



U.S. Department
of Transportation
**Maritime
Administration**

Office of Ship Operations

1200 New Jersey Ave., SE
Washington, DC 20590

Ref: 10 CFR 50.36a

March 29, 2022

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 Annual Radiological Environmental Monitoring and Radioactive Effluent
Release Reports for CY2021, Revision 0

Pursuant to Technical Specifications 2.5.1 and 2.5.2, the Maritime Administration (MARAD) is required to submit an Annual Radiological Environmental Monitoring Report and an Annual Radioactive Effluent Release Report, respectively. MARAD hereby submits Revision 0 to the Annual Radiological Environmental Monitoring and Radioactive Effluent Release Reports as Enclosure (1).

This submittal contains no new Regulatory Commitments.

If there are any questions or concerns with any issue discussed in this submittal, please contact me at:
O: (202) 366-2631, M: (410) 776-8268, and/or e-mail me at erhard.koehler@dot.gov.

Respectfully,

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

Enclosure

NMSS01
IE2S
IE48
NMSS
NRR

Docket No. 50-238; License NS-1; N.S. *SAVANNAH*
Submittal of Annual Radiological Environmental Monitoring and Radioactive Effluent Release
Reports for CY2021, Revision 0
March 29, 2022

Enclosure:

1. STS-219, Annual Radiological Environmental Monitoring and Radioactive Effluent Release
Reports for CY2021, Revision 0

Docket No. 50-238; License NS-1; N.S. *SAVANNAH*
Submittal of Annual Radiological Environmental Monitoring and Radioactive Effluent Release
Reports for CY2021, Revision 0
March 29, 2022

cc:

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NSS ESC

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MAR 610, 612, 615

Hardcopy, cover letter only

MAR-600, 640, 640.2

Hardcopy with all enclosures

MAR-100, 640.2 (rf)

USNRC (Jack Parrott, Stephen Hammann)

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**Maritime
Administration**

Office of Ship Disposal

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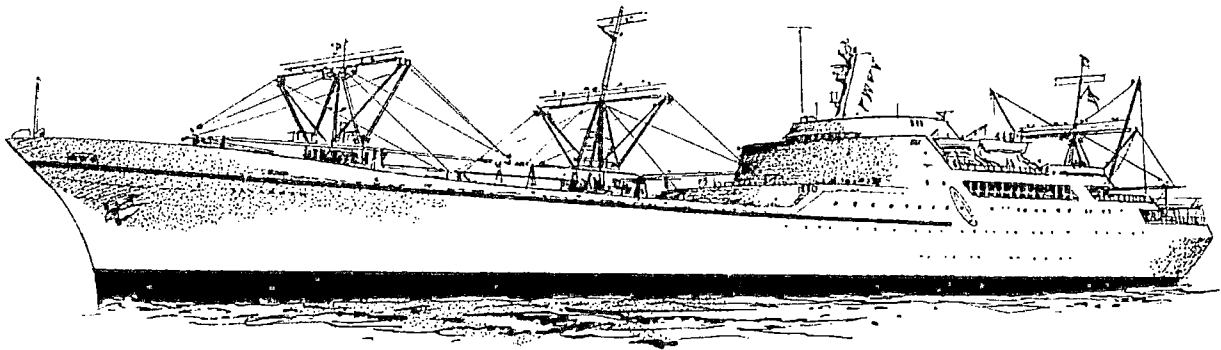
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**Enclosure 1 to Submittal of Annual Radiological Environmental Monitoring and Radioactive
Effluent Release Reports for CY2021, Revision 0**

**STS - 219, ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING AND
RADIOACTIVE EFFLUENT RELEASE REPORTS FOR CY2021**



U.S. Department of Transportation
Maritime Administration



N.S. SAVANNAH

**ANNUAL RADIOLOGICAL ENVIRONMENTAL
MONITORING AND RADIOACTIVE EFFLUENT
RELEASE REPORTS
FOR CY2021**

STS-219

Revision 0

Approved:

Date: March 29, 2022

Manager, N.S. *SAVANNAH* Programs

Prepared by:
Nuclear Ship Support Services, LLC

RECORD OF REVISIONS

Revision	Summary of Revisions
0	The original version of the 2020 Annual Radiological Environmental Monitoring and Radioactive Effluent Release Reports

LIST OF EFFECTIVE PAGES

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1.0 INTRODUCTION

This Annual Radiological Environmental Monitoring and Radioactive Effluent Release Reports for CY2021 are submitted by the Maritime Administration (MARAD) as licensee for the Nuclear Ship *SAVANNAH* (NSS) and cover the Calendar Year (CY) 2021 reporting period.

In accordance with the requirements of TS 2.5 Reporting Requirements, "... the following reports shall be submitted prior to April 1 of each year in accordance with 10 CFR 50.4:

- Annual Radiological Environmental Monitoring Report.
- Annual Radioactive Effluent Release Report.

This report is arranged into four sections following the introduction. Section 2.0 lists items required to be reported by the Technical Specifications (TSs). Sections 3.0 through 5.0 report those items as described in Section 2 below.

2.0 ITEMS REQUIRED BY TECHNICAL SPECIFICATIONS

The items specifically required to be included in these written annual reports are as follows:

- a. TS 2.5.1, Annual Radiological Environmental Monitoring Report (see 3.0).
- b. TS 2.5.2, Annual Radioactive Effluent Release Report (see 4.0).
- c. TS 2.1.1, Changes to the Process Control Program (PCP) (see 5.1).
- d. TS 2.2.1, Changes to the Offsite Dose Calculation Manual (ODCM) (see 5.2).

This report was reviewed by the Safety Review Committee at the meeting on February 17, 2022 and by the Executive Steering Committee members during its concurrence routing prior to submission of this report to the NRC.

3.0 ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

Per TS 2.5.1,

The Annual Radiological Environmental Monitoring Report shall include summaries, interpretations, and analyses of trends of the results of the radiological environmental monitoring program for the previous calendar year. The material provided shall be consistent with the objectives outlined in the Offsite Dose Calculation Manual (ODCM), and in 10 CFR 50, Appendix I, Section IV.B.2.

The Annual Radiological Environmental Monitoring Report shall include the results of analyses of all radiological environmental samples and of all environmental radiation measurements taken during the previous calendar year pursuant to the ODCM.

In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

Per the STS-005-020, Offsite Dose Calculation Manual (ODCM), the following two items are specifically required to be reported in the Annual Radiological Environmental Monitoring Report.

5.2.1 Direct Radiation Measuring Devices

Direct radiation measuring devices, such as thermoluminescent dosimeters (TLDs), optically stimulated luminescent dosimeters (OSL) or equivalent monitoring devices, shall be placed at strategic locations throughout the vessel to monitor the radiation from reactor generated materials. MARAD shall determine these locations on the vessel and shall require dosimeter readings at least semi-annually.

5.2.2 Water and Sediment Samples

Semi-annually, water samples and bottom sediment shall be taken adjacent to the ship and analyzed for principal gamma emitting radionuclides.

3.1 DIRECT RADIATION MEASURING DEVICES RESULTS

At the beginning of CY 2021, there were 45 permanently placed thermo-luminescent dosimeter (TLD) monitoring stations dispersed throughout the non-RCAs of the NSS and in those areas of the NSS that are routinely occupied. During 2021 Q3, an additional 13 TLD monitoring stations were established bringing the total number of monitoring stations to 58. Fixed point radiation surveys are performed during TLD change outs. Results from the TLDs from all monitoring stations indicated that readings were insignificant as compared to the background radiation levels. No fixed-point radiation dose rate exceeded 5 μ rem/hr (micro-rem/hr).

3.2 WATER AND SEDIMENT SAMPLES RESULTS

Environmental water and sediment samples were taken adjacent to the ship at various times during the calendar year as required by TS. The environmental sample results indicate that any changes in the radiological conditions in the environment surrounding NSS are insignificant as compared to the samples taken shortly before the NSS arrived at Pier 13. Therefore, based on the results of the radiological environmental monitoring program, NSS operations at Pier 13 did not have any adverse effects on the health and safety of the public or on the environment in 2021.

The results of the CY2021 Radiological Environmental Sampling Results are listed in Appendix A, *CY2021 Radiological Environmental Sampling Results*.

4.0 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Per TS 2.5.2,

The Annual Radioactive Effluent Release Report shall include a summary of the quantities of 1) radioactive liquid and gaseous effluents and 2) solid waste released from the NSS. The material provided shall be consistent with the objectives outlined in the ODCM and Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

4.1 SUMMARY OF QUANTITIES OF RADIOACTIVE LIQUID EFFLUENTS RELEASED

No radioactive liquid effluents were released in 2021.

4.2 SUMMARY OF QUANTITIES OF RADIOACTIVE GASEOUS EFFLUENTS RELEASED

No radioactive gaseous effluents were released in 2021.

4.3 SUMMARY OF THE QUANTITIES OF RADIOACTIVE SOLID WASTE RELEASED

There were no shipments of radioactive solid waste in 2021.

5.0 PROCEDURE CHANGES REPORT

5.1 PROCESS CONTROL PROGRAM (PCP) CHANGES

Per TS 2.1,

The PCP shall describe the administrative and technical controls for liquid and solid radioactive waste systems management. Changes to the PCP will be outlined in the Annual Radioactive Effluent Release Report per Section 2.5.2. This submittal shall contain:

- 2.1.1. Information to support the rationale for the change and the changed pages of the PCP or a statement there were no changes;

There were two revisions to the PCP in 2021.

5.1.1 JUSTIFICATION OF REVISION 1 CHANGES

Revision 1 consisted of 13 administrative changes.

Change 1: Removed the delayed implementation phrase in Step 1.1:

This procedure is effective upon approval by the Senior Technical Advisor (STA), ~~but with delayed implementation.~~

Change 2: Replaced the original Step 1.3.2 regarding use of forms with:

Radioactive Waste Process Control Program shall be reviewed, by the Radiation Safety Officer (RSO), at least annually and revised, if necessary, to ensure continued compliance with regulatory requirements.

Change 3: Added four performance references:

2.2.1 STS-001-PI, Process Instruction for Preparing Procedures.

2.2.2 STS-002-011, Work Control Process

2.2.7 STS-003-008, Quality Assurance Procurement Evaluation

2.2.8 STS-005-024, Mixed Waste Management Plan

Change 4: Added the specific procedure for controlling approval of solidification processes:

5.1.4 Solidification processes shall be reviewed and approved prior to performance in accordance with STS-002-011, Work Control Process.

Change 5: Added the specific procedure for controlling resin processing:

5.5.5 The means of processing depleted resins dewatered on-site for direct disposal shall be reviewed and approved in accordance with STS-002-011, Work Control Process

Change 6: Added the specific procedure for controlling other methods of resin processing:

5.5.9 Other methods of processing resins shall be reviewed and approved in accordance with STS-002-011 Work Control Process.

Change 7: Corrected a typographical error by deleting an extra [space]:

5.6.4 Controls and inspection criteria shall be established for the receipt and prior to-use inspections of transport containers and disposal containers for DAW packages shipped directly for disposal.

Changes 8 and 9: Added the specific procedure for evaluating vendor performance:

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5.8.2 The vendor shall be evaluated, per STS-003-008 Quality Assurance Procurement Evaluation, prior to the shipment of materials or utilizing them to perform work. Disposal shall be executed in accordance with the vendor's programs and procedures.

5.12.3 The vendor shall be evaluated, per STS-003-008 Quality Assurance Procurement Evaluation, prior to the shipment of materials or utilizing them to perform work. Disposal shall be executed in accordance with the vendor's programs and procedures.

Change 10: Listed the specific procedure for controlling mixed waste:

5.12.4 Control of the generation of mixed waste is provided in STS-005-024, Mixed Waste Management Plan.

Change 11: Added the requirement to also consult with the Training Coordinator:

5.16.4 Training programs from other facilities may be accepted in place of the STS program. Consult with the Radiation Safety Officer and Training Coordinator for review, approval and appropriate record documentation of training.

Change 12: Added the specific procedure for changing procedures:

5.17.1 The RSO shall control revision of this PCP. Changes to the program that may result from changes in vendor processes or plant activities should be reviewed by the RSO. Changes to this procedure shall be reviewed and approved in accordance with STS-001-PI, Process Instruction for Preparing Procedures.

Change 13: Added the specific job title:

6.1 The Documentation and Administrative Support Manager (DM) shall maintain documents generated for the planning and performance of the work controlled by this procedure as required by STS-002-023, Records Management and STS-003-001, Decommissioning Quality Assurance Plant.

A complete copy of Revision 1 is attached as Appendix B, STS-005-022, Radioactive Waste Process Control Program, Revision 1.

5.1.2 JUSTIFICATION OF REVISION 2 CHANGES

Revision 2 consisted of 4 administrative changes.

Change 1: Replaced RSO with Waste Manager:

5.7.1 Verification of suitability for disposal shall be determined through collaboration with the processing or disposal facility. Special characterization methodology may be required for components and a review and approval by the disposal facility prior to shipment is likely. The packaging of irradiated object(s) for direct disposal may be limited by the package or cask used for transport. Shipping and disposal documentation shall be reviewed by the *Waste Manager* and deemed acceptable by the processing or disposal facility prior to shipment.

Change 2: Replaced the word *procedures* with the word *documentation* in sentence 1:

5.13.3 Approved *documentation* shall specify the method of waste classification to meet the requirements of 10 CFR 61.55. These procedures shall include the collection of data, computational methods, computer codes, etc. The following is a synopsis of the methodology employed and required elements of the procedures.

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Change 3: Reformatted step 5.13.14 to clarify its intent:

5.13.14 Calculations to determine curie content and waste classification of radwaste performed by means other than computer codes (i.e. manual calculations, etc.) shall be checked by a qualified individual who:

- a. Is **NOT** the originator of the calculations;
- b. Meets or exceeds the qualifications of ANSI N18.1-1971, paragraphs 4.3.2 or 4.5.2 as defined in 4.13.1; and,
- c. Shall be responsible to check and document the following:
 - Check the appropriateness of the application of the computational method;
 - Check assumptions and input data for reasonableness;
 - Perform a sufficient number of checks of the calculations to reasonably test accuracy and consistency of the results; and,
 - Perform a check of the results by comparison with other similar calculations.

Change 4: Clarified step 5.16.3 to eliminate reference to training department. Training is currently coordinated by the Nuclear Advisor:

5.16.3 Annual retraining requirements for HAZMAT employees are prescribed by OSHA in 29 CFR 1910.120(p) (7) and EPA under 40 CFR 264.16. The training indicated above may satisfy or partially satisfy those training requirements in the year attended.

A complete copy of Revision 2 is attached as Appendix B, STS-005-022, Radioactive Waste Process Control Program, Revision 2.

5.2 OFFSITE DOSE CALCULATION MANUAL (ODCM) CHANGES

Per TS 2.2,

The ODCM shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents; in the calculation of gaseous and liquid effluent monitoring alarm and trip setpoints; and in the conduct of the radiological environmental monitoring program. Changes to the ODCM will be outlined in the Annual Radioactive Effluent Release Report per Section 2.5.2. This submittal shall contain:

- 2.2.1 A complete copy of the ODCM with an accompanying criteria and justification for the changes or a statement there were no changes;

There were no changes to the ODCM in 2021.

6.0 REFERENCES

None

**APPENDIX A. CY2021 RADIOLOGICAL ENVIRONMENTAL
SAMPLING RESULTS**

Sample Location Pier #13, Canton Marine Terminal	Sample Date	Type of sample	Co-60 (pCi/g)	Cs-137 (pCi/g)
Starboard Aft of ship	6/24/2021	Water (A)	<MDA (minimum detectable activity)	<MDA
Starboard Aft of ship	6/24/2021	Sediment (A)(B)	<MDA	1.63 E-1 (C) MDA = 8.11E-02
Port Forward of ship	6/24/2021	Water (A)	<MDA	<MDA
Port Forward of ship	6/24/2021	Sediment (A)(B)	<MDA	<MDA
Port Aft of ship	1/5/2022 (D)	Water (A)	<MDA	<MDA
Port Aft of ship	1/5/2022 (D)	Sediment (A)(B)	<MDA	1.14 E-01 (C) MDA = 8.75E-02
Starboard Forward of Ship	12/21/2021	Water (A)	<MDA	<MDA
Starboard Forward of Ship	12/21/2021	Sediment (A)(B)	<MDA	<MDA (C)

Table Data Notes

- (A) Calculated MDAs are a-posteriori values at the 95% confidence level.
- (B) Activity is reported on a dry weight basis unless otherwise indicated in the case narrative and is decay corrected to the sample collect date.
- (C) Results are statistically positive at the 95% confidence level. (activity is greater than or equal to the two sigma uncertainty)
- (D) These samples were scheduled to be taken the last week of 2021; however, because of an COVID shutdown of the ship that week, the samples were taken the week that the ship was reopened.

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Reports for CY2021, Revision 0**

Appendix B STS-005-022, Radioactive Waste Process Control Program, Revision 1

**APPENDIX B. STS-005-022, RADIOACTIVE WASTE PROCESS
CONTROL PROGRAM, REVISION 1**

The following 22 pages are a complete copy of Revision 1 of STS-005-022, Radioactive Waste Process Control Program.

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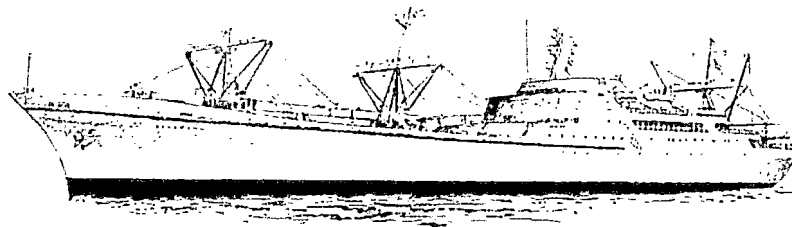
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N.S. SAVANNAH TECHNICAL STAFF

STS-005-022

RADIOACTIVE WASTE PROCESS CONTROL PROGRAM

Level of Use: Information



REVISION 1

BY: DOUG ROBERSON

N S S S L L C

Approved:	E. W. Koehler	July 30, 2021
	Senior Technical Advisor	Date

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RECORD OF REVISIONS

Revision	Summary of Revisions
0. 11/09/2018	Original Issue
1.	Attachment change permission removed, formerly 1.3.2. Records Section Updated. Implementation simplified and 1.3.2 added for continuity of intent. References to other STS procedures added. Other minor corrections made.

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1.0 INTRODUCTION

1.1 Implementation and Cancellation

This procedure is effective upon approval by the Senior Technical Advisor (STA). It remains in effect until cancelled or superseded.

1.2 Purpose

This procedure describes the administrative and technical controls for liquid and solid radioactive waste systems management program (i.e., Process Control Program [PCP]) This PCP provides assurance that NSS meets disposal requirements.

This PCP complies with the Decommissioning Quality Assurance Plan by establishing requirements for process parameters, controls, tests, sampling, and analysis to ensure compliance with 10 CFR 20, 10 CFR 61, and 10 CFR 71, 49 CFR 172 - 177, applicable state regulations, and disposal site criteria.

This procedure provides administrative control requirements for radwaste systems and the classification, packaging, and shipment of radioactive materials for disposal as waste or for processing for eventual disposal as waste.

1.3 Scope/Applicability

- 1.3.1 This procedure applies to STS who during the performance of their job functions impact generation, processing, packaging or shipment of Low Level Radioactive Waste (LLRW).
- 1.3.2 Radioactive Waste Process Control Program shall be reviewed, by the Radiation Safety Officer (RSO), at least annually and revised, if necessary, to ensure continued compliance with regulatory requirements.

2.0 REFERENCES

2.1 Developmental References

- 2.1.1 10 CFR Part 20, Appendix G to Part 20, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests"
- 2.1.2 STS-003-001, Decommissioning Quality Assurance Plan
- 2.1.3 10 CFR 20.2006, "Transfer for Disposal and Manifests"
- 2.1.4 10 CFR 21, "Reporting of Defects and Non-Compliances"
- 2.1.5 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste"
- 2.1.6 10 CFR 71, "Packaging and Transfer of Radioactive Material"

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- 2.1.7 49 CFR Sub Chapter C - Hazardous Materials Regulations, Part 173, "Shippers - General Requirements for Shipments"
- 2.1.8 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response"
- 2.1.9 40 CFR 264.16, "Personnel Training"
- 2.1.10 NRC Regulatory Guide 1.143, Rev. 1, October, 1979, "Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Power Plants"
- 2.1.11 NRC Generic Letter 91-02, "Reporting Mishaps Involving LLW Forms Prepared for Disposal"
- 2.1.12 "Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification", May 1983
- 2.1.13 Low-Level Waste Management Branch, "Technical Position on Waste Form", Rev. 1, January, 1991
- 2.1.14 NMSS "Final Branch Technical Position on Concentration Averaging and Encapsulation, Revision in Part to Waste Classification Technical Position", January, 1995
- 2.1.15 NRC Low Level Waste Licensing Branch Waste Classification Technical Position, May 1983, and NRC letter L.B. Higginbotham to Licensees, February 10, 1984, Additional Guidance on Implementation of 10CFR61
- 2.1.16 NRC Regulatory Guide 7.10 - Establishing Quality Assurance Programs for Packaging Used in the Transport of Radioactive Material
- 2.1.17 NRC Bulletin 79-19, Packaging of Low-Level Radioactive Waste for Transport and Burial
- 2.1.18 NRC Information Notice 2004-13, Registration, Use and Quality Assurance Requirements for NRC-Certified Transportation Packages
- 2.1.19 NMSS Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015
- 2.2 Performance References
 - 2.2.1 STS-001-PI, Process Instruction for Preparing Procedures.
 - 2.2.2 STS-002-011, Work Control Process
 - 2.2.3 STS-002-023, Records Management
 - 2.2.4 STS-003-001, Decommissioning Quality Assurance Plan
 - 2.2.5 STS-003-002, Corrective Action Process

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- 2.2.6 STS-003-003, Quality Classification List
- 2.2.7 STS-003-008, Quality Assurance Procurement Evaluation
- 2.2.8 STS-005-024, Mixed Waste Management Plan

3.0 DEFINITIONS

Batch: A fixed volume of wet waste with essentially uniform physical, chemical, and radiological properties. A single batch of wet waste may be solidified or dewatered in several containers. An isolated tank of agitated wet waste is an example of a batch.

Certificate of Compliance: USNRC Approved Packages - Documentation certifying that the package (packaging and its contents) meets the applicable safety standards set forth in 10 CFR Part 71.

Chelating Agent: Amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, and glucinic acid).

Discrete Items: For purposes of Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015, discrete items are items belonging to one of the following waste types: activated metals, sealed sources, cartridge filters, contaminated materials, and components incorporating radioactivity into their design.

Disposal Facility: An off-site facility for the disposal of radwaste which is licensed for that purpose by the host state and/or by the NRC.

Dry Active Waste (DAW): Radwaste that is typically paper, wood, plastic, trash, air filters, metal, soil, concrete, asphalt, and used plant components, which without processing, contains essentially no free liquid.

High Integrity Container: Documentation certifying a container has been designed to prevent the egress of its radioactive contents in a land burial environment for a design goal of at least 300 years.

Irradiated Hardware: Neutron activated non-fuel-bearing components.

Item: Any level of unit assembly, including structures, systems, subsystems, subassembly, component, part or material.

Liquid Radwaste System: A system that relates to the handling, pretreatment, conditioning, storage, or release to the environment of liquids containing radioactive material for which no further use is foreseen. Examples include sump effluents, equipment used to pump out portable storage containers, and existing ship process systems and related instrumentation and control systems. Radwaste systems terminate at the point of controlled discharge to the environment.

Mishap: The misuse or failure of Class B or C waste forms or high integrity containers that require evaluation for reportability in accordance with NRC's Technical Position on Waste Form, Rev. 1, January 1999, and NRC Generic Letter 91-02.

Mixed Waste: A mixture of radioactive waste and a hazardous waste as defined by 40 CFR 261.

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Radioactive Material (for shipping purposes only): Material having a specific activity as defined in 49 CFR 173.403. If the material is not radioactive for the purposes of hazardous material Class 7 transport, it is not subject to the requirements of 49 CFR 173. However, this is not considered free release criteria or considered non-radioactive under the provisions of 10 CFR 20.

Radioactive Material Package: The packaging together with its radioactive contents as presented for transport.

Radioactive Material Packaging: The assembly of components necessary to ensure compliance with the packaging requirements of 49 CFR 173 and 10 CFR 71. It may consist of one or more containers, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, the tie-down system, and auxiliary equipment may be designated as part of the packaging.

Radioactive Waste (Radwaste or Waste): Radioactive material that has no further economic value and is to be shipped to a decontamination, volume reduction, or disposal facility.

Waste Classification: The process for characterization of radioactive waste to determine its suitability for disposal and the controls required for disposal in a near-surface disposal facility.

Waste Stream: Waste with relatively uniform radiological and physical characteristics. Often, the waste results from a single process.

Waste Type: Wastes with similar physical characteristics but which might have different radiological characteristics.

Wet Waste: Radwaste containing free standing liquids or packaged underwater. Wet waste is usually solidified, encapsulated, or dewatered before shipping. Examples include radioactively spent resin, liquid filters, sludge, oil, decontamination fluids and irradiated hardware packaged underwater.

4.0 RESPONSIBILITIES

4.1 Radiation Safety Officer (RSO)

5.0 PROCESS

5.1 Review and Qualification of Solidification Processes

5.1.1 Any proposed solidification process shall be evaluated for acceptability and applicability to the waste stream intended for solidification on a case by case basis.

5.1.2 Solidification of liquid wastes shall be in accordance with the NRC Technical Position on Waste Form, Rev. 1, January 1999; Waste-form Technical Position, Rev. 1, HPPOS-290 PDR-930621 0270; Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015; and the applicable disposal site criteria prior to disposal. (See Attachment 1, Minimum Review Criteria for Solidification Processes for details).

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- 5.1.3 Vendor Process Control Programs (PCP) shall be evaluated per STS-003-008, Quality Assurance Procurement Evaluation, prior to implementation and receive review and approval in accordance with applicable administrative procedures. The review shall identify that there is sufficient supporting documentation of the vendor's PCP to give assurance that the final product will meet all requirements for transport and disposal, and that sufficient procedural controls exist to assure safe operations.
- 5.1.4 Solidification processes shall be reviewed and approved prior to performance in accordance with STS-002-011, Work Control Process.
- 5.1.5 Minimum review criteria are provided in Attachment 1.
- 5.2 High Integrity Containers (HICs)
 - 5.2.1 A HIC may be used to provide stability in lieu of the requirement for waste-form stability for sludges, resins, filters, etc. HICs shall meet applicable regulatory and disposal site requirements
 - 5.2.2 The qualification criteria for HICs include:
 - a. Container design shall be qualified in accordance with the NRC Branch Technical Position on Waste Form, (Rev. 1, 1991) and the requirements of the disposal facility. If applicable, the regulatory agency for the disposal facility shall issue a Certificate of Compliance (C of C) or otherwise approve the design;
 - b. Plant and vendor procedures shall meet the inspection, preparation for use, filling, storage, handling, and transportation and disposal requirements of the applicable certificate of compliance; and,
 - c. Waste processed in HICs may utilize the HIC as the stable waste-form to meet the stability and free liquid requirements of 10 CFR 61.56 and the disposal facility. However, the process control parameters for the waste processing shall be controlled to within the limitations of the Certificate of Compliance (C of C) on the HIC (typically temperature or chemical limitations in the C of C may require additional controls in the process).
 - 5.2.3 Prohibited materials are specific to the HIC qualification and certification. Attachment 2 provides a typical listing of prohibited materials.
- 5.3 High Integrity Container Reportable Events
 - 5.3.1 During the process of dewatering or solidification of Class B or C waste, deviations from the process control parameters or acceptable waste-form properties shall be evaluated for reportability as mishaps. Failures during qualification testing are not considered mishaps and are not reportable events. In Generic Letter 91-02, NRC

“... suggested that the voluntary submittal of information regarding waste-form mishaps be reported within 30 days of the incident to

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5.3.1 (continued)

the NRC [per 10 CFR 50.4] ... and to the designated State disposal-site regulatory authority."

The purpose of the Generic Letter is to communicate that NRC "has decided to rely on voluntary submittal of informational reports by both waste-form generators and processors regarding mishaps to LLW forms prepared for disposal."

5.3.2 Mishaps involving the HIC during or after processing and deviation from prescribed process control parameters for solidification shall be evaluated for reportability. In Generic Letter 91-02, the NRC staff "identified three classes of useful information that interest NRC and could be reported. These three include:

- a. The failure of high-integrity containers used to ensure a stable waste-form. Container failure can be evidenced by changed container dimensions, cracking, or damage resulting from mishandling (e.g., dropping or impacting against another object);
- b. The misuse of high-integrity containers, evidenced by a quantity of free liquid greater than 1 percent of container volume, or by an excessive void space within the container. Such misuse is prohibited by 10 CFR 61.56; and,
- c. The production of a solidified Class B or C waste-form that has any of the following characteristics:
 - Contains free liquid in quantities exceeding 0.5 percent of the volume of the waste;
 - Contains waste with radionuclides in concentrations exceeding those considered during waste-form qualification testing accepted by the regulatory agency, which could lead to errors in assessment of waste class;
 - Contains a significantly different waste loading than that used in qualification testing accepted by the regulatory agency;
 - Contains chemical ingredients not present in qualification testing accepted by the regulatory agency, and those quantities are sufficient to unacceptably degrade the waste product;
 - Shows instability evidenced by crumbling, cracking, spalling, voids, softening, disintegration, non-homogeneity, or dimensional changes; and,
 - Evidence of processing phenomena that exceed the limiting processing conditions identified in applicable topical reports on process control plans, e.g., foaming, temperature extremes, premature or slow hardening, and production of volatile material.

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- 5.3.3 Mishaps involving the container or solidification process shall be evaluated for reportability under 10 CFR 21.
- 5.3.4 Mishaps shall be documented using the STS-003-002, Corrective Action Process.
- 5.3.5 Mishaps maybe subject to a 30 day reporting criteria of 10 CFR 21.21 and require approval of the disposal facility prior to transport.

5.4 Cartridge Filter Elements

- 5.4.1 Cartridge filter elements may be shipped for off-site processing and disposal. The vendor's processes should be reviewed to ensure compliance with the applicable disposal site criteria and 10 CFR 61 requirements.
- 5.4.2 Cartridge filter elements may be processed on-site for direct disposal. Cartridge filter elements shall be processed using an approved dewatering system in accordance with approved vendor procedures. The dewatering process shall be tested and the methodology accepted as meeting the applicable burial site criteria and 10 CFR 61 requirements.
- 5.4.3 The processing procedures for filters dewatered on-site for direct disposal shall be reviewed and approved in accordance with applicable NSS procedures.
- 5.4.4 Class A filters requiring stabilization and Class B and Class C filters shall be disposed of in an approved HIC or a solidified matrix that satisfies the stabilized waste-form criteria of 10 CFR 61.56(b).
- 5.4.5 The waste classification of cartridge filters for disposal shall be in accordance with Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, 2015.

5.5 Demineralizer Resins

- 5.5.1 Depleted resins may be shipped for off-site processing and disposal. The vendor's processes should be reviewed to ensure compliance with the applicable disposal site criteria and 10 CFR 61 requirements.
- 5.5.2 Depleted resins may be processed on-site for direct disposal. Similar waste types from different waste streams may be blended in accordance with guidance provided in Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015.
- 5.5.3 Depleted resins shall be processed using an approved dewatering system in accordance with approved vendor procedures. The dewatering process shall be tested and the methodology accepted as meeting the applicable burial site criteria and 10 CFR 61 requirements.
- 5.5.4 Resin types or waste forms selected for use on site shall be reviewed and approved by the RSO prior to use.

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- 5.5.5 The means of processing depleted resins dewatered on-site for direct disposal shall be reviewed and approved in accordance with STS-002-011, Work Control Process.
- 5.5.6 A valid 10 CFR 61 analysis shall be used to determine the radionuclide distribution. This information along with waste volume per package, weight per package, and package size shall be used to determine the liner's specific activity.
- 5.5.7 The package's total activity may be based on a dose rate to curie conversion factor or extrapolation of the sample analysis consistent with the waste classification methodology explained later in this procedure.
- 5.5.8 Class A waste resins requiring stabilization and Class B and Class C waste resins shall be disposed of in an approved HIC or a solidified matrix that satisfies the stabilized waste-form criteria of 10 CFR 61.56(b).
- 5.5.9 Other methods of processing resins shall be reviewed and approved in accordance with STS-002-011 Work Control Process.
- 5.6 Dry Active Waste (DAW)
 - 5.6.1 DAW is typically packaged into boxes, intermodal containers, or C-vans and shipped to a licensed vendor that processes the DAW for final disposal or shipped directly to a licensed disposal facility.
 - 5.6.2 DAW shall be examined prior to packaging to screen out items that may:
 - Conflict with a vendor's ability to process the material or the disposal site criteria or
 - Contain "Hot Spots" as defined in Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015
 - 5.6.3 Liquids or items found in DAW that would compromise the integrity of the package shall be removed and separated for special handling.
 - 5.6.4 Controls and inspection criteria shall be established for the receipt and prior to-use inspections of transport containers and disposal containers for DAW packages shipped directly for disposal.
- 5.7 Irradiated Metal/Hardware
 - 5.7.1 Verification of suitability for disposal shall be determined through collaboration with the processing or disposal facility. Special characterization methodology may be required for components and a review and approval by the disposal facility prior to shipment is likely. The packaging of irradiated object(s) for direct disposal may be limited by the package or cask used for transport. Shipping and disposal documentation shall be reviewed by the

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5.7.1 (continued)

RSO and deemed acceptable by the processing or disposal facility prior to shipment.

5.7.2 If the material is recycled or processed prior to disposal, the material shall be packaged for transport in accordance with 49 CFR 190, 10 CFR 20, 10 CFR 61, 10 CFR 71 and any limitations of the package or transport cask. Disposal is based on the vendor's process control program.

5.7.3 Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015 identifies specific proscriptive constraints on what discrete items can be blended with other items or how specific components can be sectioned for disposal.

5.8 Incinerable Fluids

5.8.1 Fluids that are capable of being incinerated (e.g. hydraulic fluids, lubricating oils, etc.) may be shipped to a processor that is licensed to perform that activity.

5.8.2 The vendor shall be evaluated, per STS-003-008 Quality Assurance Procurement Evaluation, prior to the shipment of materials or utilizing them to perform work. Disposal shall be executed in accordance with the vendor's programs and procedures.

5.8.3 In the process, the fluid is typically consumed and the resultant activity captured for disposal or released under the vendor's license. The vendor may return any material that cannot be processed for disposal to NSS.

5.9 Sludges / Bottoms

5.9.1 Fluids that are not capable of being incinerated may be processed by a vendor licensed to process, concentrate and/or solidify wet wastes. Processing resulting in on-site solidification is subject to the process controls for solidification discussed earlier.

5.9.2 The vendor may return any material that cannot be processed for disposal to NSS.

5.10 Chelating Agents

5.10.1 Chelating agents shall be administratively controlled through the use of approved procedures to less than 0.1 % by weight to comply with 10 CFR 20 Appendix G and disposal site criteria.

5.10.2 When the use of chelating agents is intrinsic to the process waste stream, they shall be identified and quantified. The presence of identified and quantified chelates up to 8 % by weight has been accepted and may exceed 8% with prior approval of the disposal facility. Waste loading with chelating agents is limited by the disposal facility's acceptance criteria.

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5.11 Prohibited Waste Constituents

- 5.11.1 No radioactive waste capable of detonation or of explosive decomposition or reaction shall be shipped for disposal per 10 CFR 61.56 (a) (4). Components containing explosive materials, such as some automatic valves (e.g. fire protection valves on Halon and/or CO2 systems), should be identified and the removal or disposal of these valves controlled by the work control process.
- 5.11.2 No radioactive waste capable of generating toxic gases, vapors, or fumes shall be shipped for disposal per 10 CFR 61.56 (a) (5).
- 5.11.3 No radioactive waste that is pyrophoric shall be shipped for disposal per 10 CFR 61.56 (a) (6).
- 5.11.4 Control of the generation of these types of waste shall be provided through the use of approved NSS procedures.

5.12 Mixed Waste

- 5.12.1 No mixed waste shall be submitted for disposal per 10 CFR 61.56 (a) (8) unless properly treated.
- 5.12.2 NSS does not plan to process mixed waste on-site and will ship its mixed waste inventory to licensed and permitted facilities for processing prior to disposal.
- 5.12.3 The vendor shall be evaluated, per STS-003-008 Quality Assurance Procurement Evaluation, prior to the shipment of materials or utilizing them to perform work. Disposal shall be executed in accordance with the vendor's programs and procedures.
- 5.12.4 Control of the generation of mixed waste is provided in STS-005-024, Mixed Waste Management Plan.
- 5.12.5 Material Safety Data Sheets (MSDS) on consumable materials are maintained for chemicals used on site.

5.13 Waste Characterization and Classification

- 5.13.1 Waste classification shall meet the requirements of 10 CFR 61 and disposal site criteria.
- 5.13.2 Procedures or other administrative controls or documents shall assure that the radioactivity content transferred to any one liner or HIC will not result in exceeding the design basis site boundary dose.
- 5.13.3 Approved procedures shall specify the method of waste classification to meet the requirements of 10 CFR 61.55. These procedures shall include the collection of data, computational methods, computer codes, etc. The following is a synopsis of the methodology employed and required elements of the procedures.

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- 5.13.4 Individuals performing the calculations described in this section and the reviewer of those calculations shall be qualified to perform the associated activities. Approval, in lieu of specific qualification, should be based on experience at other nuclear facilities and demonstrated proficiency with the types of calculations or computer codes required.
- 5.13.5 Radioactive waste streams are sampled and/or assessed prior to shipment as required or after any evolution that may affect the distribution of radionuclides by a factor of 10 in waste streams for Class A, Band C waste defined in 10 CFR 61.55.
- 5.13.6 An approved outside laboratory is used by NSS to analyze waste streams to determine the distribution and activity of radionuclides listed in Tables 1 and 2 of 10 CFR 61. Scaling factors are determined which allow the activity of 10 CFR 61 radionuclides to be estimated using the results of gamma spectrometric analysis or direct gamma dose rate measurements.
- 5.13.7 Scaling factors shall be updated based on the results of the most recent full assay of the waste stream.
- 5.13.8 On-going checks of the validity of the waste stream scaling factors shall be accomplished through sampling and evaluation of the changes in relative concentrations of gamma emitting isotopes.
- 5.13.9 Periodic evaluation of the laboratory performance shall be evaluated through blind sampling, independent certification or periodic inspection.
- 5.13.10 For resin wastes, isotopic analysis is normally performed on samples of resin obtained prior to or during processing. Representative resin samples shall be analyzed for gamma components and appropriate scaling factors are applied to key gamma radionuclides (such as Co-60 or Cs-137) to determine the specific activity of difficult to measure radionuclides expected in the waste stream based on a prior laboratory analysis. The total activity present in a container shall be calculated based on the specific activity and the volume or weight of the waste in the container or dose rate to curie conversion calculations.
- 5.13.11 For containers of cartridge filters, dose rate to curie conversion calculations shall be performed on each filter or set of filters to determine the total gamma activity present. Scaling factors shall be applied to key gamma radionuclide curie content to determine the activity of those applicable radionuclides not measured by gamma analysis or dose rate measurement.
- 5.13.12 For DAW, dose rate to curie conversion calculations shall be performed to determine the total gamma emitter activity present in a container. Scaling factors shall be applied to key gamma radionuclide curie content to determine the activity of those radionuclides not measured in the gamma spectrum.
- 5.13.13 Computational methods (including computer codes used to perform waste classification) shall be verified and validated by an individual who meets or

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5.13.13 (continued)

exceeds the qualifications of ANSI N18.1-1971, paragraphs 4.3.2 or 4.5.2 as follows:

- a. Review the computational methods basis document or manual;
- b. Ensure technical accuracy, technical adequacy, reasonableness of assumptions, and traceability of data;
- c. Benchmark calculation results against other methods to prove reasonable agreement;
- d. Document Initial reviews and benchmark results; and,
- e. Review and approve verification / validation prior to implementation of the method.

5.13.14 Calculations to determine curie content and waste classification of radwaste performed by means other than computer codes (i.e. manual calculations, etc.) shall be checked by a qualified individual who meets or exceeds the qualifications of ANSI N18.1-1971, paragraphs 4.3.2 or 4.5.2 as defined in 4.13.1, who is other than the originator and who shall be responsible to check and document the following:

- a. Check the appropriateness of the application of the computational method;
- b. Check assumptions and input data for reasonableness;
- c. Perform a sufficient number of checks of the calculations to reasonably test accuracy and consistency of the results; or,
- d. Perform a check of the results by comparison with other similar calculations; and,

Note

It is generally expected that the waste classification analysis, in and of itself, should be sufficient to show that the classification was undertaken in a way consistent with the guidance found in the Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, 2015.

5.13.15 Calculation methodology to assess the concentration of radionuclides for waste disposal shall incorporate the guidance provided in the Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, 2015. Specifically, if the classification of a waste is based on the volumetrically averaged or weight averaged nuclide concentration:

- a. Prepare the waste classification analysis;

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5.13.15

- b. Retain the analysis with the manifest documentation; and,
- c. Have available for inspection a record documenting the waste classification analysis.

5.14 Liquid Radwaste Systems and Items

5.14.1 All of the waste dilution and disposal (WD) and equipment drain and waste collection (PD) systems and equipment are deactivated, disabled and perform no active function. These requirements pertain to reactivated systems as well as temporary systems that may be installed to process liquid radioactive waste.

5.14.2 Liquid Radwaste Systems shall meet the following technical requirements:

- a. The design, procurement, fabrication, construction, inspection, and testing requirements of Regulatory Positions 1 through 5 of NRC Reg. Guide 1.143 should be met;
- b. The use of flexible and quick disconnects shall be minimized and limited to necessary interfaces with ship systems or between skids. Initially, these components are subject to a hydrostatic test for flexible hose. After the initial test, periodic (6 ± 1 month) visual inspections should be documented of flexible hoses and connections in accessible areas for leaks, cracks or damage should verify that they remain serviceable or are replaced when necessary; and,
- c. In the event repairs, replacements, or additions are made to the pressure boundary following the hydrostatic test, the affected portions of the pressure boundary shall be retested in accordance with the hydrostatic test pressure requirements of NRC Reg. Guide 1.143.

5.14.3 Reactivated and temporary radwaste processing systems shall be evaluated to determine which portions should be listed as required by STS-003-003, Quality Classification List. This evaluation is not required for approved suppliers whose equipment is designed and fabricated to the requirements of NRC Reg. Guide 1.143.

5.14.4 Reactivated and temporary radwaste processing systems outboard of the ship shall meet the requirements of Section 5.14.2, with the following exceptions and additions:

- a. Reactivated and temporary radwaste processing systems shall be located on a concrete pad or inside a building;
- b. Reactivated and temporary systems shall be curbed, diked or drained to plant systems to contain the entire spilled liquid inventory of the largest tank in the system;

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5.14.4 (continued)

- c. Splash shields shall be located so that leakage or spray from hoses, vents, overflows, flanges, packing or other unwelded connections will be contained; and,
- d. Provisions to process any liquid in the curbed area shall be available.

5.14.5 Where strict compliance with the requirements of Section 5.14.2 or 5.14.4 is not practical; an engineering evaluation of each deviation shall be documented and approved through an independent safety review. The engineering evaluation shall identify the deviation, evaluate the impact of the deviation on the probability and consequences of pressure boundary failure, and describe compensating measures that provide equivalent protection against radioactive spills and uncontrolled environmental releases. The deviation shall also be reviewed for its impact on controlled documents.

5.14.6 IE Circular No. 80-18 provides guidance for writing safety evaluations for radwaste systems. Only one safety evaluation is required for mobile systems that periodically return to the same location as long as the applicability of the safety evaluation is verified each time the mobile system is set up.

5.15 Radioactive Material Packaging and Shipping

5.15.1 Activities in support of the transfer of radioactive material to a land disposal facility are subject to the requirements of the Decommissioning Quality Assurance Plan to ensure compliance with 10 CFR 20, Appendix G, Section III.A.3. Vendors providing services and items in support of land disposal of radioactive material shall be evaluated for compliance with 10 CFR 20, Appendix G, Section III.A.3.

5.15.2 Containers, shipping casks and methods of packaging shall meet applicable federal regulations, e.g. 10 CFR 71 and 49 CFR 173 Subpart I.

5.15.3 The procurement, use, maintenance, and repair of packaging designed for the transport of radioactive material not specifically exempted under 10 CFR 71.10 shall be controlled by procedures which implement the requirements of 10 CFR 71.12.

5.15.4 The fabrication, initial testing and qualification of packages and NRC certification of those packages are beyond the scope of this program.

5.16 Training

5.16.1 Training is required by 49 CFR 172.700 for all personnel involved in the shipment, transport and/or receipt of hazardous materials.

5.16.2 Hazardous Materials Training commensurate with the guidance of 49 CFR 172.701 through 704 (Subpart H) and NRC Bulletin 79-19 shall be conducted and the scope and content of the training shall be commensurate with the duties and hazards associated with the individual's anticipated functions.

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5.16.2 (continued)

- a. Initial training is required within 90 days of employment or change in job function.
- b. Recurrent training shall be conducted once every three years for Subpart H and NRC Bulletin 79-19.

5.16.3 Annual retraining requirements for HAZMAT employees are prescribed by OSHA in 29 CFR 1910.120(p) (7) and EPA under 40 CFR 264.16. The training indicated above may satisfy or partially satisfy those training requirements in the year attended. Consult with the Training Department for appropriate documentation.

5.16.4 Training programs from other facilities may be accepted in place of the STS program. Consult with the Radiation Safety Officer and Training Coordinator for review, approval and appropriate record documentation of training.

5.17 Process Control Program (PCP) Document and Procedure Control

5.17.1 The RSO shall control revision of this PCP. Changes to the program that may result from changes in vendor processes or plant activities should be reviewed by the RSO. Changes to this procedure shall be reviewed and approved in accordance with STS-001-PI, Process Instruction for Preparing Procedures.

5.17.2 New process qualifications or changes in an existing process may be implemented prior to updating this procedure, provided the technical evaluation and approvals for that process are documented.

5.17.3 The RSO should ensure that required changes are incorporated to this procedure as appropriate for planned activities.

6.0 RECORDS

6.1 The Documentation and Administrative Support Manager (DM) shall maintain documents generated for the planning and performance of the work controlled by this procedure as required by STS-002-023, Records Management and STS-003-001, Decommissioning Quality Assurance Plant.

6.2 Waste shipment manifests and supporting documentation shall be retained until license termination plus 10 years. Supporting documents may include the analysis or a reference to the analysis used in the determination of the total activity contained in the disposal package.

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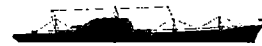


Attachment 1. Minimum Review Criteria for Solidification Processes **Page 1 of 1**

Qualification of the solidification matrix shall be by test of non-radioactive simulated samples or actual samples of wet waste in accordance with the NRC Technical Position on Waste Form, Rev. 1, dated January, 1991. Successful qualification test results of physically and chemically similar wet waste (i.e. type tests) are acceptable. The qualification criteria shall include:

- A description of the acceptable waste-form properties (free liquid, stability, etc.) determined by 10 CFR 61.56 and the applicable disposal facility requirements;
- Provisions for waste characterization;
- A reference to any qualification test results that apply to the process with a discussion of the differences and similarities of the application at NSS to the parameters assumed in the test;
- A discussion of the process control parameters important for assuring that the process will result in an acceptable waste-form such as solidification agents, chemical additions, mixing ratios, mixing time, drying time and temperature. Acceptable ranges or boundary conditions for each parameter should be identified;
- Identification of measurement and test instrumentation and QC hold points required to monitor the process or verify that the process is operating within the acceptable range of the process control parameters specified above. The instrumentation shall be periodically calibrated with calibrations traceable to NIST;
- A procedure for sampling of the solidification process that will verify for each batch of wet wastes that the process control parameters result in complete solidification with no free liquids. If the sample fails to verify solidification, the procedure shall specify what actions are to be taken. Samples shall be clearly labeled and retrievable either up to the time of disposal or for long term storage and testing (6 and 12 months) as required for problem waste streams identification in Appendix A of the NRC's Technical Position on Waste Form;
- Identification of QC provisions to verify the absence of free liquid in each container processed. If free liquid is detected, the procedure shall ensure that free liquid is eliminated prior to shipment to a disposal facility. The presence of greater than 0.5 percent by volume of free liquid after the solidification of Class B or C waste forms shall be reviewed for reportability; and
- For exothermic processes, a description of the process control parameters that must be satisfied prior to capping the container.

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Attachment 2. Material Not Compatible with Polyethylene HICs Page 1 of 1

The following materials are not compatible with Polyethylene HICs:

Acetone Ethyl Butyrate Nitrobenzene
Amyl Acetate Ethyl Chloride Octyl Cresol
Amyl Chloride Ethyl Ether Oleic Acid
Aqua Regia Ethylene Chloride Oleum
Benzene Ethylene Chlorohydrins Petroleum Ether
Bromine Liquid Ethylene Dichloride Phenol
Camphor Oil Fluorine Propylene Dichloride
Carbon Disulfide Furfural Sulfuric Acid (60%)
Carbon Tetrachloride Furfural Alcohol
Chloride Liquid Fuel Oil Tetralin
Moist Chlorine Gas Gasoline Titanium Tetrachloride
Chlorobenzene Hydrofluoric Acid (cone.) Toluene
Chloroform Methyl Bromide Trichloroethylene
Chlorosulfonic Acid Methyl Chloride Turpentine
Cyclohexanone Methyl Ethyl Ketone (MEK) Xylene
Dimethylamine Methylene Chloride
Ethyl Acetate Nitric Acid (cone.)

NOTE: High integrity containers shall not be subject to concentrate free standing oil. However, this does not prohibit the materials in the HIC from containing incidental or trace amounts of oil or petroleum base materials which have been absorbed in the waste materials, provided that the amount of absorbed oil and petroleum base materials does not exceed one percent (1 %) by waste volume in the container.

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Attachment 3. Waste Types Suitable for Dewatering Page 1 of 1

1. Specific waste types acceptable for dewatering are:

Resins

DOWEXMR3 R&HIRN238 GRAVERGR-1-0

DOWEXMR13 R&H IRN 217 GRAVER GR-2-0

DOWEX anion SBRC R&HIRA93 GRAVER GR-4-0

DOWEX HGRW-2 IONACNC-10 GRAVER GR-4-9

IONACNA-38 GRAVER GR-3-9

IONACNM-60

Other Waste Types

AtoChem GAC 40W (Granular Activated Charcoal)

2. Any common polystyrene-based bead ion exchange resins not included in the listing above are acceptable for dewatering subject to the following conditions:
 - The resin shall have a moisture content of less than or equal to 57 percent when shipped from the supplier to the ship; and,
 - Mixtures of resins shall have a weighted average of "as shipped" moisture contents less than or equal to 57 percent.
3. The bead ion exchange resins qualified in accordance with Sections 1 and 2 of this attachment shall also satisfy the following criteria to be acceptable for dewatering:
 - If oil or grease is detected in the media, the spent resin shall be evaluated to quantify that the media contains less than 1 % oil or grease by container volume;
 - The media shall not contain significant quantities of crud that could inhibit dewatering capabilities;
 - The media shall not contain significant amounts of organic contaminants that could inhibit dewatering capabilities; and,
 - Physical degradation of the media shall be limited to that due to routine water demineralization and resin transfer operations.
4. Miscellaneous metals and irradiated hardware are acceptable for dewatering as long as the shape does not create the potential to trap water.

SAVANNAH Technical Staff

**STS-219, Annual Radiological Environmental Monitoring and Radioactive Effluent Release
Reports for CY2021, Revision 0**

Appendix C STS-005-022, Radioactive Waste Process Control Program, Revision 2

**APPENDIX C. STS-005-022, RADIOACTIVE WASTE PROCESS
CONTROL PROGRAM, REVISION 2**

The following 22 pages are a complete copy of Revision 2 of STS-005-022, Radioactive Waste Process Control Program.

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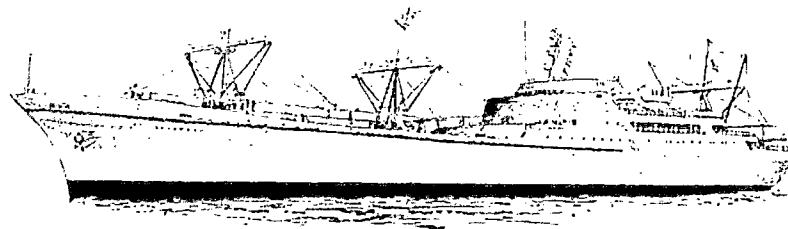
U.S. Department of Transportation
Maritime Administration

N.S. SAVANNAH TECHNICAL STAFF

STS-005-022

RADIOACTIVE WASTE PROCESS CONTROL PROGRAM

Level of Use: Information



REVISION 2

BY: FRANK LITTERER

N S S S L L C

Approved:	<u>E. W. Koehler</u>	<u>10/22/2021</u>
	Senior Technical Advisor	Date

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RECORD OF REVISIONS

Revision	Summary of Revisions
0. 11/09/2018	Original Issue
1. 07/30/2021	Attachment change permission removed, formerly 1.3.2. Records Section Updated. Implementation simplified and 1.3.2 added for continuity of intent. References to other STS procedures added. Other minor corrections made.
2.	Waste manager responsibilities added. 5.13.3 phrasing updated to "approved documentation" for clarity. 5.13.14 reformatted for clarity. Reference to "Training Department" removed from 5.16.3.

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1.0 INTRODUCTION

1.1 Implementation and Cancellation

This procedure is effective upon approval by the Senior Technical Advisor (STA). It remains in effect until cancelled or superseded.

1.2 Purpose

This procedure describes the administrative and technical controls for liquid and solid radioactive waste systems management program (i.e., Process Control Program [PCP]). This PCP provides assurance that NSS meets disposal requirements.

This PCP complies with the Decommissioning Quality Assurance Plan by establishing requirements for process parameters, controls, tests, sampling, and analysis to ensure compliance with 10 CFR 20, 10 CFR 61, and 10 CFR 71, 49 CFR 172 - 177, applicable state regulations, and disposal site criteria.

This procedure provides administrative control requirements for radwaste systems and the classification, packaging, and shipment of radioactive materials for disposal as waste or for processing for eventual disposal as waste.

1.3 Scope/Applicability

- 1.3.1 This procedure applies to STS who during the performance of their job functions, impact generation, processing, packaging or shipment of Low Level Radioactive Waste (LLRW).
- 1.3.2 Radioactive Waste Process Control Program shall be reviewed, by the Radiation Safety Officer (RSO), at least annually and revised, if necessary, to ensure continued compliance with regulatory requirements.

2.0 REFERENCES

2.1 Developmental References

- 2.1.1 10 CFR Part 20, Appendix G to Part 20, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests"
- 2.1.2 STS-003-001, Decommissioning Quality Assurance Plan
- 2.1.3 10 CFR 20.2006, "Transfer for Disposal and Manifests"
- 2.1.4 10 CFR 21, "Reporting of Defects and Non-Compliances"
- 2.1.5 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste"
- 2.1.6 10 CFR 71, "Packaging and Transfer of Radioactive Material"

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- 2.1.7 49 CFR Sub Chapter C - Hazardous Materials Regulations, Part 173, "Shippers - General Requirements for Shipments"
- 2.1.8 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response"
- 2.1.9 40 CFR 264.16, "Personnel Training"
- 2.1.10 NRC Regulatory Guide 1.143, Rev. 1, October, 1979, "Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Power Plants"
- 2.1.11 NRC Generic Letter 91-02, "Reporting Mishaps Involving LLW Forms Prepared for Disposal"
- 2.1.12 "Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification", May 1983
- 2.1.13 Low-Level Waste Management Branch, "Technical Position on Waste Form", Rev. 1, January, 1991
- 2.1.14 NMSS "Final Branch Technical Position on Concentration Averaging and Encapsulation, Revision in Part to Waste Classification Technical Position", January, 1995
- 2.1.15 NRC Low Level Waste Licensing Branch Waste Classification Technical Position, May 1983, and NRC letter L.B. Higginbotham to Licensees, February 10, 1984, Additional Guidance on Implementation of 10CFR61
- 2.1.16 NRC Regulatory Guide 7.10 - Establishing Quality Assurance Programs for Packaging Used in the Transport of Radioactive Material
- 2.1.17 NRC Bulletin 79-19, Packaging of Low-Level Radioactive Waste for Transport and Burial
- 2.1.18 NRC Information Notice 2004-13, Registration, Use and Quality Assurance Requirements for NRC-Certified Transportation Packages
- 2.1.19 NMSS Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015
- 2.2 Performance References
 - 2.2.1 STS-001-PI, Process Instruction for Preparing Procedures
 - 2.2.2 STS-002-011, Work Control Process
 - 2.2.3 STS-002-023, Records Management
 - 2.2.4 STS-003-001, Decommissioning Quality Assurance Plan
 - 2.2.5 STS-003-002, Corrective Action Process

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- 2.2.6 STS-003-003, Quality Classification List
- 2.2.7 STS-003-008, Quality Assurance Procurement Evaluation
- 2.2.8 STS-005-024, Mixed Waste Management Plan

3.0 DEFINITIONS

Batch: A fixed volume of wet waste with essentially uniform physical, chemical, and radiological properties. A single batch of wet waste may be solidified or dewatered in several containers. An isolated tank of agitated wet waste is an example of a batch.

Certificate of Compliance: USNRC Approved Packages - Documentation certifying that the package (packaging and its contents) meets the applicable safety standards set forth in 10 CFR Part 71.

Chelating Agent: Amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, and glucinic acid).

Discrete Items: For purposes of Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015, discrete items are items belonging to one of the following waste types: activated metals, sealed sources, cartridge filters, contaminated materials, and components incorporating radioactivity into their design.

Disposal Facility: An off-site facility for the disposal of radwaste which is licensed for that purpose by the host state and/or by the NRC.

Dry Active Waste (DAW): Radwaste that is typically paper, wood, plastic, trash, air filters, metal, soil, concrete, asphalt, and used plant components, which without processing, contains essentially no free liquid.

High Integrity Container: Documentation certifying a container has been designed to prevent the egress of its radioactive contents in a land burial environment for a design goal of at least 300 years.

Irradiated Hardware: Neutron activated non-fuel-bearing components.

Item: Any level of unit assembly, including structures, systems, subsystems, subassembly, component, part or material.

Liquid Radwaste System: A system that relates to the handling, pretreatment, conditioning, storage, or release to the environment of liquids containing radioactive material for which no further use is foreseen. Examples include sump effluents, equipment used to pump out portable storage containers, and existing ship process systems and related instrumentation and control systems. Radwaste systems terminate at the point of controlled discharge to the environment.

Mishap: The misuse or failure of Class B or C waste forms or high integrity containers that require evaluation for reportability in accordance with NRC's Technical Position on Waste Form, Rev. 1, January 1999, and NRC Generic Letter 91-02.

Mixed Waste: A mixture of radioactive waste and a hazardous waste as defined by 40 CFR 261.

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Radioactive Material (for shipping purposes only): Material having a specific activity as defined in 49 CFR 173.403. If the material is not radioactive for the purposes of hazardous material Class 7 transport, it is not subject to the requirements of 49 CFR 173. However, this is not considered free release criteria or considered non-radioactive under the provisions of 10 CFR 20.

Radioactive Material Package: The packaging together with its radioactive contents as presented for transport.

Radioactive Material Packaging: The assembly of components necessary to ensure compliance with the packaging requirements of 49 CFR 173 and 10 CFR 71. It may consist of one or more containers, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, the tie-down system, and auxiliary equipment may be designated as part of the packaging.

Radioactive Waste (Radwaste or Waste): Radioactive material that has no further economic value and is to be shipped to a decontamination, volume reduction, or disposal facility.

Waste Classification: The process for characterization of radioactive waste to determine its suitability for disposal and the controls required for disposal in a near-surface disposal facility.

Waste Stream: Waste with relatively uniform radiological and physical characteristics. Often, the waste results from a single process.

Waste Type: Wastes with similar physical characteristics but which might have different radiological characteristics.

Wet Waste: Radwaste containing free standing liquids or packaged underwater. Wet waste is usually solidified, encapsulated, or dewatered before shipping. Examples include radioactively spent resin, liquid filters, sludge, oil, decontamination fluids and irradiated hardware packaged underwater.

4.0 RESPONSIBILITIES

4.1 Radiation Safety Officer (RSO)

4.2 Waste Manager

5.0 PROCESS

5.1 Review and Qualification of Solidification Processes

5.1.1 Any proposed solidification process shall be evaluated for acceptability and applicability to the waste stream intended for solidification on a case by case basis.

5.1.2 Solidification of liquid wastes shall be in accordance with the NRC Technical Position on Waste Form, Rev. 1, January 1999; Waste-form Technical Position, Rev. 1, HPPOS-290 PDR-930621 0270; Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015; and the applicable disposal site criteria prior to disposal. (See Attachment 1, Minimum Review Criteria for Solidification Processes for details).

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5.1.3 Vendor Process Control Programs (PCP) shall be evaluated per STS-003-008, Quality Assurance Procurement Evaluation, prior to implementation and receive review and approval in accordance with applicable administrative procedures. The review shall identify that there is sufficient supporting documentation of the vendor's PCP to give assurance that the final product will meet all requirements for transport and disposal, and that sufficient procedural controls exist to assure safe operations.

5.1.4 Solidification processes shall be reviewed and approved prior to performance in accordance with STS-002-011, Work Control Process.

5.1.5 Minimum review criteria are provided in Attachment 1.

5.2 High Integrity Containers (HICs)

5.2.1 A HIC may be used to provide stability in lieu of the requirement for waste-form stability for sludges, resins, filters, etc. HICs shall meet applicable regulatory and disposal site requirements

5.2.2 The qualification criteria for HICs include:

- a. Container design shall be qualified in accordance with the NRC Branch Technical Position on Waste Form, (Rev. 1, 1991) and the requirements of the disposal facility. If applicable, the regulatory agency for the disposal facility shall issue a Certificate of Compliance (C of C) or otherwise approve the design;
- b. Plant and vendor procedures shall meet the inspection, preparation for use, filling, storage, handling, and transportation and disposal requirements of the applicable certificate of compliance; and,
- c. Waste processed in HICs may utilize the HIC as the stable waste-form to meet the stability and free liquid requirements of 10 CFR 61.56 and the disposal facility. However, the process control parameters for the waste processing shall be controlled to within the limitations of the Certificate of Compliance (C of C) on the HIC (typically temperature or chemical limitations in the C of C may require additional controls in the process).

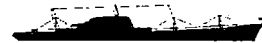
5.2.3 Prohibited materials are specific to the HIC qualification and certification. Attachment 2 provides a typical listing of prohibited materials.

5.3 High Integrity Container Reportable Events

5.3.1 During the process of dewatering or solidification of Class B or C waste, deviations from the process control parameters or acceptable waste-form properties shall be evaluated for reportability as mishaps. Failures during qualification testing are not considered mishaps and are not reportable events. In Generic Letter 91-02, NRC

“... suggested that the voluntary submittal of information regarding waste-form mishaps be reported within 30 days of the incident to

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5.3.1 (continued)

the NRC [per 10 CFR 50.4] ... and to the designated State disposal-site regulatory authority."

The purpose of the Generic Letter is to communicate that NRC "has decided to rely on voluntary submittal of informational reports by both waste-form generators and processors regarding mishaps to LLW forms prepared for disposal."

5.3.2 Mishaps involving the HIC during or after processing and deviation from prescribed process control parameters for solidification shall be evaluated for reportability. In Generic Letter 91-02, the NRC staff "identified three classes of useful information that interest NRC and could be reported. These three include:

- a. The failure of high-integrity containers used to ensure a stable waste-form. Container failure can be evidenced by changed container dimensions, cracking, or damage resulting from mishandling (e.g., dropping or impacting against another object);
- b. The misuse of high-integrity containers, evidenced by a quantity of free liquid greater than 1 percent of container volume, or by an excessive void space within the container. Such misuse is prohibited by 10 CFR 61.56; and,
- c. The production of a solidified Class B or C waste-form that has any of the following characteristics:
 - Contains free liquid in quantities exceeding 0.5 percent of the volume of the waste;
 - Contains waste with radionuclides in concentrations exceeding those considered during waste-form qualification testing accepted by the regulatory agency, which could lead to errors in assessment of waste class;
 - Contains a significantly different waste loading than that used in qualification testing accepted by the regulatory agency;
 - Contains chemical ingredients not present in qualification testing accepted by the regulatory agency, and those quantities are sufficient to unacceptably degrade the waste product;
 - Shows instability evidenced by crumbling, cracking, spalling, voids, softening, disintegration, non-homogeneity, or dimensional changes; and,
 - Evidence of processing phenomena that exceed the limiting processing conditions identified in applicable topical reports on process control plans, e.g., foaming, temperature extremes, premature or slow hardening, and production of volatile material.

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- 5.3.3 Mishaps involving the container or solidification process shall be evaluated for reportability under 10 CFR 21.
- 5.3.4 Mishaps shall be documented using the STS-003-002, Corrective Action Process.
- 5.3.5 Mishaps maybe subject to a 30 day reporting criteria of 10 CFR 21.21 and require approval of the disposal facility prior to transport.

5.4 Cartridge Filter Elements

- 5.4.1 Cartridge filter elements may be shipped for off-site processing and disposal. The vendor's processes should be reviewed to ensure compliance with the applicable disposal site criteria and 10 CFR 61 requirements.
- 5.4.2 Cartridge filter elements may be processed on-site for direct disposal. Cartridge filter elements shall be processed using an approved dewatering system in accordance with approved vendor procedures. The dewatering process shall be tested and the methodology accepted as meeting the applicable burial site criteria and 10 CFR 61 requirements.
- 5.4.3 The processing procedures for filters dewatered on-site for direct disposal shall be reviewed and approved in accordance with applicable NSS procedures.
- 5.4.4 Class A filters requiring stabilization and Class B and Class C filters shall be disposed of in an approved HIC or a solidified matrix that satisfies the stabilized waste-form criteria of 10 CFR 61.56(b).
- 5.4.5 The waste classification of cartridge filters for disposal shall be in accordance with Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, 2015.

5.5 Demineralizer Resins

- 5.5.1 Depleted resins may be shipped for off-site processing and disposal. The vendor's processes should be reviewed to ensure compliance with the applicable disposal site criteria and 10 CFR 61 requirements.
- 5.5.2 Depleted resins may be processed on-site for direct disposal. Similar waste types from different waste streams may be blended in accordance with guidance provided in Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015.
- 5.5.3 Depleted resins shall be processed using an approved dewatering system in accordance with approved vendor procedures. The dewatering process shall be tested and the methodology accepted as meeting the applicable burial site criteria and 10 CFR 61 requirements.
- 5.5.4 Resin types or waste forms selected for use on site shall be reviewed and approved by the RSO prior to use.

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- 5.5.5 The means of processing depleted resins dewatered on-site for direct disposal shall be reviewed and approved in accordance with STS-002-011, Work Control Process.
- 5.5.6 A valid 10 CFR 61 analysis shall be used to determine the radionuclide distribution. This information along with waste volume per package, weight per package, and package size shall be used to determine the liner's specific activity.
- 5.5.7 The package's total activity may be based on a dose rate to curie conversion factor or extrapolation of the sample analysis consistent with the waste classification methodology explained later in this procedure.
- 5.5.8 Class A waste resins requiring stabilization and Class B and Class C waste resins shall be disposed of in an approved HIC or a solidified matrix that satisfies the stabilized waste-form criteria of 10 CFR 61.56(b).
- 5.5.9 Other methods of processing resins shall be reviewed and approved in accordance with STS-002-011 Work Control Process.
- 5.6 Dry Active Waste (DAW)
 - 5.6.1 DAW is typically packaged into boxes, intermodal containers, or C-vans and shipped to a licensed vendor that processes the DAW for final disposal or shipped directly to a licensed disposal facility.
 - 5.6.2 DAW shall be examined prior to packaging to screen out items that may:
 - Conflict with a vendor's ability to process the material or the disposal site criteria or
 - Contain "Hot Spots" as defined in Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015
 - 5.6.3 Liquids or items found in DAW that would compromise the integrity of the package shall be removed and separated for special handling.
 - 5.6.4 Controls and inspection criteria shall be established for the receipt and prior to-use inspections of transport containers and disposal containers for DAW packages shipped directly for disposal.
- 5.7 Irradiated Metal/Hardware
 - 5.7.1 Verification of suitability for disposal shall be determined through collaboration with the processing or disposal facility. Special characterization methodology may be required for components and a review and approval by the disposal facility prior to shipment is likely. The packaging of irradiated object(s) for direct disposal may be limited by the package or cask used for transport. Shipping and disposal documentation shall be reviewed by the

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5.7.1 (continued)

Waste Manager and deemed acceptable by the processing or disposal facility prior to shipment.

5.7.2 If the material is recycled or processed prior to disposal, the material shall be packaged for transport in accordance with 49 CFR 190, 10 CFR 20, 10 CFR 61, 10 CFR 71 and any limitations of the package or transport cask. Disposal is based on the vendor's process control program.

5.7.3 Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, Vol .1, February 2015 identifies specific proscriptive constraints on what discrete items can be blended with other items or how specific components can be sectioned for disposal.

5.8 Incinerable Fluids

5.8.1 Fluids that are capable of being incinerated (e.g. hydraulic fluids, lubricating oils, etc.) may be shipped to a processor that is licensed to perform that activity.

5.8.2 The vendor shall be evaluated, per STS-003-008 Quality Assurance Procurement Evaluation, prior to the shipment of materials or utilizing them to perform work. Disposal shall be executed in accordance with the vendor's programs and procedures.

5.8.3 In the process, the fluid is typically consumed and the resultant activity captured for disposal or released under the vendor's license. The vendor may return any material that cannot be processed for disposal to NSS.

5.9 Sludges / Bottoms

5.9.1 Fluids that are not capable of being incinerated may be processed by a vendor licensed to process, concentrate and/or solidify wet wastes. Processing resulting in on-site solidification is subject to the process controls for solidification discussed earlier.

5.9.2 The vendor may return any material that cannot be processed for disposal to NSS.

5.10 Chelating Agents

5.10.1 Chelating agents shall be administratively controlled through the use of approved procedures to less than 0.1 % by weight to comply with 10 CFR 20 Appendix G and disposal site criteria.

5.10.2 When the use of chelating agents is intrinsic to the process waste stream, they shall be identified and quantified. The presence of identified and quantified chelates up to 8 % by weight has been accepted and may exceed 8% with prior approval of the disposal facility. Waste loading with chelating agents is limited by the disposal facility's acceptance criteria.

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5.11 Prohibited Waste Constituents

- 5.11.1 No radioactive waste capable of detonation or of explosive decomposition or reaction shall be shipped for disposal per 10 CFR 61.56 (a) (4). Components containing explosive materials, such as some automatic valves (e.g. fire protection valves on Halon and CO2 systems), should be identified and the removal or disposal of these valves controlled by the work control process.
- 5.11.2 No radioactive waste capable of generating toxic gases, vapors, or fumes shall be shipped for disposal per 10 CFR 61.56 (a) (5).
- 5.11.3 No radioactive waste that is pyrophoric shall be shipped for disposal per 10 CFR 61.56 (a) (6).
- 5.11.4 Control of the generation of these types of waste shall be provided through the use of approved NSS procedures.

5.12 Mixed Waste

- 5.12.1 No mixed waste shall be submitted for disposal per 10 CFR 61.56 (a) (8) unless properly treated.
- 5.12.2 NSS does not plan to process mixed waste on-site and will ship its mixed waste inventory to licensed and permitted facilities for processing prior to disposal.
- 5.12.3 The vendor shall be evaluated, per STS-003-008 Quality Assurance Procurement Evaluation, prior to the shipment of materials or utilizing them to perform work. Disposal shall be executed in accordance with the vendor's programs and procedures.
- 5.12.4 Control of the generation of mixed waste is provided in STS-005-024, Mixed Waste Management Plan.
- 5.12.5 Material Safety Data Sheets (MSDS) on consumable materials are maintained for chemicals used on site.

5.13 Waste Characterization and Classification

- 5.13.1 Waste classification shall meet the requirements of 10 CFR 61 and disposal site criteria.
- 5.13.2 Procedures or other administrative controls or documents shall assure that the radioactivity content transferred to any one liner or HIC will not result in exceeding the design basis site boundary dose.
- 5.13.3 Approved documentation shall specify the method of waste classification to meet the requirements of 10 CFR 61.55. These procedures shall include the collection of data, computational methods, computer codes, etc. The following is a synopsis of the methodology employed and required elements of the procedures.

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- 5.13.4 Individuals performing the calculations described in this section and the reviewer of those calculations shall be qualified to perform the associated activities. Approval, in lieu of specific qualification, should be based on experience at other nuclear facilities and demonstrated proficiency with the types of calculations or computer codes required.
- 5.13.5 Radioactive waste streams are sampled and/or assessed prior to shipment as required or after any evolution that may affect the distribution of radionuclides by a factor of 10 in waste streams for Class A, Band C waste defined in 10 CFR 61.55.
- 5.13.6 An approved outside laboratory is used by NSS to analyze waste streams to determine the distribution and activity of radionuclides listed in Tables 1 and 2 of 10 CFR 61. Scaling factors are determined which allow the activity of 10 CFR 61 radionuclides to be estimated using the results of gamma spectrometric analysis or direct gamma dose rate measurements.
- 5.13.7 Scaling factors shall be updated based on the results of the most recent full assay of the waste stream.
- 5.13.8 On-going checks of the validity of the waste stream scaling factors shall be accomplished through sampling and evaluation of the changes in relative concentrations of gamma emitting isotopes.
- 5.13.9 Periodic evaluation of the laboratory performance shall be evaluated through blind sampling, independent certification or periodic inspection.
- 5.13.10 For resin wastes, isotopic analysis is normally performed on samples of resin obtained prior to or during processing. Representative resin samples shall be analyzed for gamma components and appropriate scaling factors are applied to key gamma radionuclides (such as Co-60 or Cs-137) to determine the specific activity of difficult to measure radionuclides expected in the waste stream based on a prior laboratory analysis. The total activity present in a container shall be calculated based on the specific activity and the volume or weight of the waste in the container or dose rate to curie conversion calculations.
- 5.13.11 For containers of cartridge filters, dose rate to curie conversion calculations shall be performed on each filter or set of filters to determine the total gamma activity present. Scaling factors shall be applied to key gamma radionuclide curie content to determine the activity of those applicable radionuclides not measured by gamma analysis or dose rate measurement.
- 5.13.12 For DAW, dose rate to curie conversion calculations shall be performed to determine the total gamma emitter activity present in a container. Scaling factors shall be applied to key gamma radionuclide curie content to determine the activity of those radionuclides not measured in the gamma spectrum.
- 5.13.13 Computational methods (including computer codes used to perform waste classification) shall be verified and validated by an individual who meets or

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5.13.13 (continued)

exceeds the qualifications of ANSI N18.1-1971, paragraphs 4.3.2 or 4.5.2 as follows:

- a. Review the computational methods basis document or manual;
- b. Ensure technical accuracy, technical adequacy, reasonableness of assumptions, and traceability of data;
- c. Benchmark calculation results against other methods to prove reasonable agreement;
- d. Document Initial reviews and benchmark results; and,
- e. Review and approve verification / validation prior to implementation of the method.

5.13.14 Calculations to determine curie content and waste classification of radwaste performed by means other than computer codes (i.e. manual calculations, etc.) shall be checked by a qualified individual who:

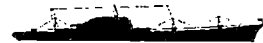
- a. Is **NOT** the originator of the calculations;
- b. Meets or exceeds the qualifications of ANSI N18.1-1971, paragraphs 4.3.2 or 4.5.2 as defined in 4.13.1; and,
- c. Shall be responsible to check and document the following:
 - Check the appropriateness of the application of the computational method;
 - Check assumptions and input data for reasonableness;
 - Perform a sufficient number of checks of the calculations to reasonably test accuracy and consistency of the results; and,
 - Perform a check of the results by comparison with other similar calculations.

Note

It is generally expected that the waste classification analysis, in and of itself, should be sufficient to show that the classification was undertaken in a way consistent with the guidance found in the Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, 2015.

5.13.15 Calculation methodology to assess the concentration of radionuclides for waste disposal shall incorporate the guidance provided in the Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, 2015.

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5.13.15 (continued)

Specifically, if the classification of a waste is based on the volumetrically averaged or weight averaged nuclide concentration:

- a. Prepare the waste classification analysis;
- b. Retain the analysis with the manifest documentation; and,
- c. Have available for inspection a record documenting the waste classification analysis.

5.14 Liquid Radwaste Systems and Items

5.14.1 All of the waste dilution and disposal (WD) and equipment drain and waste collection (PD) systems and equipment are deactivated, disabled and perform no active function. These requirements pertain to reactivated systems as well as temporary systems that may be installed to process liquid radioactive waste.

5.14.2 Liquid Radwaste Systems shall meet the following technical requirements:

- a. The design, procurement, fabrication, construction, inspection, and testing requirements of Regulatory Positions 1 through 5 of NRC Reg. Guide 1.143 should be met;
- b. The use of flexible and quick disconnects shall be minimized and limited to necessary interfaces with ship systems or between skids. Initially, these components are subject to a hydrostatic test for flexible hose. After the initial test, periodic (6 ± 1 month) visual inspections should be documented of flexible hoses and connections in accessible areas for leaks, cracks or damage should verify that they remain serviceable or are replaced when necessary; and,
- c. In the event repairs, replacements, or additions are made to the pressure boundary following the hydrostatic test, the affected portions of the pressure boundary shall be retested in accordance with the hydrostatic test pressure requirements of NRC Reg. Guide 1.143.

5.14.3 Reactivated and temporary radwaste processing systems shall be evaluated to determine which portions should be listed as required by STS-003-003, Quality Classification List. This evaluation is not required for approved suppliers whose equipment is designed and fabricated to the requirements of NRC Reg. Guide 1.143.

5.14.4 Reactivated and temporary radwaste processing systems outboard of the ship shall meet the requirements of Section 5.14.2, with the following exceptions and additions:

- a. Reactivated and temporary radwaste processing systems shall be located on a concrete pad or inside a building;

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5.14.4 (continued)

- b. Reactivated and temporary systems shall be curbed, diked or drained to plant systems to contain the entire spilled liquid inventory of the largest tank in the system;
- c. Splash shields shall be located so that leakage or spray from hoses, vents, overflows, flanges, packing or other unwelded connections will be contained; and,
- d. Provisions to process any liquid in the curbed area shall be available.

5.14.5 Where strict compliance with the requirements of Section 5.14.2 or 5.14.4 is not practical; an engineering evaluation of each deviation shall be documented and approved through an independent safety review. The engineering evaluation shall identify the deviation, evaluate the impact of the deviation on the probability and consequences of pressure boundary failure, and describe compensating measures that provide equivalent protection against radioactive spills and uncontrolled environmental releases. The deviation shall also be reviewed for its impact on controlled documents.

5.14.6 IE Circular No. 80-18 provides guidance for writing safety evaluations for radwaste systems. Only one safety evaluation is required for mobile systems that periodically return to the same location as long as the applicability of the safety evaluation is verified each time the mobile system is set up.

5.15 Radioactive Material Packaging and Shipping

5.15.1 Activities in support of the transfer of radioactive material to a land disposal facility are subject to the requirements of the Decommissioning Quality Assurance Plan to ensure compliance with 10 CFR 20, Appendix G, Section III.A.3. Vendors providing services and items in support of land disposal of radioactive material shall be evaluated for compliance with 10 CFR 20, Appendix G, Section III.A.3.

5.15.2 Containers, shipping casks and methods of packaging shall meet applicable federal regulations, e.g. 10 CFR 71 and 49 CFR 173 Subpart I.

5.15.3 The procurement, use, maintenance, and repair of packaging designed for the transport of radioactive material not specifically exempted under 10 CFR 71.10 shall be controlled by procedures which implement the requirements of 10 CFR 71.12.

5.15.4 The fabrication, initial testing and qualification of packages and NRC certification of those packages are beyond the scope of this program.

5.16 Training

5.16.1 Training is required by 49 CFR 172.700 for all personnel involved in the shipment, transport or receipt of hazardous materials.

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5.16.2 Hazardous Materials Training commensurate with the guidance of 49 CFR 172.701 through 704 (Subpart H) and NRC Bulletin 79-19 shall be conducted and the scope and content of the training shall be commensurate with the duties and hazards associated with the individual's anticipated functions.

- a. Initial training is required within 90 days of employment or change in job function.
- b. Recurrent training shall be conducted once every three years for Subpart H and NRC Bulletin 79-19.

5.16.3 Annual retraining requirements for HAZMAT employees are prescribed by OSHA in 29 CFR 1910.120(p) (7) and EPA under 40 CFR 264.16. The training indicated above may satisfy or partially satisfy those training requirements in the year attended.

5.16.4 Training programs from other facilities may be accepted in place of the STS program. Consult with the Radiation Safety Officer and Training Coordinator for review, approval and appropriate record documentation of training.

5.17 Process Control Program (PCP) Document and Procedure Control

5.17.1 The RSO shall control revision of this PCP. Changes to the program that may result from changes in vendor processes or plant activities should be reviewed by the RSO. Changes to this procedure shall be reviewed and approved in accordance with STS-001-PI, Process Instruction for Preparing Procedures.

5.17.2 New process qualifications or changes in an existing process may be implemented prior to updating this procedure, provided the technical evaluation and approvals for that process are documented.

5.17.3 The RSO should ensure that required changes are incorporated to this procedure as appropriate for planned activities.

6.0 RECORDS

6.1 The Documentation and Administrative Support Manager (DM) shall maintain documents generated for the planning and performance of the work controlled by this procedure as required by STS-002-023, Records Management and STS-003-001, Decommissioning Quality Assurance Plant.

6.2 Waste shipment manifests and supporting documentation shall be retained until license termination plus 10 years. Supporting documents may include the analysis or a reference to the analysis used in the determination of the total activity contained in the disposal package.

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Attachment 1. Minimum Review Criteria for Solidification Processes Page 1 of 1

Qualification of the solidification matrix shall be by test of non-radioactive simulated samples or actual samples of wet waste in accordance with the NRC Technical Position on Waste Form, Rev. 1, dated January, 1991. Successful qualification test results of physically and chemically similar wet waste (i.e. type tests) are acceptable. The qualification criteria shall include:

- A description of the acceptable waste-form properties (free liquid, stability, etc.) determined by 10 CFR 61.56 and the applicable disposal facility requirements;
- Provisions for waste characterization;
- A reference to any qualification test results that apply to the process with a discussion of the differences and similarities of the application at NSS to the parameters assumed in the test;
- A discussion of the process control parameters important for assuring that the process will result in an acceptable waste-form such as solidification agents, chemical additions, mixing ratios, mixing time, drying time and temperature. Acceptable ranges or boundary conditions for each parameter should be identified;
- Identification of measurement and test instrumentation and QC hold points required to monitor the process or verify that the process is operating within the acceptable range of the process control parameters specified above. The instrumentation shall be periodically calibrated with calibrations traceable to NIST;
- A procedure for sampling of the solidification process that verifies for each batch of wet wastes that the process control parameters result in complete solidification with no free liquids. If the sample fails to verify solidification, the procedure shall specify what actions are to be taken. Samples shall be clearly labeled and retrievable either up to the time of disposal or for long term storage and testing (6 and 12 months) as required for problem waste streams identification in Appendix A of the NRC's Technical Position on Waste Form;
- Identification of QC provisions to verify the absence of free liquid in each container processed. If free liquid is detected, the procedure shall ensure that free liquid is eliminated prior to shipment to a disposal facility. The presence of greater than 0.5 percent by volume of free liquid after the solidification of Class B or C waste forms shall be reviewed for reportability; and
- For exothermic processes, a description of the process control parameters that must be satisfied prior to capping the container.

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Attachment 2. Material Not Compatible with Polyethylene HICs Page 1 of 1

The following materials are not compatible with Polyethylene HICs:

Acetone Ethyl Butyrate Nitrobenzene
Amyl Acetate Ethyl Chloride Octyl Cresol
Amyl Chloride Ethyl Ether Oleic Acid
Aqua Regia Ethylene Chloride Oleum
Benzene Ethylene Chlorohydrins Petroleum Ether
Bromine Liquid Ethylene Dichloride Phenol
Camphor Oil Fluorine Propylene Dichloride
Carbon Disulfide Furfural Sulfuric Acid (60%)
Carbon Tetrachloride Furfural Alcohol
Chloride Liquid Fuel Oil Tetralin
Moist Chlorine Gas Gasoline Titanium Tetrachloride
Chlorobenzene Hydrofluoric Acid (cone.) Toluene
Chloroform Methyl Bromide Trichloroethylene
Chlorosulfonic Acid Methyl Chloride Turpentine
Cyclohexanone Methyl Ethyl Ketone (MEK) Xylene
Dimethylamine Methylene Chloride
Ethyl Acetate Nitric Acid (cone.)

NOTE: High integrity containers shall not be subject to concentrate free standing oil. However, this does not prohibit the materials in the HIC from containing incidental or trace amounts of oil or petroleum base materials which have been absorbed in the waste materials, provided that the amount of absorbed oil and petroleum base materials does not exceed one percent (1 %) by waste volume in the container.

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Attachment 3. Waste Types Suitable for Dewatering Page 1 of 1

1. Specific waste types acceptable for dewatering are:

Resins

DOWEXMR3 R&HIRN238 GRAVERGR-1-0
DOWEXMR13 R&H IRN 217 GRAVER GR-2-0
DOWEX anion SBRC R&HIRA93 GRAVER GR-4-0
DOWEX HGRW-2 IONACNC-10 GRAVER GR-4-9
IONACNA-38 GRAVER GR-3-9
IONACNM-60

Other Waste Types

AtoChem GAC 40W (Granular Activated Charcoal)

2. Any common polystyrene-based bead ion exchange resins not included in the listing above are acceptable for dewatering subject to the following conditions:
 - The resin shall have a moisture content of less than or equal to 57 percent when shipped from the supplier to the ship; and,
 - Mixtures of resins shall have a weighted average of "as shipped" moisture contents less than or equal to 57 percent.
3. The bead ion exchange resins qualified in accordance with Sections 1 and 2 of this attachment shall also satisfy the following criteria to be acceptable for dewatering:
 - If oil or grease is detected in the media, the spent resin shall be evaluated to quantify that the media contains less than 1 % oil or grease by container volume;
 - The media shall not contain significant quantities of crud that could inhibit dewatering capabilities;
 - The media shall not contain significant amounts of organic contaminants that could inhibit dewatering capabilities; and,
 - Physical degradation of the media shall be limited to that due to routine water demineralization and resin transfer operations.
4. Miscellaneous metals and irradiated hardware are acceptable for dewatering as long as the shape does not create the potential to trap water.