In addition, the staff would consider potential environmental impact findings that are based more on the future capabilities to monitor and mitigate cask degradation (if supported by associated research), instead of obtaining data to understand long-term aging effects on cask components. As a result, the staff will iteratively adjust the basis, scope, and conservatism of the WC update to mitigate any lack of data or uncertainties.

By April 2012, the staff will have an improved understanding of the scope of technical analyses that should be developed, the research plans of external parties that can be effectively leveraged, and potential changes that are needed in the scope and timing of the EIS.
By this time, the staff will have received stakeholder feedback and developed insights from the final gap assessments. The BRC will have completed its final recommendations, and DOE's Office of Nuclear Energy will likely have progressed in developing research plans to address EST (see Enclosure 2 for additional information). The staff may need to update the EST Regulatory Program at that time and make changes in the scope or completion times for the WC update, as appropriate.

Table 1-1
Key Activities of the WC Update

<table>
<tr><th colspan="3">Key Activities</th></tr>
<tr><th>Technical Analysis</th><th>EIS</th><th>Rule</th></tr>
<tr><td colspan="2">Internal scoping activities to determine what preliminary analyses need to be conducted</td><td rowspan="4">----</td></tr>
<tr><td>Conduct short-term preliminary technical analyses to assist in defining EIS scope; includes targeted stakeholder interaction</td><td>----</td></tr>
<tr><td>Long-term research and analyses activities</td><td rowspan="2">Conduct NEPA scoping process (after initial stakeholder interactions); refine EIS scenarios and assumptions.

Develop draft EIS</td></tr>
<tr><td>Develop technical analysis and WC decision</td><td>Develop proposed rule language and statements of consideration (SOCs)</td></tr>
<tr><td colspan="3">Publish proposed rule and draft EIS for comment (with technical analyses and WC decision as an appendix)</td></tr>
<tr><td colspan="3">Public Comment Period and Resolution of Comments</td></tr>
<tr><td>Update technical analyses (as appropriate)</td><td>Develop final EIS</td><td>Develop final rule language and SOCs</td></tr>
<tr><td colspan="3">Publish final rule and final EIS (with WC decision)</td></tr>
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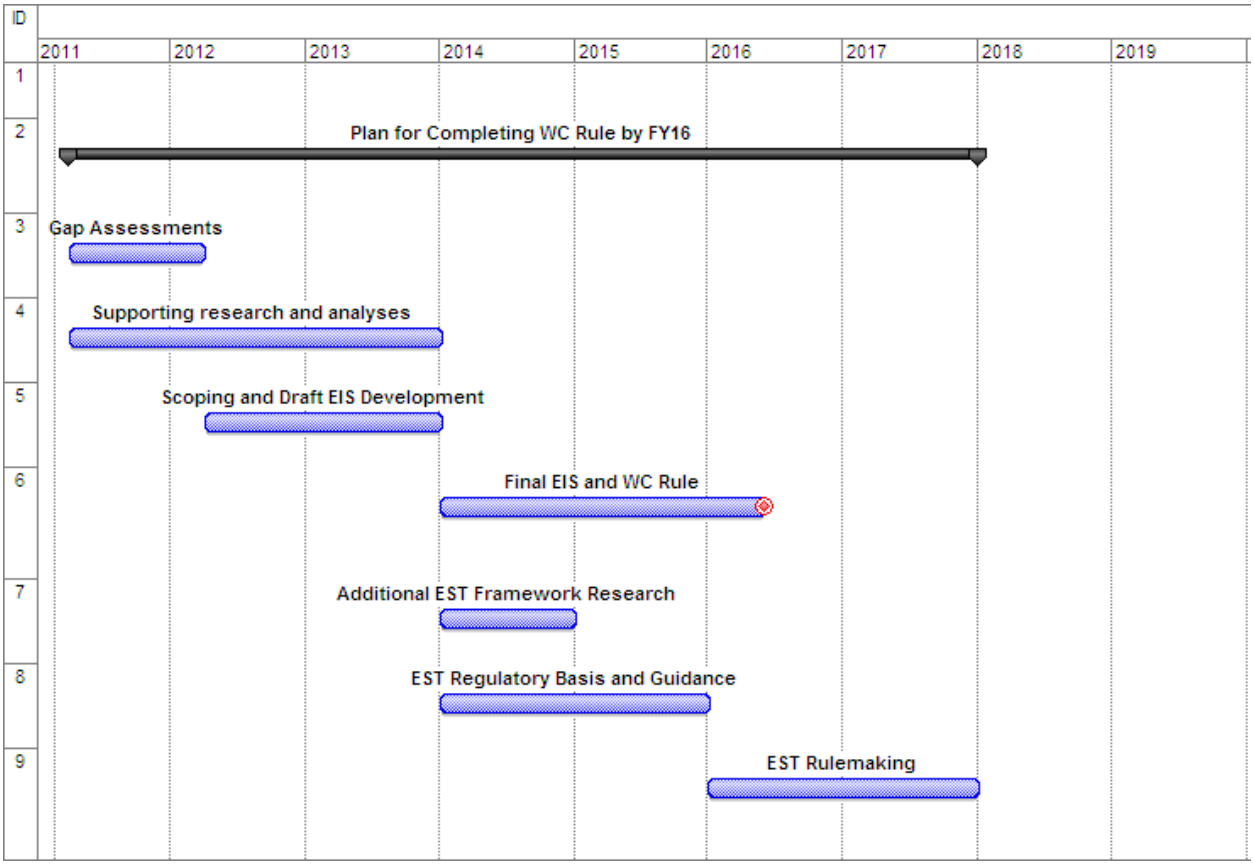
Figure 1- 1 Major Activities of WC Update



Appendix—Preliminary Scope of EIS

The staff has identified preliminary scenarios for analysis and preliminary scoping assumptions to define the scope of the waste confidence (WC) environmental impact statement (EIS). These scenarios and assumptions significantly influence the scope of research, environmental impact analyses, resources, and overall time needed to complete the EIS and develop the WC decision (generic safety findings). The staff is currently performing internal scoping reviews, including environmental gap assessments and sensitivity analyses, to better understand the impact of these scenarios and initial scoping assumptions. Early results from these scoping analyses and stakeholder feedback will assist the staff in identifying the magnitude or nature of the impacts that need to be assessed in the EIS. After refining the scenarios and scoping assumptions the staff will publish a Federal Register Notice announcing its intent to develop an EIS and initiate the formal public scoping process consistent with the National Environmental Policy Act (NEPA).

Preliminary Scenarios

Based in part on the direction in Staff Requirements Memorandum (SRM)-SECY-09-0090, "Final Update of the Commission's Waste Confidence Decision," dated September 15, 2010, the staff has identified four preliminary scenarios for the draft EIS. The EIS will focus on analyzing the environmental impacts associated with the storage and handling of spent nuclear fuel (SNF) and high-level waste (HLW) within each scenario. The generic safety issues associated with the storage of SNF and HLW will be included in the updated WC decision, which will be an appendix to the EIS. Each scenario assumes that SNF and HLW will ultimately be transported to a geologic repository for disposal (and that at least one repository will need to be constructed). To the extent practical, the EIS will not include detailed quantification and analyses of environmental impacts that are not directly related to the handling, storage, and transportation of SNF (e.g., detailed site-specific construction impacts). The detailed assessment of impacts associated with facility construction, operation, and decommissioning would be addressed in a facility-specific licensing action and associated NEPA analysis (EIS or environmental assessment.

The scenarios evaluated in the WC EIS will consider the potential application of advanced SNF management technologies and alternative approaches to disposal, such as deep borehole disposal (as directed in SRM-SECY-09-0090). To the extent practical, the analyses will draw on existing research and analyses (including international experience) related to reprocessing and alternate disposal technologies. However, additional analyses of alternate disposal, reprocessing, and advanced fuel management concepts may be necessary to fully inform the EIS; these additional analyses might require additional NRC studies.

<u>Scenario 1—Extended onsite storage at reactor sites and independent spent fuel storage installations (ISFSIs)</u>

This scenario assumes that SNF is stored for extended periods at operating reactor sites and away-from-reactor independent SNF storage installations (approximately 50–100 sites) for up to 300 years. The dry cask storage facilities at some reactor sites will continue to operate in-place after reactor facilities are decommissioned and until the SNF is transported to a disposal site.

Scenario 2—Interim onsite storage and shipment to regional storage facilities

This scenario assumes that SNF is stored at current storage facilities for an interim period, and then a significant population of SNF is transported to one or more regional dry cask storage facilities for extended storage. These regional facilities would have the capacity to store SNF from the surrounding region until it is transported for disposal.

Scenario 3—Interim onsite storage and shipment to large centralized storage facility

This scenario assumes that SNF is stored at current storage facilities for an interim period, and then a significant population of SNF is transported to one very large, centralized dry storage facility or a monitored retrievable storage facility operated by the U.S. Department of Energy (DOE). The SNF would be stored at this facility until it is transported to a disposal facility. The impacts from this scenario may be similar to the impacts of regionalized storage under Scenario 2. During scoping, the staff will determine if these options can be evaluated together as a single scenario, with scaling of Scenario 2 impacts to represent a larger centralized storage facility.

Scenario 4—Interim onsite storage and shipment to at least one reprocessing facility

This scenario assumes that SNF is stored for an interim period using one or more of three methods described for Scenarios 1, 2 and 3, and then a significant amount of SNF is transported to one or more reprocessing facilities for the recovery of fissionable material for fuel and removal of short-lived species for waste reduction. As a result of reprocessing, new forms of HLW and low-level waste (LLW) would be generated and stored at the reprocessing facility. These wastes would eventually be transported to a national HLW repository or LLW disposal facilities, as appropriate.

Preliminary Scoping Assumptions

The staff has identified preliminary scoping assumptions to further define and constrain the scope of the environmental impact analyses within each scenario, as appropriate. Some assumptions have uncertainties that could increase over the longer periods of time that would be analyzed in the EIS. In general, the EIS would minimize speculation about future conditions when identifying the long-term characteristics of the affected environment and the back end of the fuel cycle. These initial scoping assumptions generally assume that present-day attributes, current scientific knowledge, and established trends for potential growth in the use of nuclear power and SNF generation rates are applicable for SNF management scenarios during extended periods. For example, the EIS would not speculate in detail about advanced reprocessing or transmutation technologies, but would use available information on current technologies and on reasonably foreseeable technologies that are being explored in depth. However, some projection may be needed to fully develop the EIS.

(1) The affected environment and baseline environmental conditions will be defined within the scope of the current WC rule and decision.

The NRC has confidence that SNF can be stored safely and securely for at least 60 years beyond the licensed life of operation for a given reactor (75 FR 81032). This period represents a timeframe from the present day to approximately 2059 (see footnote 1 in this enclosure). To adequately describe the "affected environment," which is required for an EIS under NEPA and NRC regulations, the staff will need to characterize conditions at the starting point for the impact analyses (i.e., 60 years beyond licensed reactor operations). The staff will use information supporting the present WC rule to develop baseline criteria for describing the affected environment in the EIS.

(2) There is no loss of either passive or active institutional controls.

During the period of extended storage of SNF, the staff assumes that responsible entities (e.g., reactor licensees or the Federal Government) will provide oversight for the safe and secure operation and maintenance of a licensed storage facility, using security, monitoring, inspection, aging management (maintenance and repair), and enforcement programs that are at least as stringent as the current regulatory requirements. The responsible entities would provide the necessary financial resources for operating, securing, and maintaining storage facilities for extended periods of time (regardless of cost). The NRC and other Federal Government agencies would provide regulatory oversight of these operations during extended periods.

(3) Long-term storage and handling facilities will operate under an extended aging management framework designed to monitor, detect, and mitigate significant aging impacts.

A general regulatory framework exists to accommodate multiple storage license renewals with an aging management plan for SNF. The framework consists of time-limited aging analyses and a program to monitor, detect, and mitigate the effects of aging. As part of the environmental scoping analyses, the staff will consider the potential for future licensees to perform significant mitigation actions to address long-term aging effects. These actions could include significant component refurbishment or repackaging of the fuel in large cask populations into new systems, which could influence environmental impacts over longer time periods.

(4) Long-term transportation will rely on existing package technologies and operate under current transportation infrastructures and regulatory requirements.

Many SNF transportation systems are designed to be dual-purpose in that they meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71, "Packaging and Transportation of Radioactive Material," for future transportation and also serve as storage casks for storage under 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste." However, a variety of single-purpose and dual-purpose cask designs and variations in SNF characteristics (e.g., high-burnup fuel) exist, which may limit future transportability. As a result, the EIS will consider the impacts of repackaging operations or other actions to ensure transportability after extended storage. To develop the transportation impacts analyses, the staff will assume that present-day infrastructure and transportation modes are in place in the future and will use, where appropriate, relevant aspects of existing transportation

impact analyses in other recent NRC and DOE NEPA documents. The staff will not speculate about changes in the national transportation infrastructure (roads, railways, etc.) or transportation modes that may occur decades or centuries from now.

(5) Current light-water reactor (LWR) SNF will generally serve as the baseline SNF to be considered in long-term scenarios. The EIS may address the potential influence of advanced fuel types and LWR cladding.

Consistent with the basis of the current WC rule (75 FR 81037), the staff assumes that the impacts associated with current LWR fuel management adequately represent the impacts of management of future fuel types under the current generic safety findings. As a baseline, the EIS will consider current LWR fuel and potential reprocessing methods in long-term storage scenarios and will assume that future fuel types and management processes are analogous to current fuel management processes. In addition, the staff will assume that the burnup of the fuel may increase above current limits as reactor technology progresses.

(6) A moderate increase in the use of nuclear power will be assumed in projecting long-term SNF generation rates.

The continued use and potential growth of nuclear power is expected to increase the amount of waste in storage, thus affecting the environmental impacts (e.g., the need for larger storage capabilities and aging management impacts). For the purposes of assessing the cumulative impacts, the staff will assume “medium” growth of nuclear power as projected by DOE, in which nuclear power continues to supply approximately 20 percent of U.S. electricity production (see ADAMS Accession No. ML110180652).

(7) Dry cask storage technologies will be the industry’s preferred alternative over spent fuel pools for additional long-term storage capacity.

For economic reasons, the staff expects industry to use dry cask storage for large-scale, extended storage needs beyond the licensed life of the reactor. Spent fuel pools will continue to play an integral role in interim storage and handling of SNF at reactors during renewed license terms and decommissioning operations. Operational pools are used to temporarily store SNF and are needed to allow sufficient radioactive decay before loading of the SNF into dry storage casks and transportation packages. Spent fuel pools may be in operation for many decades in potential extended reactor operations. Therefore, the staff assumes that reactor pools will be part of the continued infrastructure for managing SNF, but primarily only for pre-ISFSI storage and handling uses. This does not discount the possibility that unique spent fuel pool facilities, such as GE Morris, may be used on a smaller scale or that some utilities may make business decisions to keep spent fuel pools operational for long periods after cessation of reactor operations.

(8) Consistent with current regulatory requirements, confinement barriers must protect spent fuel against significant degradation during extended storage to maintain retrievability and prevent operational safety problems during removal from storage. Potential uncertainty regarding the properties of fuel cladding could require new storage and transportation alternatives for the safe management of a large amount of high-burnup fuel during extended periods.

As discussed in more detail in Appendix A to the current EST project plan, cask systems are designed to maintain cladding integrity during interim dry storage to ensure that the primary fission product barrier is maintained through the back end of the fuel cycle. The staff believes that cladding integrity should be preserved to the extent practical. However, the staff recognizes that the uncertainty associated with maintaining cladding integrity for extended periods (within spent fuel pools, dry cask storage, and subsequent transportation) may require the consideration of new mitigating solutions to safely manage a large population of high-burnup fuel. As discussed in the current EST project plan, the staff is examining this issue and will identify any policy issues for the Commission's consideration, as appropriate.

(9) The WC EIS will consider terrorism and sabotage (including associated security measures).

In 2007, the U.S. Court of Appeals for the Ninth Circuit held that NEPA requires an examination of the environmental impacts that would result from an act of terrorism against an ISFSI (*San Luis Obispo Mothers for Peace v. NRC,* 449 F. 3d 1016 (2006), *cert. denied,* 127 S.Ct. 1124 (2007)). However, outside of the Ninth Circuit, the Commission has adhered to its traditional position that the environmental effects of a terrorist attack do not need to be considered in its NEPA analyses. (*See Amergen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-07-08, 65 NRC 124 (2007).) In 2009, the U.S. Court of Appeals for the Third Circuit upheld the Commission's position that terrorist attacks are too far removed from the natural or expected consequences of agency action to require an environmental impact analysis. (*New Jersey Dept. of Environmental Protection v. U.S. Nuclear Regulatory Commission,* 561 F.3d 132 (2009)). Even so, this EIS will include a discussion of terrorism that the NRC believes satisfies the Ninth Circuit's holding in the *Mothers for Peace* decision. Assuming that there are no legislative or judicial developments that affect the status quo, the staff plans to assess the long-term impacts at a generic level, assuming present-day threat scenarios, security measures applied by licensees, and the classified results of security assessments. The staff's proposed scope for assessing terrorism impacts may be adjusted based on the results of the technical analyses for EST and may also be informed by the ongoing rulemaking for 10 CFR Part 73, "Physical Protection of Plants and Materials." Further, the staff recognizes that threat scenarios may change. As part of its regulatory oversight, the NRC will respond to specific threats and continually assess the need for associated security measures as threat environments change.