

**POLICY ISSUE**  
**(Information)**

May 27, 2016

SECY-16-0067

FOR: The Commissioners

FROM: Scott W. Moore, Acting Director  
Office of Nuclear Material Safety  
and Safeguards

SUBJECT: ANNUAL STATUS REPORT: ACTIVITIES RELATED TO EXTENDED  
STORAGE AND TRANSPORTATION REGULATORY PROGRAM  
REVIEW

PURPOSE:

This paper provides the Commission with the final status report on the staff's activities related to the Extended Storage and Transportation (EST) Regulatory Program Review (EST program). The staff last updated the Commission on this matter in May 2015 (Reference 1). This paper responds to the Commission's direction in SRM-COMSECY-10-0007 to provide an annual status report (Reference 2) and does not address any new commitments.

SUMMARY:

The staff of the U.S. Nuclear Regulatory Commission (NRC) has worked to identify and address potential technical and/or regulatory issues associated with the EST of spent nuclear fuel (SNF). The staff has completed its evaluation of the Priority 1 and 2 technical issues identified in its report, "Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel," hereinafter called the TIN Report (Reference 3). The staff has determined that aging issues can be addressed through the dry cask storage license renewal framework and the EST program can be closed with no adverse impact on safety, security, or environmental protection.

CONTACT: Wendy Reed, NMSS/DSFM  
(301) 415-7213

## BACKGROUND:

In 2010, the staff was directed by the Commission to examine potential EST issues in conjunction with considerations for a possible update to its Waste Confidence Decision and Rule covering a longer time period (Reference 2). This latter aspect of the project was subsequently separated from EST and addressed by the Continued Storage Generic Environmental Impact Statement and revised Final Rule published in September 2014 (Reference 4).

Since 2010, NRC staff has worked to achieve the goal of the EST program described in COMSECY-10-0007, which is to identify and address potential technical and/or regulatory issues associated with storage and transportation of SNF over extended periods beyond 120 years, to ensure that the regulatory framework for these activities is appropriate, and to maintain safety and security of SNF in EST.

The EST program was identified in Enclosure 1 of SECY-16-0009, *Recommendations Resulting from the Integrated Prioritization and Re-Baselining of Agency Activities* (Reference 5) as one that could be shed starting in Fiscal Year (FY) 17 with no adverse impact on safety, security, or environmental protection. The Commission approved the staff's recommendation to shed this program within 6 months of a Commission decision in SRM-SECY-16-0009 (Reference 6).

## DISCUSSION:

In FY16, the EST program continued to support and was closely coordinated with other NRC efforts on SNF storage and transportation that focus on current licensing activities, including dry storage license renewals. With respect to renewals, NRC staff is developing revised regulatory guidance for an operations-focused renewal framework in anticipation of future storage renewal applications for both independent spent fuel storage installations (ISFSI) and Certificates of Compliance. This operations-focused framework includes a learning aspect, where aging management programs consider and respond to operating experience (including inspection results/data from a particular storage system or site, new technologies, and other applicable nuclear-related or non-nuclear related operating research).

The key components of this framework include the revision of NUREG-1927, Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel,<sup>1</sup> (Reference 7) which reflects an operations-focused approach to renewals and aging management, and the draft Managing Aging Processes for Storage (MAPS) regulatory guidance,<sup>2</sup> which will contain specific aging management recommendations that can be used by renewal applicants to develop applications, and to guide the staff's use of NUREG-1927, Revision 1. The staff anticipates that both documents will contribute to making the renewal application and subsequent staff review more effective and efficient. Results from EST research into aging effects coupled with recent enhancements in the guidance for spent fuel dry cask storage Aging Management Programs (AMP) (i.e., MAPS report) are providing effective, timely, and efficient identification of those effects. Evaluation, mitigation, and corrective action are key

---

<sup>1</sup> Issued as a draft for public comment in June 2015 and Revision 1 is scheduled to be finalized in summer 2016.

<sup>2</sup> Scheduled to be issued for public comment in summer 2016.

aspects of AMP and should be implemented before dry storage systems reach the timeframes for EST (i.e., 120 to 300 years).

During development of the renewal framework and implementation of the EST program, staff determined that the aims of the EST program could be adequately addressed through the dry cask storage renewal framework and does not anticipate needing rulemaking changes to address EST. This is because the renewal framework and EST program share the common goal of continued safe storage during the extended period of performance. Through its completion of the Priority 1 and 2 EST research activities described further below, staff determined that anticipated aging issues can be addressed through appropriate operational methodologies outlined in approved AMP. As a result of these EST research activities, staff does not expect unique aging mechanisms that would not be addressed by the dry cask storage renewal framework to challenge the safety functions of the storage systems during the long term storage timeframe (i.e., 120 to 300 years). Nevertheless, continued NRC oversight and licensee inspections and monitoring activities outlined in approved aging management programs should identify any potential materials degradation occurrences that may challenge the safety functions of the storage systems. For these reasons, staff determines that the EST program can be closed with no adverse impact on safety, security, or environmental protection.

#### Technical Areas

The staff has completed evaluation of the technical issues identified in its TIN Report. The table below shows the status of work of the Priority 1 and 2 areas identified in the TIN Report.

Priority	Technical Issue	Relevant Deliverables	Path To Success
1	Stress corrosion cracking (SCC) of canister	NUREG/CR-7170, "Assessment of Stress Corrosion Cracking Susceptibility for Austenitic Stainless Steels Exposed to Atmospheric Chloride and Non-Chloride Salts," ML14051A417	No further EST work identified
	Fuel pellet swelling	"Cladding Stress during Extended Storage of High Burnup Spent Nuclear Fuel," ML15180A411	No further EST work identified

1	Thermal calculations	NUREG/CR-7191, "Thermal Analysis of Horizontal Storage Casks for Extended Storage Applications," ML14352A098	No further EST work identified. Some modeling work continues to support renewals
	Effects of residual moisture after normal drying	NRC reports on vacuum drying adequacy (ML13169A039), vacuum drying methods and factors affecting residual moisture (ML13192A125), and a vacuum drying test plan (ML13192A127)	No further EST work identified
	In-service monitoring methods for storage systems and components	"Available Methods for Functional Monitoring of Dry Cask Storage Systems," ML14323A067	No further EST work identified
2	Propagation of existing flaws in cladding	"Cladding Stress during Extended Storage of High Burnup Spent Nuclear Fuel," ML15180A411	No further EST work identified
	Low temperature creep of cladding	"Cladding Stress during Extended Storage of High Burnup Spent Nuclear Fuel," ML15180A411	No further EST work identified
	Concrete degradation	Concrete workshop public meeting summary (ML15062A058) and transcripts (ML15093A003, ML15093A004).	No further EST work identified

The rest of the Priority 2 areas from the TIN report (e.g., microbiologically induced corrosion) not listed in the table were addressed in the Aging Management Table (AMT) activity described below, and do not require further work.

During its evaluation, the staff recognized that some of the work to resolve technical issues identified within the TIN Report and the subsequent research products were also applicable to current storage and transportation licensing issues, including renewals. Some of this work is highlighted below.

Development of improved, more realistic thermal models for dry cask systems is one of the Priority 1 areas identified in the TIN Report. This modeling is important because it can predict more realistic temperatures for fuel cladding and the canister surface as compared to previous models, and remove unnecessary conservatism. These temperature predictions are useful in determining when various regions of the canister exterior may be susceptible to SCC. Such information can help ensure that canister inspections during renewal periods of operation are focused at the right locations in the storage system and begin in the appropriate time frame. In the past year, a similar computational fluid dynamics (CFD) thermal model for a non-ventilated vertical dry cask system to complement work for a horizontal ventilated cask system (Reference 8) was developed by NRC. This work was necessary as the flow pattern and heat transfer phenomena are different between the vertical and horizontal systems. NRC's model work is coordinated with a staff-directed experimental program on a full-size fuel assembly supported by funds from NRC and the U.S. Department of Energy (DOE) for current dry storage systems (not

under the EST program). The purpose of the experimental program is to obtain data on thermal and fluid flow parameters for use in validating staff's model work and related numerical models. Specifically, the CFD model analyzes the storage system and fuel loading that DOE will use in its High Burnup Dry Storage Cask Research and Development Project. This project, sponsored by the DOE in cooperation with industry and sited at Dominion Power's North Anna ISFSI, will provide measured temperature data from inside the cask to help validate thermal models, including the one developed by NRC.

NRC staff also developed storage system-specific AMTs to provide the technical basis for future renewal regulatory guidance (i.e., MAPS report). The AMTs consider the material, environment, potential degradation mechanism, and important to safety function for safety-significant structures, systems, and components in a storage system design to determine whether an aging effect can occur. Some of the topics addressed in the AMTs include Priority 1 and 2 items in the TIN report. Staff is using the AMTs to support development of the draft MAPS regulatory guidance. The MAPS report is similar to the Generic Aging Lessons Learned (GALL) report for reactors (Reference 9). Like the GALL report, the MAPS report should streamline and improve the efficiency of the license renewal process for applicants and NRC reviewers. It will provide NRC guidance and recommendations for an acceptable approach for including AMP for dry cask storage systems. Specific system designs selected for AMT development were based on renewal applications expected through 2021, and will be incrementally updated in the MAPS as additional storage systems approach renewal. The thermal modeling described in the previous paragraph and the AMTs will continue to support the renewal framework.

#### Related Work Being Done By Other Organizations

As part of NRC's licensing support and international activities (separate from the EST program), the staff continues to maintain cognizance of technical investigations related to spent fuel and transportation being performed by industry, DOE, academic researchers, and international counterparts; this includes the Electric Power Research Institute Extended Storage Collaboration Program, which has strong international participation as well as research funded through DOE's Nuclear Energy University Program. In addition, the staff participates in related activities of the International Atomic Energy Agency (IAEA), including the IAEA Cooperative Research Program, now in its fourth year, to evaluate demonstration programs that can provide information on expected behavior of components and fuel in dry storage.

#### CONCLUSIONS:

The staff has completed evaluation of the Priority 1 and 2 technical issues identified in its TIN Report. The staff has also successfully incorporated pertinent products from the EST program (e.g., AMTs) into the dry cask storage license renewal framework. The staff determined, going forward, aging issues can be addressed through the dry cask storage license renewal framework. The staff continues to monitor activities from the industry, DOE, international counterparts, and other researchers in related areas. Close out of the EST program enables staff to utilize planned EST resources in current and future fiscal years for activities needed to support resolution of emerging licensing issues as well as emergent work such as review of interim consolidated storage applications. The EST program can be closed with no adverse

impact on safety, security, or environmental protection. In accordance with SRM-SECY-16-0009, the EST program will be closed out in FY 16, and this will be the final annual update paper to the Commission regarding the EST program.

RESOURCES:

The FY16 resources for the Office of Nuclear Material Safety and Safeguards are \$73,000 and 2.0 full-time equivalents (FTE) budgeted in the Spent Fuel Storage and Transportation Business Line, Rulemaking Product Line, Rulemaking Support Product. The resources for the Office of Nuclear Regulatory Research are \$404,000 and 1.6 FTE budgeted in the Spent Fuel Storage and Transportation Business Line, Research Product Line, Waste Research Product. Resources for the EST program will not be required beyond FY16.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objection.

*/RA/*

Scott W. Moore, Acting Director  
Office of Nuclear Material Safety  
and Safeguards

Enclosure:  
References

impact on safety, security, or environmental protection. In accordance with SRM-SECY-16-0009, the EST program will be closed out in FY 16, and this will be the final annual update paper to the Commission regarding the EST program.

RESOURCES:

The FY16 resources for the Office of Nuclear Material Safety and Safeguards are \$73,000 and 2.0 full-time equivalents (FTE) budgeted in the Spent Fuel Storage and Transportation Business Line, Rulemaking Product Line, Rulemaking Support Product. The resources for the Office of Nuclear Regulatory Research are \$404,000 and 1.6 FTE budgeted in the Spent Fuel Storage and Transportation Business Line, Research Product Line, Waste Research Product. Resources for the EST program will not be required beyond FY16.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objection.

*/RA/*

Scott W. Moore, Acting Director  
Office of Nuclear Material Safety  
and Safeguards

Enclosure:  
References

**ML16097A082**

**WITS 201000286**

<b>OFFICE</b>		<b>NMSS/SFM</b>	<b>NMSS/SFM</b>	<b>NMSS/SFM</b>	<b>NMSS/SFM</b>	<b>NMSS/PBPA</b>
<b>NAME</b>		WReed	ACsontos	BPham	MLombard	CSchum
<b>DATE</b>		4/6/16	4/14/16	4/18/16	4/20/16	4/27/16
<b>OFFICE</b>		<b>RES</b>	<b>CFO</b>	<b>OGC</b>	<b>Tech Editor</b>	<b>NMSS</b>
<b>NAME</b>		EHackett	KLam	JBielecki	WMoore	SMoore
<b>DATE</b>		4/5/16 via email	5/11/16 via email	5/16/16 via email	05/18/16	05/27/16

**OFFICIAL RECORD COPY**