



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

REGION I  
2100 RENAISSANCE BLVD., SUITE 100  
KING OF PRUSSIA, PA 19406-2713

January 8, 2018

Erhard W. Koehler  
Senior Technical Advisor, N.S. Savannah  
U.S. Department of Transportation  
Maritime Administration (MAR-640.2)  
1200 New Jersey Avenue, SE W25-209/212  
Washington, DC 20590-0001

SUBJECT: NRC INSPECTION REPORT NO. 05000238/2017001, U.S. DEPARTMENT OF  
TRANSPORTATION, N.S. SAVANNAH, BALTIMORE, MARYLAND

Dear Mr. Koehler:

On December 12, 2017, Mark Roberts and Katherine Warner of this office conducted a safety inspection at the Nuclear Ship (N.S.) Savannah berthed in Baltimore, Maryland. The safety inspection reviewed programs and activities associated with the N.S. Savannah while the vessel is in a long-term safe storage status. The enclosed inspection report documents the inspection results, which were discussed with you at the conclusion of the inspection on December 27, 2017. Based on the results of this inspection, no findings of safety significance were identified.

In accordance with 10 CFR Part 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web Site at <https://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

No response to this letter is required. If you have any questions, please contact Mark Roberts of my staff at [Mark.Roberts@nrc.gov](mailto:Mark.Roberts@nrc.gov) or (610) 337-5094.

Sincerely,

A handwritten signature in black ink, appearing to read 'Raymond J. Powell', written in a cursive style.

Raymond J. Powell, Chief  
Decommissioning, ISFSI, and Reactor Health  
Physics Branch  
Division of Nuclear Materials Safety

Docket No. 05000238  
License No. NS-1

Enclosure:  
Inspection Report No. 05000238/2017001

cc w/Enclosure: Art Paynter, QA Manager  
John Osborne, Licensing and  
Compliance Manager  
State of Maryland

No response to this letter is required. If you have any questions, please contact Mark Roberts of my staff at [Mark.Roberts@nrc.gov](mailto:Mark.Roberts@nrc.gov) or (610) 337-5094.

Sincerely,

/RA/

Raymond J. Powell, Chief  
Decommissioning, ISFSI, and Reactor Health  
Physics Branch  
Division of Nuclear Materials Safety

Docket No. 05000238  
License No. NS-1

Enclosure:  
Inspection Report No. 05000238/2017001

cc w/Enclosure: Art Paynter, QA Manager  
John Osborne, Licensing and  
Compliance Manager  
State of Maryland

DISTRIBUTION w/enclosure:  
TSmith, DUWP/NMSS  
BWatson, DUWP/NMSS

DOCUMENT NAME: G:\WordDocs\Current\Insp Letter\LNS-1.2017001.docx

**SUNSI Review Complete:** MRoberts

After declaring this document AAn Official Agency Record® it **will** be released to the Public.

To receive a copy of this document, indicate in the box: AC® = Copy w/o attach/encl AE® = Copy w/ attach/encl AN® = No copy

OFFICE	DNMS/RI	N	DNMS/RI	N	DNMS/RI			
NAME	KWarner <i>KW</i>		MRoberts <i>MR</i>		RPowell <i>RP</i>			
DATE	12/18/17		12/27/17		12/27/17			

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

INSPECTION REPORT

Docket No. 05000238

License No. NS-1

Inspection No. 05000238/2017001

Licensee: U.S. Department of Transportation  
Maritime Administration (MARAD)  
Washington, DC 20590

Facility: N.S. Savannah

Location: Canton Marine Terminal  
Pier 13  
4601 Newgate Avenue  
Baltimore, MD 21224

Inspection Dates: December 12 and 21(exit), 2017

Inspectors: Mark C. Roberts, Senior Health Physicist  
Decommissioning ISFSI, and Reactor Health Physics Branch  
Division of Nuclear Materials Safety  
Region I

Katherine Warner, Health Physicist  
Decommissioning ISFSI, and Reactor Health Physics Branch  
Division of Nuclear Materials Safety  
Region I

Approved By: Raymond J. Powell, Chief  
Decommissioning ISFSI, and Reactor Health Physics Branch  
Division of Nuclear Materials Safety  
Region I

Enclosure

## **EXECUTIVE SUMMARY**

U.S. Department of Transportation  
N.S. Savannah  
NRC Inspection Report No. 05000238/2017001

A routine announced safety inspection was conducted on December 12, 2017, by two Region I inspectors of the Nuclear Ship (N.S.) Savannah, currently berthed at a marine terminal in Baltimore, Maryland. NRC oversight of the decommissioning project is managed by staff from the NRC's Reactor Decommissioning Branch, Division of Decommissioning, Uranium Recovery, & Waste Programs (DUWP), Office of Nuclear Material Safety and Safeguards (NMSS) with inspection support from the NRC Region I office.

The N.S. Savannah is classified by the NRC as a research and test reactor. The program for overseeing the decommissioning of research and test reactors is described in Inspection Manual Chapter (IMC) 2545, "Research and Test Reactor Inspection Program." The inspection included a review of the programs and activities associated with the N.S. Savannah while the vessel is in a long-term protective storage status. The inspection consisted of observations and tours by the inspectors, interviews with N.S. Savannah personnel, and a review of procedures and records. There are currently no ongoing decommissioning activities being conducted on the N.S. Savannah. Based on the results of this inspection, no findings of safety significance were identified.

## **REPORT DETAILS**

### **1.0 Background**

The N.S. Savannah is the property of the U. S. Department of Transportation (DOT), Maritime Administration (MARAD). The N.S. Savannah was designed, constructed, and operated as a joint research and development project of MARAD and the Atomic Energy Commission. The ship operated from 1961 until it was removed from service in 1970. In 1971, the ship was defueled and various dismantling activities were conducted through 1976 to remove much of the radioactive material from the ship and to isolate radiologically contaminated systems. These activities included removing ion exchange systems and resins and most of the water from the primary, secondary, and auxiliary systems. A "Possession Only" license was issued in May 1976. The N.S. Savannah is a registered National Historic Landmark. In May 2008, the ship was towed from Norfolk, Virginia to its present location in Baltimore, Maryland. The program for overseeing the decommissioning of research and test reactors is described in IMC 2545.

### **2.0 Long-term Safe Storage Status Review**

#### **a. Inspection Scope (Inspection Procedure 69002)**

The inspectors reviewed the following items, which are required to be reported to the NRC in annual reports per technical specifications: (1) the status of the facility, (2) results of radiation surveys and monitoring station dosimeter readings, (3) results of environmental sample analyses, (4) results of quarterly intrusion alarm system checks, (5) radioactive material releases and shipments of radioactive waste, (6) a description of the principal maintenance performed on the vessel, (7) unauthorized entry into radiation control areas by visitors or employees, (8) degradation of any boundaries that contain the radioactive materials aboard the vessel, and (9) results of occupational exposures. The inspection consisted of observations and tours by the inspectors, interviews with N.S. Savannah personnel, and a review of procedures and records. In an October 31, 2017 letter, MARAD representatives submitted a license amendment request to allow certain dismantlement activities. This action has not been acted upon by the DUWP, NMSS staff and although discussed, was not reviewed as part of this inspection.

The inspectors also reviewed Radiation Work Permits (RWPs); results from intrusion, fire, and flood detection system surveillance testing; and procedures and protocols implemented by the N.S. Savannah staff for public access to the vessel. The inspectors discussed the protocols used by the N.S. Savannah's nuclear operations staff to respond to alarm conditions and reviewed documentation related to the N.S. Savannah's corrective action process.

#### **b. Observations and Findings**

The inspectors confirmed that the ship remains in its protective storage condition in Baltimore Harbor with a retention crew during regular working hours and regular attendance by the MARAD nuclear operations staff. In March 2013, MARAD awarded a contract to TOTE Services that integrates radiation protection and emergency response, custodial care of the vessel, and nuclear professional support services. This contract is scheduled to extend at least into 2018. Routine maintenance, surveillance tests, and environmental and radiological monitoring in support of technical specification

requirements continue under the contract. Radiation Services Organization, Inc. of Laurel, Maryland is subcontracted to provide radiation protection and emergency response services.

The N.S. Savannah is equipped with two alarm systems that combine to cover fire detection, flood, intrusion detection, and monitors access to the locked B Deck Reactor Compartment entrance. The systems provide local visible and audio warning alarms and notification to a remote monitoring system that alerts a local fire department and N.S. Savannah personnel as appropriate. Periodic alarm system checks are performed and documented in accordance with the N.S. Savannah's surveillance testing procedures. There is also a procedure providing initial response and guidance to abnormal or emergency conditions aboard the ship. The inspectors noted that a number of corrective action reports had been entered into the Savannah's corrective action reporting system associated with the intrusion alarm system. The inspectors determined that the corrective actions were entered into the system and assigned appropriate significance classifications and response time commitments. The inspectors noted that corrective actions included additional training and/or procedure revisions as appropriate.

The inspectors reviewed radiological environmental monitoring programs and the results from surveys in the radiologically and non-radiologically controlled areas of the N.S. Savannah. Thermoluminescent dosimeters are placed in 46 locations in non-radiologically controlled areas and exchanged semi-annually. The inspectors confirmed that the results from these measurements were indistinguishable from background radiation levels. In accordance with the vessel's technical specifications, sediment and water samples are collected in the vicinity of the ship and analyzed for gamma-emitting radionuclides that could be attributable to any potential releases from the ship. Sample results were consistent with expected background radiological conditions. Radiological surveys are conducted at least annually in accordance with the vessel's technical specifications in both radiologically and non-radiologically controlled areas. Survey results in the non-radiologically controlled areas were indistinguishable from background radiation levels. Survey results in the radiologically controlled areas were consistent with previous annual survey results. The inspectors noted that areas were properly posted and access to all radiological areas were protected by locked doors.

Based on a tour of the vessel, review of the annual reports, and discussions with N.S. Savannah staff, there have been no issues identified with the material condition of any of the ship's boundaries that contain radioactive materials. Potential pathways for non-routine radiological releases of radioactive liquids have been capped to prevent inadvertent releases. There is no active decommissioning in progress so there has been no release of radioactive material as effluents or as radioactive waste. Maintenance campaigns have been conducted in the cold chemistry lab, the health physics lab, and the hot chemistry lab to improve the general house-keeping in these areas, in particular, loose paint that likely contain lead, was removed. Loose lead paint chips have been collected and are in locked storage for future evaluation and resolution.

An RWP system is used to access the controlled areas on the ship. Each RWP provided a description of the measures required for access to and egress from the controlled areas and described protective clothing, radiation dosimeter requirements for access, and post-egress personal monitoring. The inspectors accessed the reactor compartment and containment vessel during the inspection, a controlled area, and received an appropriate RWP briefing from the Radiation Safety Officer and were

appropriately monitored by radiation control technicians upon exit. All radiation survey equipment examined was within current calibration intervals. The inspectors noted that all reported occupational doses from the containment vessel entry were minimal.

Although the N.S. Savannah is not open for general public visitation, the vessel is often available for public visitation for special open house events or in response to specific requests from organizations. Prior to boarding the vessel, visitors are provided with a briefing that covers safety and general information about the ship. During public access events or tours, routine work is suspended and access to certain areas is restricted by ropes or physical barriers per N.S. Savannah procedures. N.S. Savannah Technical Staff representatives are positioned in strategic areas to direct visitors.

c. Conclusions

There are currently no ongoing decommissioning activities being conducted on the N.S. Savannah. Based on the results of this inspection, no findings of safety significance were identified.

**3.0 Exit Meeting Summary**

On December 27, 2017, the inspectors presented the inspection results to Erhard Koehler, Senior Technical Advisor, N.S. Savannah. The inspectors confirmed that proprietary information was not provided or examined during the inspection.



## **SUPPLEMENTAL INFORMATION**

### **PARTIAL LIST OF PERSONS CONTACTED**

#### Licensee and contractors

H. Evans, Radiation Safety Officer, RSO, Inc.  
E. Koehler, Senior Technical Advisor, MARAD  
J. Osborne, Licensing and Compliance Manager, Savannah Technical Staff  
A. Paynter, Quality Assurance Manager, Savannah Technical Staff

### **PARTIAL LIST OF DOCUMENTS REVIEWED**

N.S. Savannah Annual Report 2014, STS-191, Rev.0, February, 2015  
N.S. Savannah Annual Report 2015, STS-196, Rev.0, February, 2016  
N.S. Savannah Annual Report 2016, STS-199, Rev.0, February, 2017  
N.S. Savannah Decommissioning Funds Status Report for CY 2016, STS-200 March 31, 2017  
N.S. Savannah Amendment to Facility Operating License Amendment No. 14, April 2008  
(includes Technical Specifications)  
N.S. Savannah Updated Final Safety Analysis Report, STS-004-002, Rev 9, May 1, 2017  
Environmental Radiation Exposure Reports  
N.S. Savannah, Surveillance, Inspection, and Calibration, STS-004-004, Rev. 11, October 16, 2014  
N.S. Savannah, Corrective Action Process, STS-003-002, Rev 7, December 8, 2016  
Corrective Action Resolution Forms  
N.S. Savannah Radiation Work Permits for 2017 (RWPs 17-001 and 17-002)  
Environmental Sample Analysis Reports  
Miscellaneous Surveillance and Alarm Test Results  
Safety Review Committee Minutes  
N.S. Savannah, Inspection Checklist for Site Patrol, Reactor Compartment B-Deck Door and Draft Marks, SIC-TS-D-1, December 2017  
N.S. Savannah, Abnormal & Emergency Conditions, STS-007-001, Rev. 5, December 2015

### **ITEMS OPEN, CLOSED, AND DISCUSSED**

None

### **LIST OF ACRONYMS USED**

CFR	Code of Federal Regulations
DOT	U. S. Department of Transportation
DUWP	Division of Decommissioning, Uranium Recovery, & Waste Programs
IMC	Inspection Manual Chapter
MARAD	U. S. Maritime Administration
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	Nuclear Regulatory Commission
N.S.	Nuclear Ship
RWP	Radiation Work Permit