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U.S. Department  
of Transportation

Maritime  
Administration

SAVANNAH Technical Staff  
Office of Ship Operations

400 Seventh Street, S.W.  
Washington, D.C. 20590

Ref: 10 CFR 50.82(a)(4)(i)

December 11, 2006

**ATTN: Document Control Desk**  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

**SUBJECT: Docket No. 50-238; License No. NS-1; N.S. SAVANNAH**  
**Submittal of Post Shutdown Decommissioning Activities Report**

- References:**
- (a) Letter from Mr. R. W. Sliger, (MARAD) to Mr. A. Giambusso, (AEC), dated December 20, 1973, N.S. SAVANNAH License NS-1
  - (b) Letter from Mr. J. Davis (MARAD) to Mr. S. D. Ebnetter (NRC), dated August 2, 1990
  - (c) Letter from Mr. Z. Levine (MARAD) to Mr. R. W. Reid (NRC), dated March 17, 1976
  - (d) Letter from Mr. Z. Levine (MARAD) to Mr. R. W. Reid (NRC), dated April 13, 1976
  - (e) Letter from Mr. Z. Levine (MARAD) to Mr. R. W. Reid (NRC), dated April 21, 1976

Pursuant to 10 CFR 50.82(a)(4)(i), the United States Maritime Administration (MARAD) hereby submits the Nuclear Ship SAVANNAH (NSS) Post Shutdown Decommissioning Activities Report (PSDAR). The NSS PSDAR includes a description of the planned decommissioning activities along with a schedule for their accomplishment; an estimate of expected costs; and a discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate, previously issued environmental impact statements or recently decommissioned similar facilities.

The PSDAR requirement of 10 CFR 50.82(a)(4)(i) was initially promulgated in 1996, and required that a PSDAR be submitted prior to or within two years following the permanent cessation of operations. Because the NSS was defueled and partially decommissioned some 25 years before the PSDAR regulation was promulgated, References (a) through (e) are highlighted to demonstrate that MARAD essentially met the underlying intent of the PSDAR submission and content requirement.

In particular, Reference (a) was submitted in 1973 to report the reactor plant's wet lay-up status, and stated that its contents "could, in some future case, be supportive information to consider termination of [NSS's] Part 50 applicability, if circumstances warranted." With the exception of a discussion on decommissioning funding, Reference (a) addressed the content requirements for an initial PSDAR. Reference (b), submitted in 1990, provided the missing information regarding decommissioning funding. MARAD updated the discussion of Reference (a) in References (c), (d) and (e) to support its possession-only license amendment request in 1976. Notwithstanding prior MARAD actions, Enclosure 1 is Revision 0 of the NSS PSDAR.

ADD1

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The enclosed PSDAR is based on the best information currently available and the plans may be modified as additional information becomes available or conditions change. If plans change in a significant manner, MARAD will inform the U. S. Nuclear Regulatory Commission (NRC) in accordance with 10 CFR 50.82(a)(7). For example, after a decommissioning location is selected, the environmental analysis will be supplemented with location specific information. MARAD expects to select the decommissioning location in the first quarter of 2007. Similarly, the PSDAR does not include a site specific decommissioning cost estimate, because disclosure of the estimate at this time is prohibited under certain requirements of the Federal Acquisition Regulations (FAR). When those requirements have been met such that MARAD is allowed to disclose decommissioning cost estimates, MARAD will submit a site specific decommissioning cost estimate in accordance with 10 CFR 50.82(a)(8)(iii).

Enclosure 2 lists three new Regulatory Commitments supporting the PSDAR, Revision 0.

If there are any questions or concerns with any issue discussed in this request, please contact me at (202) 366-2631, and/or e-mail me at [erhard.koehler@dot.gov](mailto:erhard.koehler@dot.gov).

Respectfully,



Erhard W. Koehler  
Senior Technical Advisor, N.S. SAVANNAH  
Office of Ship Operations

Enclosures

**Docket No. 50-238; License NS-1; N.S. SAVANNAH**  
**Submittal of PSDAR**  
**December 11, 2006**

Enclosure:

1. NS SAVANNAH (NSS) Post Shutdown Decommissioning Activities Report (PSDAR)
2. List of Regulatory Commitments

**Docket No. 50-238; License NS-1; N.S. SAVANNAH**  
**Submittal of PSDAR**  
**December 11, 2006**

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MAR-600, 610, 610.1, 610.3, 610.5, 611, 612 (em, ship file), 613, 614

Hardcopy w/ all enclosures and attachments

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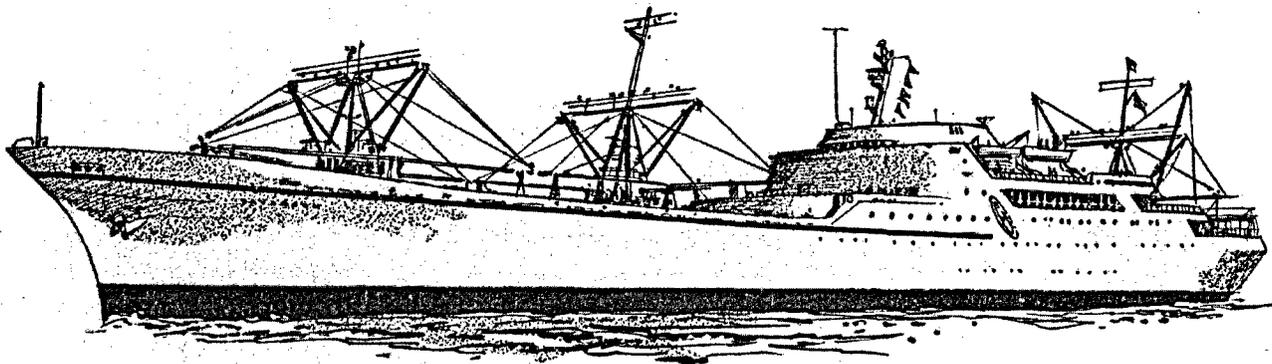
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**Docket No. 50-238; License No. NS-1; N.S. SAVANNAH**

**Enclosure 1 to Submittal of Post Shutdown Decommissioning Activities Report (PSDAR)**



**U.S. Department of Transportation  
Maritime Administration  
Office of Ship Operations**



***N.S. SAVANNAH***

**POST SHUTDOWN  
DECOMMISSIONING ACTIVITIES REPORT**

**STS-100  
Revision 0**

Approved:

11/27/2006

Manager,

N.S. SAVANNAH Programs

Date

Prepared by:  
Sayres and Associates Corporation

**RECORD OF REVISIONS**

Revision	Summary of Revisions
0	This is the original version of the Post Shutdown Decommissioning Activities Report

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**LIST OF EFFECTIVE PAGES**

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## 1.0 INTRODUCTION

In accordance with the requirements of 10 CFR 50.82, "Termination of License," paragraph (a)(4)(i), this report provides the Maritime Administration's (MARAD) Post-Shutdown Decommissioning Activities Report (PSDAR) for the Nuclear Ship SAVANNAH (NSS).

This report is arranged into sections that supply the information required in a PSDAR as described in 10 CFR 50.82 and Regulatory Guide 1.185 (Reference a). These sections include:

- A description of the licensee's planned major decommissioning activities;
- A schedule for completing these activities;
- A discussion regarding an estimate of the expected decommissioning costs; and,
- A discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements.

Section 2.0, "Background," provides a brief discussion of the design and history of the NSS. The planned decommissioning activities and the general sequencing of their implementation are described in Section 3.0, "Description of Planned Decommissioning Activities." The overall decommissioning schedule is found in Section 4.0, "Schedule of Planned Decommissioning Activities." An explanation of why the site specific cost estimate can not be provided at this time is given in Section 5.0, "Estimate of Expected Decommissioning Costs." Section 6.0, "Environmental Impacts," contains the reasons for concluding the NSS decommissioning related activities will be bounded by previously issued environmental impact statements (i.e., NUREG-0586 [Reference b] and NUREG-1496 [Reference c]).

## 2.0 BACKGROUND

### 2.1 HISTORY

MARAD is owner and licensee of NSS, the world's first nuclear powered merchant ship. Conceived in the 1950s as part of President Eisenhower's "Atoms for Peace" program, the NSS was designed, constructed and operated as a joint research and development project of the MARAD and the Atomic Energy Commission (AEC). MARAD's contribution was the ship while the AEC's was the reactor and related nuclear systems. The 80 MW<sub>th</sub> reactor was first brought to power in 1961. Seagoing trials followed in 1962.

The AEC ended its participation in the project in about 1965, transferring liability and title of the reactor to MARAD. NSS was operated in experimental and commercial demonstration service throughout the 1960s. Having completed its research and development objectives, the ship was removed from service in 1970.

The only refueling was conducted in August to October 1968 at the MARAD Refueling Facility, Todd Shipyards, Galveston, TX. This refueling was a "fuel shuffle" to extend the life of Core I. In this operation, the four center fuel elements were removed and replaced with four spare elements. The remaining 28 elements were rearranged to increase reactivity. In general, the inside elements were moved out and the outside elements were moved in. The new core design was designated Core Ia. Additionally, one control rod was replaced.

In 1971, when alternative uses for the ship failed to materialize, its nuclear power plant was defueled, partially decommissioned and prepared for long-term lay-up under contemporary best practices. Since December of 1971, the NSS has essentially been maintained in a SAFSTOR condition. SAFSTOR is defined as "a method of decommissioning in which the nuclear facility is placed and maintained in such condition that the nuclear facility can be safely stored and subsequently decontaminated to levels that

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permit release for unrestricted use.” By April 1976, additional decommissioning activities such as removing the three primary purification system ion-exchangers, their resins and dewatering the primary, auxiliary and secondary systems had been performed. The NSS possession-only license was issued on May 19, 1976 (Reference d). The NSS is a registered National Historic Landmark.

In 1981, the NSS was bareboat chartered<sup>1</sup> to the Patriots Point Development Authority (PPDA) of the State of South Carolina, for public display at the Patriots Point Naval and Maritime Museum, near Charleston, SC. The possession-only license was amended to include PPDA as a joint license holder with MARAD. Museum operations continued until early 1994, when PPDA notified MARAD of its intent to return the NSS to MARAD under the terms of the bareboat charter agreement. The NSS was removed from the museum in May 1994, and in June 1994 was drydocked in Baltimore, MD for routine hull maintenance and repair, prior to being placed in the James River Reserve Fleet at Fort Eustis, VA.

On August 15, 2006, the NSS was moved to Colonna’s Shipyard, Norfolk, VA for infrequent, required topside maintenance. A subsequent drydocking for cleaning, repairing (as needed) and painting the hull is scheduled to be awarded in FY 2007.

Following the drydocking, MARAD expects to layberth the NSS while awaiting determination of the decommissioning location. The specific location for decommissioning the NSS has not been chosen. Currently, MARAD expects the decommissioning location to be in one of the following general locales:

- o Norfolk, VA;
- o Wilmington, NC; or,
- o Charleston, SC.

The actual decommissioning location could be elsewhere.

## **2.2 SUMMARY OF ROUTINE ACTIVITIES (1971 - 2006)**

Following issuance of the Possession-only license in 1976, no significant decommissioning activities were performed. Equipment corrective and preventive maintenance, inspection activities, and routine operations were conducted in accordance with established marine practices and the Technical Specifications. Systems/structures were monitored and maintained, as needed, to control spread of radioactive material. A cathodic protection system was used to protect the underwater areas of the vessel's hull to minimize corrosion damage to the hull. Underwater inspections of the hull were conducted at least every four years to identify problems such as localized severe pitting, underwater plate thinning or other damage that would require corrective action.

When routine access was not required, the ship was locked and secured. Areas containing radioactive materials or other contamination were secured to prevent accidental intrusion and make deliberate intrusion difficult. Decontamination was generally limited to those activities necessary to maintain exposures as low as is reasonably achievable (ALARA).

In accordance with the NSS Technical Specifications, radiological and environmental surveillances were performed to ensure that radioactivity was not spread in the ship. Additionally, these surveillances ensure potential releases of radioactive material to the environment are detected and controlled.

## **2.3 SUMMARY OF COMPLETED DECOMMISSIONING ACTIVITIES (1971 - 2006)**

### **2.3.1 REACTOR VESSEL**

All 32 Core Ia fuel elements were removed from the reactor vessel to the spent fuel pool at the MARAD Refueling Facility, Todd Shipyards, Galveston, TX. All reactor internal components are in

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<sup>1</sup> A bareboat charter is an arrangement where the owner gives possession of the ship to the charterer but no crew or provisions are included as part of the agreement. The charterer is responsible for all operating expenses.

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place, i.e., core basket, upper grid plate, upper flow baffle. Thirty-six upper flow transition pieces and one irradiated control rod (cut in three pieces) have been loaded into six fuel element channels in the core basket. Thirty-two upper flow transition pieces were from Core I and 4 were from Core Ia (i.e., the 1968 fuel shuffle). The additional control rod was the one replaced during the 1968 fuel shuffle. The reactor head is in place with six of the original 48 reactor head hold down studs tensioned.

In 2005 (Reference e), analysis has found that the reactor pressure vessel and related components are Class A radioactive waste material for land disposal purposes per 10 CFR 61.55.

### **2.3.2 SPENT FUEL**

Thirty six spent fuel elements (Core I plus the four "new" elements of Core Ia) were shipped from Galveston, TX to the AEC, now U.S. Department of Energy (USDOE), Savannah River Site, Aiken, SC in nine shipments from October 4 through December 21, 1972, via a trailer using the Piqua/Elk River Shipping cask.

### **2.3.3 FISSION CHAMBERS**

Five fission chambers were removed and shipped to Todd Shipyards, Galveston TX in May 1973. On June 28, 1973, these five and an additional three stored on the NSV Atomic Servant (the nuclear services barge for NSS) were shipped to Chem-Nuclear Systems, Inc., Barnwell, SC for disposition as scrap.

### **2.3.4 PRESSURIZER**

One relief valve PR-1V was removed. The nozzle flange was fitted with an absolute filter vent to allow for pressure equalization. Circuit breakers for the heaters have been tripped at the switchboard.

### **2.3.5 CONTROL ROD DRIVE SYSTEM**

#### **a. Electrical**

The breakers for the rod drives have been opened and tagged in the control rod drive electrical cubicle and the control room. The cables between the junction boxes on the control rod drive (CRD) structure and the junction boxes located around the periphery of the cupola have been disconnected, coiled and secured on the CRD structure in the containment vessel. The support wireways have been removed, packaged and stored in Hold No. 4. In addition, the 21 buffer seal flow meter cables and the vibration monitor cables have been disconnected.

#### **b. Mechanical**

All hydraulic oil has been drained and the piping disconnected between the cupola and the CRD structure. Buffer seal system valves have been closed and tagged out. The inlet and outlet header spool pieces between the cupola and structure were removed. The buffer seal system has been drained.

The 21 control rods were disconnected from their respective CRD extension shafts and remain in their fully inserted position between the empty fuel location channels. The CRD extension shafts have been disconnected from their lead screws and are fully inserted. The CRD lead screws were withdrawn and pinned in place. Steel caps are placed onto the 21 reactor head nozzles to completely seal the nozzle from the containment vessel atmosphere and mechanically separate the CRD mechanism from the control rod.

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**2.3.6 PRIMARY COOLANT SYSTEM**

The system has been drained as completely as practical. All loop isolation inlet and outlet valves are open and back seated.

Primary pump motors and impellers were removed. Blank flanges are installed over the volute openings. The grating, piping, valves, ducting, etc. that were disconnected while removing the pump motors and impellers are left in the removed condition within the containment vessel.

**2.3.7 SECONDARY SYSTEM**

Both steam generators and piping were drained of water as completely as practical. The water on the secondary side of the steam generators was transferred to a double bottom tank below the reactor compartment. The isolation valves outside of the containment vessel are closed. There have been no modifications to the secondary system.

**2.3.8 AUXILIARY SYSTEMS**

All nuclear related auxiliary systems have been drained as completely as practical.

The three primary purification system ion-exchangers and their resins (28 Ci) have been physically removed from the ship and their lines capped.

Water from the primary (neutron) shield water tank was transferred to a double bottom tank below the reactor compartment. The equipment drain and waste collection system tanks have been drained as completely as practical.

**2.3.9 CONTAINMENT VESSEL**

The forward and aft manway shield plugs were put in place with security seals installed. Containment vessel (CV) entries were expected to be made through the aft airlock. The lifting chains and hooks were removed from the chain hoists used to handle the shield plugs to minimize the possibility of unauthorized containment vessel entry. The CV bilge was wiped clean. The inerting piping in the CV cupola head was disconnected outside. Starting in March 2005, this piping was used to supply fresh air for personnel access.

**2.3.10 RADIATION CONTROL AREA BOUNDARIES**

Secured boundaries were established to prevent unauthorized access into Radiation Control Areas (RCAs). The secured entrances included the following spaces:

- a. The reactor compartment surrounding the containment vessel that originally formed a secondary containment around the pressure containment;
- b. The Port and Starboard Stabilizer rooms;
- c. The Forward Control Areas (aka the Cold Water Chemistry Laboratory);
- d. The Port and Starboard Charge Pump rooms; and,
- e. The Hot Chemistry Laboratory, in the Control Room Area.

**2.3.11 RADIOLOGICAL AND ENVIRONMENTAL CHARACTERIZATION SCOPING SURVEY**

In 2005, a radiological and environmental characterization scoping survey of the NSS was conducted. This characterization task was intended to provide a basis for estimating the cost of decommissioning. It is documented in NSS Radiological and Non-Radiological Spaces Characterization Survey Report (Reference f).

In depth surveys to determine the extent and types of radioactive materials present were only conducted in those locations and equipment/structures that were expected to be radioactive. The remaining areas (principally aft of the engine room, forward of the reactor compartment, and in the mid-ship-house and public areas) were surveyed less rigorously than radiological areas but in sufficient detail to confirm that no radioactive materials were present in those locations.

The principle findings of the characterization scoping survey include the following:

- Absence of fission products (other than trace quantities of cesium-137), uranium and its daughter isotopes, as well as transuranics (e.g., plutonium), indicates there were no significant fuel failures;
- Crud contribution to total curie content is minimal;
- No contamination was found in the non-radiological spaces;
- Minimal contamination was found in radiological spaces;
- Overall dose rates were much lower than expected;
- Previously radiologically identified sites were found uncontaminated; and,
- Containment vessel systems, structures and components were exceptionally radiologically clean.

### **3.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES**

The primary goal is to decommission the NSS in a safe and cost effective manner. The overall plan for decommissioning the NSS has been divided into four periods:

- Preparations for Decommissioning, Decontamination, and Radiological Remediation (DDR) Activities;
- Performance of DDR Activities;
- License Termination; and,
- Future Plans for the NSS.

The following provides a discussion of the current DDR plan, the significant specific activities, and the general sequencing for each of the above periods. The planning required for each DDR activity, including the selection of the process to perform the work, will be completed prior to the start of work for that activity. Finally, a discussion of other issues related to decommissioning is also included.

#### **3.1 PROJECT CONCEPT AND OVERVIEW**

Currently, MARAD envisions DDR of the NSS nuclear reactor, primary system, reactor plant auxiliary systems and other contaminated systems/components as the next step in a continuous process that will result in license termination and not preclude the option to restore the ship as a museum. Reactor plant auxiliary systems (auxiliary systems) include all of those support systems to the primary system such as:

- Emergency Cooling (DK) System;
- Soluble Poison (SP) System;
- Primary Loop Purification (PP) System;
- Buffer Seal (SL) System;
- Hydrogen Addition (HA) System;
- Primary Relief (PR) System;
- Primary Sampling (SA) System;
- Intermediate Cooling Water (CW) System;
- Containment Cooling (CC) System;
- Shutdown Circulation (SC) System;
- Primary Pressurizing (PE) System; and,
- Waste Management Systems -

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- Equipment Drain and Waste Collection (PD) System; and,
- Gaseous Waste Collection and Disposal (WL) System.

There is no agency intent to dispose of the ship itself following the DDR. Based on this premise and the fact that the ship is a registered National Historic Landmark, MARAD intends to pursue the DDR industrial work in a fashion that minimizes any adverse effect to adjacent ship structure.

MARAD assumes that all primary and auxiliary system components are contaminated and subject to disposal. MARAD does not contemplate any significant radiological decontamination efforts of any component (e.g., vessel, piping, pumps, etc.) unless such efforts can provide a demonstrable benefit. Since all plant components were installed through the existing ship accesses, MARAD intends that industrial DDR make use of these accesses to the greatest extent possible, and that intact component removal shall be the preferred method. Significant exceptions to this intact component removal policy include the two steam generators, and the annular neutron shield tank within the Containment Vessel.

Following cleaning and preservation of the vessel exterior surfaces and interior cleaning from the A Deck upwards in late 2006, MARAD expects that performance of limited, additional restoration of shipboard spaces will make the ship habitable during the preparation for and performance of DDR activities. Consequentially, MARAD assumes most contractor activities and facilities will be located onboard to the greatest extent possible. As in the 1971 defueling, and subsequent partial decommissioning, the ship itself will be the designated site for regulated activities. Following the 2007 drydocking, the NSS will be relocated to a layberth facility, where it will remain until it is moved to the decommissioning location. Throughout this, and all subsequent phases of the work, the NSS will remain in the custody and husbandry of MARAD, including pier services.

### **3.2 PREPARATIONS FOR DDR ACTIVITIES**

Preparations for DDR Activities is the time period in anticipation of decommissioning activities when detailed preparations are undertaken to provide a smooth transition from SAFSTOR dormancy to DDR. Activities to be initiated and/or performed during this period include, but are not limited to, the following:

- Develop a decommissioning organizational structure and select staff from assigned MARAD staff and outside resources, as required;
- Obtain regulatory approvals to proceed with decommissioning (e.g., NRC, U.S. Environmental Protection Agency, U.S. Coast Guard, state and local authorities, etc.) as needed;
- Develop and implement all NSS programs, manuals, procedures, etc. to control DDR activities;
- Select the decommissioning location and subsequently, determination of the location of the ultimate disposal site for low-level radioactive waste;
- Review and reclassify systems, structures, and components consistent with DDR activities;
- Determine mechanical and electrical system functionality and status;
- Conduct an historical site assessment;
- Prepare site support and storage facilities, as required;
- Prepare work plans for decontamination and dismantlement (i.e., removal) activities;
- Determine transportation and disposal container requirements for activated materials and/or other hazardous materials, including shielding and stabilization;
- Develop activity specifications and task specific procedures for occupational exposure control, site security, industrial safety, control and release of liquid and gaseous effluents and processing of radwaste generated in decommissioning;
- Erect physical barriers and/or secure all access to radioactive or contaminated areas, except as required for controlled access (i.e., inspection, planning and maintenance);
- Perform radiation surveys of work areas, major components, and sampling of internal piping contamination levels and post warning signs as appropriate;

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- Remove and package asbestos containing insulation inside the Containment Vessel and other Radiation Control Areas;
- Decontaminate structures and external surfaces of plant systems; and,
- Begin site characterization so that radiological, hazardous and other regulated wastes will be identified, categorized, and quantified as DDR progresses.

### **3.3 PERFORMANCE OF DDR ACTIVITIES**

Performance of DDR Activities is the time period when the primary activity will be removing, packaging and shipping reactor plant systems. Activities to be performed during this period include, but are not limited to, the following:

- Conduct decontamination of components and piping systems, as required, to minimize worker exposure and spread of contamination;
- Remove and package the CRD structure for shipment;
- Remove and package the primary (neutron) shield water tank for shipment;
- Remove the reactor vessel, with its internals secured in place, and package it in a shipping cask, as required, for shipment;
- Remove and package steam generators for shipment;
- Remove and package the pressurizer for shipment;
- Remove and package the primary coolant piping and associated components for shipment;
- Remove and package auxiliary systems and associated components for shipment as they become nonessential to the vessel removal operations, related decommissioning activities, or worker health and safety (e.g., waste collection and processing systems, electrical and ventilation systems, etc.);
- Decontaminate the Containment Vessel;
- Remove and package remaining components, equipment, and plant services in support of the area release survey(s), and,
- Ship packaged waste items, as appropriate, to the waste disposal site.

### **3.4 LICENSE TERMINATION**

License Termination Activities to be performed during this period of decommissioning activities include, but are not limited to, the following:

- At least two years prior to the anticipated date of license termination, prepare and submit the License Termination Plan (LTP) to define the details of the final radiological survey to be performed after all decontamination activities are completed;
- After the NRC approval of the LTP, perform and document the final site survey to demonstrate that the site can be released for unrestricted use; and,
- Prepare and submit an application to terminate the NS-1 license.

### **3.5 FUTURE PLANS FOR THE NSS**

Concurrent with the activities described above, MARAD currently anticipates performing limited restoration of shipboard spaces for use to support all four periods of decommissioning activities. Restoration activities will be consistent with those appropriate for a registered National Historic Landmark and will not preclude the option of restoring the ship as a museum.

### **3.6 OTHER DECOMMISSIONING ISSUES**

The decontamination and/or disassembly of contaminated structures, systems and components may be accomplished by decontamination in place, decontamination and dismantlement, or dismantlement and disposal. A combination of these methods may be utilized to reduce contamination levels, worker radiation exposures and project costs.

**3.6.1 SPECIFIC DDR ACTIVITIES RELATING TO REMOVAL OF SYSTEMS AND COMPONENTS**

Components and any material generated in support of DDR activities (i.e., DDR waste) will be safely and efficiently removed using the techniques and methods determined to be the most appropriate for the particular circumstances. Currently, MARAD anticipates that disassembled/segmented/removed material will be routed to a central processing area on the ship. Any material or DDR waste below the applicable radiological limits will be released for unrestricted disposition (e.g., scrap, recycle, or general disposal). Radioactively contaminated or activated materials will be removed from the site as necessary to allow the NSS to be released for unrestricted use.

Low-level radioactive waste will be processed in accordance with the NSS procedures and utilize available commercial options. Contaminated material will be characterized and segregated for additional onboard decontamination or processing, off ship processing (e.g., disassembly, chemical cleaning, volume reduction, waste treatment, etc.), and/or packaged for controlled disposal at a low-level radioactive waste disposal facility. Appropriate contamination controls will be employed to minimize the spread of contamination and protect personnel.

**3.6.2 LOW-LEVEL RADIOACTIVE WASTE DISPOSAL**

Unlike most licensed facilities, the NSS is mobile and can be decommissioned in many locations. The specific location for decommissioning the NSS has not been chosen. The three possible sites, Norfolk, VA, Wilmington, NC and Charleston, SC allow the NSS to use any of the following as the waste disposal site:

Chem-Nuclear Systems, LLC Barnwell County, SC;  
USDOE, National Nuclear Security Administration, Nevada Test Site; or,  
EnergySolutions, LLC, Clive UT.

**3.6.3 HAZARDOUS AND/OR MIXED WASTE DISPOSAL**

Hazardous waste and hazardous/radioactive (i.e., mixed) waste may be generated during decommissioning. All waste will be managed according to all applicable Federal and State regulations.

Hazardous material waste from the NSS will be transported only by authorized and licensed transporters and shipped only to authorized and licensed facilities. If technology, resources, and approved processes are available, processes will be evaluated to render the mixed waste non-hazardous.

**4.0 SCHEDULE OF PLANNED DDR ACTIVITIES**

Major milestones established for decommissioning NSS are listed in the table below and in more detail in 8.0 DECOMMISSIONING PROJECT SCHEDULE.

PERIOD	DATES
Preparations for DDR Activities	2006-2010
Performance of DDR Activities	2009-2014
Final Site Survey/License Termination	2013-2017
Performance of limited Restoration Activities	2006-2017

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Completion of the decommissioning schedule is contingent upon two key factors:

1. Access to licensed low-level radioactive waste disposal sites; and,
2. Timely, continued funding of the decommissioning activities from the U.S. Congress.

Under any eventuality such as unavailability of a low-level radioactive waste disposal site, temporary shortfall in decommissioning funding or other unforeseen circumstances, the capability to suspend decontamination and dismantlement activities and maintain the NSS in a safe storage condition with appropriate funding will be maintained.

## **5.0 ESTIMATE OF EXPECTED DECOMMISSIONING COSTS**

Funding for decommissioning the NSS is provided by Congressional appropriations. This form of decommissioning funding is specifically allowed by 10 CFR 50.75(e)(1)(v) "For a power reactor licensee that is a Federal ... licensee ..., funds for decommissioning will be obtained when necessary."

In January 2006, MARAD prepared a Rough Order of Magnitude (ROM) site-specific decommissioning cost estimate. The ROM estimate included consideration of regulatory requirements, contingency requirements, and low and high-level radioactive waste disposal availability. Independent, industry reviewers contracted by MARAD, have concluded the ROM estimate is reasonable.

Precisely because the NSS is a Federal Licensee, the Federal Acquisition Regulation (FAR) <http://www.arnet.gov/far/> or <http://farsite.hill.af.mil/>, Section 3.104-3 -- Statutory and Related Prohibitions, Restrictions, and Requirements prohibits MARAD from disclosing the ROM cost estimate to decommission the NSS. From a practical point of view, the FAR does not allow MARAD to publicly disclose any decommissioning cost estimate until the DDR contractor is selected. Since the intent of this section of the PSDAR is to provide the public and NRC confidence that MARAD has sufficient resources to safely and efficiently decommission the NSS, MARAD can state that numerous recent fiscal year budget requests by the Department of Transportation have addressed decommissioning costs of the NSS. An example can be found at <http://www.dot.gov/bib2007/overview.html>. In the unlikely event MARAD decides to delay decommissioning prior to license termination, budget requests will ensure adequate resources are available to safely return the NSS to a SAFSTOR status and, as appropriate, move the ship to one of the MARAD Reserve Fleet locations.

The status of the NSS decommissioning funding is reported periodically to the NRC in accordance with 10 CFR 50.75(f)(1), "Reporting and recordkeeping for decommissioning planning."

## **6.0 ENVIRONMENTAL IMPACTS**

10 CFR 50.82(a)(4)(i) describes the PSDAR and requires that it include "a discussion that provides the reasons for concluding that the environmental impacts associated with the site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements."

Per Reference (g), because the NSS was licensed prior to the National Environmental Policy Act, 1969, no Environmental Impact Statement for the NSS was required. In Reference (g), MARAD stated their determination that they had "fulfilled its statutory responsibilities under the National Environmental Policy Act by preparing this [enclosed] Environmental Assessment and that no formal environmental impact statement would be required for the [SAFSTOR] actions that are being taken."

Therefore to meet the intent of 10 CFR 50.82(a)(4)(i), the potential environmental impacts associated with the proposed decommissioning activities for the NSS (Reference h) were compared with similar impacts given in the Generic Environmental Impact Statements (GEISs) on decommissioning (Reference b) and radiological criteria for license termination (Reference c).

**6.1 COMPARISON OF SITE SPECIFIC DDR ACTIVITIES TO THE GEIS**

The decommissioning of the NSS will have the following generally positive environmental effects:

- Radiological sources that create the potential for radiation exposure to site workers and the public will be reduced; and,
- The intent of decommissioning is to place the ship in a condition allowing unrestricted use.

The decommissioning of the NSS will be accomplished with no significant adverse environmental impacts based on the following:

- No site-specific factors pertaining to the NSS would alter the conclusions of the GEISs;
- Radiation dose to the public will be minimal;
- Radiation dose to the decommissioning workers will be minimal;
- The low-level radioactive waste removed from the NSS will occupy a small portion of the burial volume at approved waste disposal sites; and,
- The non-radiological environmental impacts are temporary and not significant.

The effects of decommissioning activities with respect to specific environmental issues are discussed below.

**6.1.1 RADIATION DOSE TO THE PUBLIC**

As noted in 2.3.1 above, the reactor was defueled in 1971. The remaining radioactive material is primarily the activated pressure vessel and other primary system components. Reduction of this material through decay forms the basis for concluding radiation dose to the public will be maintained below levels comparable to when the NSS was operating. Application of radiation protection and contamination controls will further ensure dose to the public is maintained lower than when the NSS operated.

**6.1.2 OCCUPATIONAL RADIATION EXPOSURE**

The occupational radiation exposure for decommissioning the NSS is estimated to be 38 person-Rem based on the actual occupational radiation exposure for decommissioning the Saxton Nuclear Experimental Corporation (SNEC) facility, Reference (i). The SNEC facility is more similar to the NSS than the large commercial pressurized water reactor (PWR) plant described in the GEIS, Reference (b). The SNEC facility, Reference (j), was a 23.5-megawatt thermal (MW<sub>th</sub>) that operated from 1962 to 1972. After shutdown and fuel removal in 1972, the SNEC facility was placed in SAFSTOR. In 2006, decommissioning of the SNEC facility was completed and its NRC license was terminated.

The following table compares the NSS and the SNEC facility:

	NSS	SNEC facility
Power MW <sub>th</sub>	80	24
Shutdown/Defueled	1970/1971	1972/1972
RPV neutron activation analysis	452.2 Ci (2005 estimate) using Metal Sample analysis, Reference (e)	1452 Ci (1996 estimate)

Per Table 4.3-2 of the GEIS, the reference PWR in SAFSTOR for 30 years is allocated 282.4 person-Rem for SAFSTOR preparation and 10.2 Person-Rem for SAFSTOR preparation truck

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shipments. The GEIS allocates 14 person-Rem for continuing care during the 30 years SAFSTOR period. For decontamination and decontamination truck shipments, the GEIS allocates 26.3 person-Rem.

Based on the GEIS, the NSS has 26.3 person-Rem available for DDR activities. The NSS estimate of 38 person-Rem (based on the SNEC facility) exceeds the GEIS estimate by 12.3 person-Rem. Basing the occupational radiation exposure estimate on the results of a similar sized nuclear facility that recently completed decommissioning is intuitively more appropriate than using the GEIS which was based on decommissioning a hypothetical plant. Therefore, MARAD estimates that the actual occupational radiation exposure for the NSS will be similar to that for the SNEC facility.

**6.1.3 LOW-LEVEL RADIOACTIVE WASTE BURIAL VOLUME**

The estimated low-level radioactive waste burial volume for decommissioning the NSS is 325 cubic meters. The GEIS estimates the volume to be 18,340 cubic meters for the reference PWR using the 30 year SAFSTOR alternative.

MARAD estimates there will be no waste requiring deep geological burial (i.e., GTCC waste) for the following reasons:

- 1) All spent fuel has been removed from the NSS; and,
- 2) The principle finding of the Reactor Pressure Vessel Drilling, Sampling, and Radiochemical Analysis Project, Reference (j), is that the reactor pressure vessel and related components on the NSS are class A radioactive waste material for land disposal purposes per 10 CFR 61.55.

The GEIS estimated approximately 11 cubic meters of GTCC waste for the reference PWR.

**6.1.4 NON-RADIOLOGICAL ENVIRONMENTAL IMPACTS**

The non-radiological environmental impacts from decommissioning the NSS are similar to those that routinely occur at industrial facilities specifically designed to build, maintain and/or dispose of ships.

The largest occupational risk associated with the decommissioning is the risk of industrial accidents. This risk will be minimized by adherence to work controls during decommissioning that are based on current safety standards. Procedures controlling work related to asbestos, lead, and other non-radiological hazards will be in place during all four periods of planned decommissioning activities.

The primary environmental effects of decommissioning the NSS will be essentially identical to those that routinely occur at industrial facilities involved in building, maintaining and/or disposing of ships. These environmental effects of decommissioning will involve no increases above those that typically occur at such sites. MARAD has identified no significant socioeconomic impacts other than those associated with the unique aspects of decommissioning a nuclear ship (e.g., temporary increase of employment of radiologically trained individuals and the concurrent influx of money into the local economy of the selected decommissioning location). No impacts to local culture, archaeological, terrestrial, or aquatic resources have been identified other than those related to the ship itself which is a registered National Historic Landmark.

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**6.1.5 ADDITIONAL CONSIDERATIONS**

The following considerations are also relevant to concluding that decommissioning activities will not result in significant environmental impacts not previously reviewed:

- The release of effluents will continue to be controlled by plant license requirements and plant operating procedures throughout decommissioning;
- With respect to radiological releases, an Offsite Dose Calculation Manual will be developed and implemented during decommissioning;
- Releases of non-radiological effluents will continue to be controlled in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) and the state where decommissioning is performed;
- Radiation protection principles will be in effect during decommissioning to ensure that protective techniques, clothing, and breathing apparatus are used as appropriate;
- Sufficient decontamination prior to dismantlement will be performed to ensure that occupational dose and public exposure will not exceed those estimated in the GEISs;
- Transport of radioactive waste will be in accordance with plant procedures, applicable Federal and State regulations, and the requirements of the receiving facility; and,
- Site access control during decommissioning will ensure that residual contamination is minimized as a radiation release pathway to the public.

**6.2 ENVIRONMENTAL IMPACTS CONCLUSION**

Based on the above discussion, the potential environmental impacts associated with decommissioning the NSS have already been postulated in and will be bounded by the previously issued environmental impact statements (References b and c) or recently completed decommissioned similar facilities. This is principally due to the following reasons:

- There are no unique aspects of the NSS or of the decommissioning techniques to be utilized that would invalidate the conclusions reached in the GEISs; and,
- The methods to be employed to dismantle and decontaminate the NSS are standard construction-based techniques fully considered in the GEISs.

Therefore, MARAD concludes that the environmental impacts associated with the site-specific decommissioning activities for the NSS will be bounded by appropriate, previously issued environmental impact statements.

## **7.0 REFERENCES**

- a. Regulatory Guide 1.185, Standard Format and Content for Post-Shutdown Decommissioning Activities Report, dated July 2000
- b. NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, dated August 1988
- c. NUREG-1496, Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC Licensed Nuclear Facilities, Volume 1, dated July 1997
- d. Letter from Mr. Robert W. Reid (NRC) to Dr. Zelvin Levine (MARAD), dated May 19, 1976, Amendment 8
- e. Reactor Pressure Vessel Drilling, Sampling, and Radiochemical Analysis Project Report, Revision 1, dated January 31, 2006
- f. NSS Radiological and Non-Radiological Spaces Characterization Survey Report, Revision 0, dated September 22, 2005
- g. Letter from Mr. R. W. Sliger, (MARAD) to Mr. A. Giambusso, (AEC), dated December 20, 1973, N.S. SAVANNAH License NS-1
- h. Nuclear Ship SAVANNAH Decommissioning - Draft Environmental Assessment, dated August 9, 2006 (Federal Register September 11, 2006 [Volume 71, Number 175] Page 53490)
- i. Saxton Nuclear Experimental Corporation Facility, License Termination Plan, Revision 1, dated September 25, 2002
- j. Updated Safety Analysis Report for Decommissioning the SNEC Facility, Revision 3, dated February 2000

# 8.0 DECOMMISSIONING PROJECT SCHEDULE

ID	Task Name	Duration	Start	Finish	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017					
					1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half		
1	NS SAVANNAH DECOMMISSIONING PROJECT	2929 days	3/1/06	5/22/17	[Gantt bar spanning from 3/1/06 to 5/22/17]																											
2																																
3	PHASE I - Preparations for Decommissioning, Decontamination, and Radiological Remediation (DDR) activities	1044 days	3/1/06	3/1/10	[Gantt bar from 3/1/06 to 3/1/10]																											
4	Prepare and Submit QA Plan	174 days	3/1/06	10/30/06	[Gantt bar from 3/1/06 to 10/30/06]																											
5	Prepare and Implement Decommissioning Programs and Procedures	743 days	3/1/06	1/4/09	[Gantt bar from 3/1/06 to 1/4/09]																											
6	Prepare and Submit PSDAR	98 days	7/5/06	11/17/06	[Gantt bar from 7/5/06 to 11/17/06]																											
7	Prepare and Submit Updated FSAR	283 days	3/1/06	3/30/07	[Gantt bar from 3/1/06 to 3/30/07]																											
8	Prepare and Submit Decommissioning Preparation License Amendment	173 days	10/18/06	6/17/07	[Gantt bar from 10/18/06 to 6/17/07]																											
9	Begin On-Site Decommissioning Preparation Design	261 days	4/2/07	4/1/08	[Gantt bar from 4/2/07 to 4/1/08]																											
10	Site Characterization (includes insulation removal and decontaminating external surfaces)	261 days	4/2/08	4/1/09	[Gantt bar from 4/2/08 to 4/1/09]																											
11	Prepare and Submit Licensing Amendment Request and any other documents required to allow decommissioning	286 days	10/1/07	11/3/08	[Gantt bar from 10/1/07 to 11/3/08]																											
12	NRC Decommissioning License Amendment Approval	1 day	3/1/10	3/1/10	[Gantt bar from 3/1/10 to 3/1/10]																											
13	PHASE II - Performance of DDR Activities	1496 days	1/5/09	9/29/14	[Gantt bar from 1/5/09 to 9/29/14]																											
14	Preparation for Decommissioning Activities (Electrical, Mechanical, Ventilation, Access, etc.)	634 days	1/5/09	6/10/11	[Gantt bar from 1/5/09 to 6/10/11]																											
15	Remove Reactor Vessel	155 days	3/1/11	10/3/11	[Gantt bar from 3/1/11 to 10/3/11]																											
16	Remove Containment Vessel Major Equipment	327 days	10/3/11	1/1/13	[Gantt bar from 10/3/11 to 1/1/13]																											
17	Remove Balance of Contaminated Plant Components and Structures	700 days	3/1/11	11/4/13	[Gantt bar from 3/1/11 to 11/4/13]																											
18	Decontamination Activities including Remaining Components and Structures	522 days	11/14/11	11/13/13	[Gantt bar from 11/14/11 to 11/13/13]																											
19	Package and Ship Radioactive Waste Materials	1496 days	1/5/09	9/29/14	[Gantt bar from 1/5/09 to 9/29/14]																											
20																																
21	PHASE III - License Termination	1145 days	1/1/13	5/22/17	[Gantt bar from 1/1/13 to 5/22/17]																											
22	Prepare and Submit License Termination Plan (LTP)	389 days	1/1/13	6/30/14	[Gantt bar from 1/1/13 to 6/30/14]																											
23	NRC LTP Approval	1 day	6/30/15	6/30/15	[Gantt bar from 6/30/15 to 6/30/15]																											
24	Prepare, Perform and Submit Final Surveys	458 days	1/1/15	10/3/16	[Gantt bar from 1/1/15 to 10/3/16]																											
25	NRC License Termination Activities	495 days	6/30/15	5/22/17	[Gantt bar from 6/30/15 to 5/22/17]																											
26	NSS License Termination	1 day	5/22/17	5/22/17	[Gantt bar from 5/22/17 to 5/22/17]																											



U.S. Department  
of Transportation

SAVANNAH Technical Staff  
Office of Ship Operations

400 Seventh Street, S.W.  
Washington, D.C. 20590

Maritime  
Administration

**Docket No. 50-238; License No. NS-1; N.S. SAVANNAH**

**Enclosure 2 to Submittal of PSDAR**

**LIST OF REGULATORY COMMITMENTS**

The following table identifies those actions committed to by MARAD in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Erhard Koehler (202) 366-2631, and/or [erhard.koehler@dot.gov](mailto:erhard.koehler@dot.gov).

REGULATORY COMMITMENT	TYPE (Check One)		DUE DATE
	One Time Action	Continuing Action	
When the requirements of the Federal Acquisition Regulation (FAR) Section 3.104-3 -- Statutory and Related Prohibitions, Restrictions, and Requirements have been met such that MARAD is allowed to disclose decommissioning cost estimates, MARAD will submit a site specific decommissioning cost estimate in accordance with 10 CFR 50.82(a)(8)(iii).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	60 days after the FAR allows public release of the estimate.
After a decommissioning location is selected, environmental analysis will be supplemented with location specific information.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	90 days after the location is publicly announced.
An Offsite Dose Calculation Manual will be developed and implemented during decommissioning.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	December 15, 2007