NEW HAMPSHIRE YANKEE
PROCESS CONTROL PROGRAM
SEABROOK STATION NUCLEAR GENERATING STATION

Revision 0
March 1986

TABLE OF CONTENTS

I. PURPOSE

The purpose of Seabrook Station's (SB) Process Control Program (PCP) is to describe the envelope within which processing and packaging of low-level radioactive waste is accomplished and as such provide assurance of complete solidification of various radioactive 'wet wastes' in accordance with the applicable portions of NRC regulations and guidance which includes the following documents:

- 10CFR61, "Licensing Requirements for Land Disposal of Radioactive Waste"
- 10CFR20, "Standards for Protection Against Radiation"
- 10CFR50, "Domestic Licensing of Production and Utilization Facilities"
- 10CFR71, "Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions"
- 49CFR, "Transportation"
- NUREG-0800; Standard Review Plan Section 11.2 Liquid Waste Management System
- NUREG-0800; Standard Review Plan Section 11.4 Solid Waste Management System
- Branch Technical Position (ETSB) 11-3 "Design Guidance for Solid Radioactive Waste Management Systems Installed in Light Water Cooled Nuclear Power Plants"
- Branch Technical Position Papers pertaining to waste classification and waste form as transmitted to commission licensees in letter from Leo B. Higgonbotham, Chief Low-Level Waste Licensing Branch, dated May 11, 1983
- Werner-Pfleiderer Volume Reduction System Technical Manual; [10855-M137A-463]
- Werner and Pfleiderer Volume Reduction System Topical Report WPC-VRS-001, Revision 1, May 1978
- Regulatory Guide 1.143, Revision 0, Design Guidance for Radioactive Waste Management System, Structure, and Components Installed in Light-Water-Cooled Nuclear Power Plants
- NUREG-0472, "Standard Radiological Effluent Technical Specifications for Pressurized Water Reactors"
- South Carolina Department of Health and Environmental Control, Radioactive Material License #097, as amended
- Washington State Department of Social and Health Services, Radioactive Material License #WN-1019-2, as amended

- NRC Special Nuclear Materials License #16-19204-01, as amended for Benton County, Washington

- NRC Special Nuclear Material License #12-13536-02, as amended for Barnwell, South Carolina

- ANSI/ANS-55.1/1979, American National Standard for Solid Radioactive Waste Processing System for Light Water Cooled Reactor Plants

- State of New Hampshire Regulations on Radioactive Waste Management Applicable to Seabrook Generating Station

II. SYSTEM DESCRIPTION

The Solid Waste Management System (SWMS) collects, volume reduces, solidifies and packages wet and dry radioactive waste in preparation for shipment for burial. The SWMS is designed to operate on a controlled batch process basis. The major components of the SWMS other than station tankage and pump inventory are: resin centrifuge, crystallizer, extruder/evaporator, and a dry active waste (DAW) box compactor. (See Figure 1.) Seabrook Station will also have the ability to utilize the services of a mobile contractor. The vendor contracted will utilize an approved solidification agent and system. The mobile radwaste vendor's wasteform qualification program will be placed on file for NRC review.

A. Solidification

Solidification of radwaste at Seabrook Station is accomplished by using a Waste-Chem (W-C) (Werner-Pfleiderer Corporation) Volume Reduction and Solidification System (VRS). This system is described in the topical report, "Radwaste Volume Reduction and Solidification System," Report No. WPC-VRS-001, November 1976 (Rev. 1 - May 1978).

The WC-VRS system utilizes a thermal-mechanical process with a thermoplastic binder material (asphalt) to reduce the volume and encapsulate and solidify process wastes.

Liquid, slurried or dewatered waste materials and asphalt are simultaneously fed to the heated VRS system. A specific waste stream and asphalt are throughly mixed at elevated temperatures and pushed through the system at approximately 1 gpm at 325°F (supply temperature). At the elevated temperatures all remaining free water and bound moisture are evaporated from the waste materials leaving behind a dehydrated waste residue. This residue is finely ground and thoroughly coated and homogeneously dispersed throughout the binder matrix. Molten waste is then discharged from the extruder to approved containers where they cool down to ambient temperatures and solidify. The waste form is now a free standing monolith. A detailed description of the solidification system is presented in section 11.4 of the Seabrook Station FSAR.

B. Remote Material Handling

The solid radwaste monorail hoist places empty drums on the turntable, which positions the drums for filling under the extruder/evaporator discharge port. The same monorail hoist removes filled drums from the turntable. The filled drums are then placed on a full drum conveyor and sent to a capping-swipe station. At the capping station the drums are capped, and may be swipped. The drums are then conveyed to the radwaste storage area within the waste processing building for temporary storage.

Wastes to be processed by the SWMS are of four types:

1. Bead resins from the plant waste system demineralizers

2. Boric acid concentrates from the liquid radwaste evaporator bottoms

3. Decontamination solution and detergent wastes from the floor drains system

4. Dry active wastes

During normal operations, spent bead resin is transferred from the resin sluice tanks to the resin hopper. Resin is then transferred from the resin hopper to the extruder/evaporator or to the resin centrifuge where transport water is driven off and the resin then free falls into the extruder/evaporator. Alternately spent resins may also be solidified or dewatered by a contracted mobile vendor.

The waste concentrates tank collects evaporator bottoms and chemical drain treatment tank liquids. The accumulated liquid wastes are then transferred to the waste feed tank where pH is adjusted. The wastes at this point can either be fed to the HPD Crystallizer, the extruder/evaporator, or to a contracted mobile vendor. The concentrates collected for processing in the solid waste management system originate from the following systems:

- liquid waste
- boron recovery
- steam generator blowdown
- floor and equipment drains

Other waste inputs handled by the system include spent filters from the various clean-up systems throughout the plant. Typically these filters are loaded in a steel drum and encapsulated with either asphalt or cement (contracted mobile vendor) or they can be air dried, compacted and disposed of as DAW or loaded into a HIC.

A subsystem of the SWMS is provided to process Dry Active Waste (DAW). This subsystem will utilize a 100 ft^3 box compactor. This system will handle typical power plant compactable and non-compactable waste. The box compactor will collect trash with an average density of 7 to 10 lbs/ft^3 and compact it to a final density of 30 to 40 lbs/ft^3.

III. PROCESS CONTROL

Certain process variables have a direct bearing on the properties of the final product which relate to the ability to form a freestanding monolith with no free water. Waste-Chem, in their topical report, describes the results of testing performed to demonstrate the ability of the extruder/evaporator system to produce an adequate product. Seabrook Station, based on this test data, will stay within the bounds of those results. The system will normally be operated with the waste feed within a specified pH range in order to protect equipment from corrosion:

In accordance with the foregoing limitations, the following parameters influence the properties and consistency of the final solid product:

- Asphalt type;
- Ratio of waste-to-asphalt; and
- Process temperature.

A. Asphalt Type

Seabrook Station will use an oxidized petroleum-based asphalt, conforming to ASTM-D-312, Type III requirements. This grade of asphalt has a low, residual, volatile content, and a high molecular weight. At room temperature, and at normal ambient conditions, this material is a freestanding monolith. Witco Chemical Company's Pioneer 221 Asphalt, conforms to the referenced ASTM specification. Specification of Witco Pioneer 221, or an equivalent, through the suppliers certificate of compliance is the means by which process control for asphalt quality is achieved.

It is the philosophy of Seabrook Station to prohibit the discharge of oil to the floor drain tanks. Seabrook Station will maintain a process limit of 1 percent oil in the waste-feed stream to the extruder. Administrative controls will ensure this limit is met. Should these administrative controls be violated and significant oil (greater than one percent) is suspected in the floor drains tank(s), methods will be utilized to separate and drain off the oil prior to its transfer to the waste concentrates tank.

B. Waste-To-Asphalt Ratio in the Product

The relative quantity (waste-to-asphalt ratio by weight) of waste stream being incorporated in the asphalt matrix has a direct influence on the properties of the final product. Encapsulation of inorganic salts and solids typically "stiffen" and harden the waste product; whereas organic liquids have the opposite effect. When the proper ratio of waste-to-asphalt is maintained, final product properties relative to solidification are independent of the waste type.

The ratio of waste-to-asphalt by weight contained in the end product has the most bearing on the viscosity and physical consistency of the product during processing. The recommended ratios by weight of waste-to-asphalt for each waste feed is as follows:

1.	Evaporator Concentrates	45/55 to 50/50
2.	Spent Resins	30/70 to 50/50

Optimum value depends on type and quantity of contaminants present. In all cases, the product will cool to form a freestanding monolith. Viewing of the product texture during container filling is available to the operator through closed circuit television.

Desired waste-to-asphalt ratios in the product are maintained by proportioning feed systems to the extruder/evaporator. Waste and asphalt feed rates are determined by calculational methodology (Appendix A). In all feed modes, the solids content of the waste stream is measured prior to initiation of feed flow. Waste feed rate limitations will be based on extruder/evaporator performance and waste form qualification testing.

The waste stream flows are physically established and controlled by using mass flow meters and variable speed progressive cavity pumps. The asphalt flow is physically established and controlled by using a mass flow meter and a variable speed positive displacement gear pump.

D. Process Temperature

A proper temperature profile along the length of the extruder/evaporator is required to provide adequate evaporative (process) capacity, and to assure that free water is not discharged from the machine. Typical process temperature profiles for Seabrook waste types are as follows:

Waste Type	Process Temperature (°F)*						
Extruder Heat Zones	1	2	3	4	5	6/7	8
Evaporator Concentrates	85	190	280	320	350	320	280
Spent Resins (Centrifuge)	85	190	280	320	350	300	190
Spent Resins (Slurry)	85	190	280	320	350	300	190

* The values given in this table are based on the VRS operating experience. The preoperational test program will determine the optimum setpoints.

Low temperature alarms are provided to alert the operator to a low temperature out of specification condition which could potentially lead to the discharge of free water. These alarms are based on a five percent deviation from set point, typically 1/2-1% or 1 - 4°F. The percent deviation permitted can be adjusted in the field up to 10% (16 - 35°F) of set point. While deviations of 10% will not result in free water in the product, this condition is the maximum deviation that should be tolerated since failure to hold this range indicates a problem with the equipment.

If an out of specification condition persists for two (2) minutes, the extruder/evaporator and feed pumps are automatically tripped or the waste stream is diverted from the extruder/evaporator by an automatic flush sequence. Free water cannot be discharged in the interim, since the residual heat of the extruder/evaporator itself is sufficient to effect evaporation. The foregoing controls/interlocks are provided to prevent the discharge of free water to the container. The temperature profiles specified above have been proven by experiment to yield residual total moisture content in the product of 1% by weight for bead resins. This margin provides assurance that free water cannot be discharged under normal circumstances. Under upset or out of specification conditions, discharge of free water is prevented by the low temperatures process interlocks.

In support of maintaining the three major process parameters:

- process temperature
- asphalt type
- mixture ratio

and to assure a stable waste form consistent with the guidance of the PCP, radwaste operators will ensure the following functions are available, as a minimum, prior to processing.

- o closed circuit television system at the asphalt loading system.
- o all temperature profile monitoring instrumentation.
- o asphalt and waste stream metering equipment (pumps, valves, etc.)
- o all sampling capabilities.

Radwaste operators will also investigate any operation of the VRS that is not within the specified bounds of the before mentioned parameters that impact on final waste form.

Because the W-C VRS is a non-chemical process in which solidification is achieved solely by cooling of the product, standard surveillance is not necessary. This statement is in itself supported by the NRC in its review and approval of the Topical Report on the Waste-Chem process.

IV. SAMPLING

Waste streams will be processed on a controlled batch basis. As a minimum, batches will be controlled by isolating the following vessels:

Concentrates Bottoms Tank
Spent Resin Hopper
Waste Feed Tanks (two)

However, if plant conditions permit, batches may be controlled (isolated) at either one of two Spent Resin Sluice Tanks or the Waste Concentrates Tank. This option provides the ability to control a larger batch (by volume) thereby minimizing the number of required samples and the number of process parameter adjustments, thus minimizing personnel exposure.

In either mode, should the controlled batch be violated, processing will cease. Controls will be reestablished and sampling repeated, if necessary prior to the resumption of processing. All sampling necessary to support waste processing will be delineated in plant procedures.

Chemistry department personnel will determine the radiochemical content of each batch in accordance with procedures listed in Appendix B. Chemistry department personnel (or a contracted vendor) will also perform characterization and conformance of the waste stream according to the regulatory guidance in the Branch Technical Position on Radioactive Waste Classification on an annual basis.

The radwaste operators, utilizing the sample data form, Figure 3, and the calculational methodology will select appropriate feed rates for introduction into the extruder/evaporators.

V. WASTE CLASSIFICATION AND CONFORMANCE TO 10CFR PART 61

Seabrook Station will meet the waste characteristics requirements identified in 10CFR61.56(a). Seabrook Station's radwaste procedures ensure that wastes determined acceptable for near surface disposal are properly classified for the purpose of segregation at the disposal site. Waste classification is performed consistent with the guidance provided in the Branch Technical position pertaining to waste classification and is based upon the concentration of certain radionuclides in the waste form as given in 10CFR Part 61.55. Seabrook Station will meet these requirements by measuring gamma-emitting radionuclides and by using interim correlation factors based on calculational methods described in the EPRI report "Radionuclide Correlations in Low-Level Radioactive Waste". The methods utilized by Seabrook Station for determining radionuclide concentration of the final waste form is conducted in accordance with Seabrook Station procedure CP5.1.

The stability requirements of 10CFR61.55(b) for Class B and C waste forms will be met by the conformance testing program as demonstrated to the NRC in the Waste-Chem transmittal of August 1984. This program simulates the Seabrook Station waste streams (bead resins, boric acid and decontamination wastes) and includes the following tests:

- compressive strength
- radiation stability
- biodegradation
- leaching
- immersion
- thermal degradation

Completed test data for Class B and C waste forms will be submitted when all results are finalized.

VI. TEMPORARY RADWASTE PROCESSING (CONTRACTED VENDOR)

In the event Seabrook Station requires the services of a contracted vendor to temporarily process and package radwaste on site, NHY will obtain the services of a vendor with an NRC approved topical report.

An engineering review on the contracted vendor's topical report will be performed to assure vendor operational requirements are compatible with Seabrook Station system operations responsibility.

In all cases, safety and ALARA concerns will be the primary goal for any temporary radwaste system interface. The services and plant interfaces available will consist of, but are not limited to the following:

- o fire protection
- o health physics support
- o potable and demineralized water
- o plant service air
- o electric power
- o plant specific procedure training
- o plant badging
- o connections to plant systems
- o waste and chemical analysis in support of vendor's PCP verification

VII. ADMINISTRATIVE CONTROLS

Administrative controls are utilized to ensure that all processing is performed in accordance with the guidelines set forth in Seabrook Station's PCP. New Hampshire Yankee is responsible for performing that function through radwaste operating and administrative procedures and through Seabrook Station's Operational Quality Assurance Program. These controls are designed to assure that the generated waste forms are acceptable for off-site shipment and that that acceptability is verified by QA. The responsibilities of the Operational Quality Assurance Program includes:

- measures to assure control of activities affecting the function of structures, systems and components.
- planned monitoring and audit programs that assure specified requirements of the operational QA program are met.
- coordinated and centralized quality assurance, direction, control and documentation as required by the applicable portions of 10CFR50 Appendix B are complied with.
- management controls are established for the safe operation of Seabrook Station.

VIII. QUALITY ASSURANCE

Implementation of the New Hampshire Yankee (NHY) Operational QA Program is assured by ongoing review, surveillance and audit functions which fall under the direction of the Nuclear Quality Manager who reports to the Vice President and Director of Quality Programs.

The authority vested in the Nuclear Quality Manager is as follows:

- independence to interpret quality requirements
- identify quality problems and trends
- provide recommendation or solutions to quality problems

The Nuclear Quality Manager has the authority to stop work when significant conditions, adverse to quality, require action.

The NHY Operational QA Program assures compliance with the waste classification and characterization requirements of 10CFR61.55 and 10CFR61.56. With respect to waste classification, this is achieved by the Nuclear Quality group verifying proper adherence to waste classification procedures and review and verification of waste classification data sheets. A Nuclear Quality Group representative shall observe waste classification procedure adherence from a single batch waste processing operation.

With respect to waste characterization, the requirements of 10CFR61.56(b) are intended to provide stability of the waste. Stability is intended to ensure that waste does not structurally degrade and affect overall stability of the waste disposal site. The auditing and surveillance function of the NHY Operational QA Program assures stability requirements are achieved in accordance with 10CFR61.

In the event a vendor is contracted to perform temporary radwaste services, the NHY Operational QA Program requires management review of the vendor topical report. The purpose of this review is to assure that vendor operation and requirements are compatible with responsibilities and operation of Seabrook Station. The contracted vendor shall comply with all QA requirements described in this document.

IX. TRAINING

The training program will be implemented for personnel having responsibilities related to waste processing operations. This training program shall ensure that waste processing will be performed within the specific requirements of the PCP. To accomplish this objective and to provide the necessary control of the SWMS, the following general training programs will be implemented.

A. Initial Plant Staff Training Program

These programs are designed to provide competent, trained personnel in all disciplines and at all levels of plant organization. The programs are designed to allow personnel to be placed at various points, according to their training, experience and intended position.

B. Detailed System Instruction

Seabrook Station will provide management approved detailed instructions and operating procedures to all personnel involved in the transfer, packaging and transport of low-level radioactive material. This training will include familiarity with all relevant systems and subsystems of the SWMS.

C. Regulatory Requirement Instruction

Seabrook Station will also provide training and periodic retraining in the DOT and NRC regulatory requirements, waste burial requirements and in-station procedures for all personnel involved in the transfer, packaging and transport of radioactive material.

X. DOCUMENT CONTROL AND RECORDS RETENTION

NHY Operational QA Program audits and surveillance of waste classification records are performed on a periodic basis. Management evaluation of such audits shall be performed and as such satisfy the requirements of 10CFR20.311(f) (5).

Seabrook Station will utilize the radioactive shipment record forms as presented in Appendix C in accordance with the station's shipping procedures for manifest preparation. Data contained in the form includes all required information as per 10CFR20.311. The tracking system for manifest preparation shall be in accordance with Seabrook Station shipping procedures.

XI. REVISIONS TO THE PCP

New Hampshire Yankee proposed revisions to the Seabrook Station PCP will receive SORC approval. These revisions may be initiated as a result of proposed plant operations, system design changes, maintenance requirements, ALARA concerns or temporary vendor interface.

The PCP, if revised, shall be submitted to the NRC with the Semi-Annual Radioactive Effluent Release Report.

APPENDIX A

SEABROOK VRS SYSTEM

METHODOLOGY FOR DETERMINING FEED SYSTEM FLOWRATES

Methods for Determining Feed System Flowrates

Sample Parameters

For all waste types, a sample must be taken of the batch to be processed. This sample will be analyzed to determine the following:

1. Waste type (i.e., resin slurry or concentrates).
2. Total solids content (by weight %).
3. Specific gravity.
4. pH (to verify pH meter reading).
5. Isotopic analysis as required for shipment and burial.

With this information available, the operator can then calculate the initial settings of waste feed rate, and asphalt feed rate.

Definitions	Units/Type
EER - extruder/evaporator evaporative rate	lbs/hr
WFR - waste feed rate	lbs/min
CFR - centrifuge feed rate	lbs/min
CMC - resin cake moisture content	0.XX
CDE - centrifuge discharge efficiency	0.XX
CSC - resin cake solids content	0.XX
SSC - slurry solids content	0.XX
AFR - asphalt feed rate	lbs/min
WSC - slurry/concentrates solids content	0.XX
SG - specific gravity	NA

Centrifuge Feed

$$CFR = \frac{(EER)(CSC)}{(CMC)(CDE)(SSC)(60)}$$

$$AFR = \frac{(EER)(CSC)}{(CMC)(60)}$$

Slurry/Concentrates Feed

$$WFR = \frac{EER}{(1-WSC)(SG)(60)}$$

$$AFR = \frac{(EER)(WSC)}{(1-WSC)(60)}$$

$$\text{Ratio Setpoint} = \frac{AFR}{WFR}$$

APPENDIX B

RADIOACTIVE WASTE PROCESSING PROCEDURES

WN0595.001	Auxiliary Boiler Start-Up
WN0595.002	Auxiliary Boiler Shutdown
WN0595.003	Auxiliary Boiler Wet-Lay-Up
WN0595.004	Auxiliary Boiler Blowdown
WN0595.005	Asphalt System Start-Up and Recirc
WN0595.006	Asphalt System Shutdown
WN0595.007	Extruder/Evaporator Utility Manifold Start-Up
WN0595.008	Extruder/Evaporator Utility Manifold Shutdown
WN0595.009	Seal Water System Start-Up
WN0595.0010	Seal Water System Shutdown
WN0595.0011	Spent Resin Recirc, Dewatering, and Transfer
WN0595.0012	Extruder/Evaporator Processing
WN0595.0013	Alternate Solidification
WN0595.0014	Concentrates Transfer to Waste Feed Systems
WN0595.0015	Forced Circulation Evaporator - Crystallizer System Start-Up
WN0595.0016	Forced Circulation Evaporator - Crystallizer System Shutdown
WN0595.0017	Caustic System Transfer and Flush
WN0596.001	Fill Station and Monorail Operation
WN0596.002	Conveyor - Capper/Seamer System Operation
WN0596.004	30 Ton Overhead Bridge Crane
WN0596.005	CCTV System Operation
WN0596.006	CGR Compactor Operation
WN0596.007	Liner Filling and Capping Operation
WN0598.001	Spent Filter Transfer Cask Operation

RADIOACTIVE WASTE SHIPPING PROCEDURES

WX0597.001	Receipt of Radwaste Shipment Vehicles
WX0597.002	Receipt Inspection, Storage and Inventory of Radioactive Material Shipping Packages
WX0597.003	Shipping Criteria
WX0597.004	Shipping Special Form Radioactive Material
WX0597.005	Shipping Low Specific Activity (LSA), Radioactive Material
WX0597.006	Shipping $\leq A_2$ Quantities of Radioactive Material
WX0597.007	Shipping $> A_2$ Quantities of Radioactive Material
WX0597.008	Shipping Limited Quantities of Radioactive Material
WX0597.009	Shipping Radioactive Instruments & Articles
WX0597.0010	Shipping Fissile Radioactive Material
WX0597.0011	Shipping Highway Route Controlled Quantities of Radioactive Material
WX0597.0012	Shipping Empty Radioactive Packaging
WX0597.0013	Dry Active Waste (DAW) - Curie Calculation
WX0597.0014	Volume Allocation and Prior Notification

CHEMISTRY SAMPLING PROCEDURES

CX910.03	Radwaste Liquid Sampling
CX910.04	Boron Recovery System Sampling
CP 5.1	Isotopic Characterization of Radwaste

BARNWELL WASTE MANAGEMENT FACILITY

Operated by: CHEM-NUCLEAR SYSTEMS, INC.
P. O. Box 726, Barnwell, South Carolina 29812
(803) 259-1781

RADIOACTIVE SHIPMENT MANIFEST FORM

(1) GENERATOR NAME _____

ADDRESS _____

_____

CITY _____ STATE _____

CONTACT _____ PHONE _____

(2) consigned to:
CHEM-NUCLEAR SYSTEMS, INC.
P. O. BOX 726, OSBORN ROAD
BARNWELL, S.C. 29812

(3) USE THIS NUMBER ON ALL CONTINUATION PAGES — VOLUME ALLOCATION NO. _____ PAGE ____ OF ____

(4)
CARRIER _____ ADDRESS _____
TELEPHONE _____ SHIPPING DATE _____
SHIPMENT TYPE _____ SHIPMENT SURFACE EXPOSURE _____ mR/hR
SHIPMENT NO. _____ LINER SERIAL NO. _____
DRIVER SIGNATURE _____ DATE _____

(5) TOTAL FOR EACH CLASS		PROPER SHIPPING NAME & HAZARD CLASS (PER 49 CFR 172.101)	ID NUMBER
NO. OF PACKAGES	WEIGHT (Pounds)		
		Radioactive Material, empty packages	UN2908
		Radioactive Material, fissile, n.o.s.—Radioactive Material	UN2918
		Radioactive Material, low specific activity, n.o.s.—Radioactive Material	UN2912
		Radioactive Material, n.o.s.—Radioactive Material	UN2982
		Radioactive Material, limited quantity, n.o.s.—Radioactive Material	UN2910
		Radioactive Material, special form, n.o.s.—Radioactive Material	UN2974
		Radioactive Material, instruments and articles—Radioactive Material	UN2911
		Other (Specify)	

(6) SHIPMENT TOTALS

VOLUME (Cubic Feet)	TOTAL NO. OF PACKAGES	ACTIVITY (10CFR 20.311) ☐ Curies ☐ Millicuries					SOURCE (Pounds)
		ALL ISOTOPES	TRITIUM	C-14	Tc-99	I-129	

(7) TOTAL SNM

ISOTOPE	GRAMS
U-233	
U-235	
TOTAL	

(8) TOTAL PALLET VOLUME (CU. FT.) _____

(9) WASTE DESCRIPTION _____

(10) PHYSICAL FORM/ SOLIDIFICATION AGENT _____

(11) CHEMICAL FORM AND NAME AND % OF CHELATING AGENT(S) _____

(12) WASTE FORM CLASS ☐ A ☐ B ☐ C

(13) ( ) Yes ( ) No THIS VEHICLE IS CONSIGNED EXCLUSIVE USE. LOADING AND UNLOADING MUST BE ACCOMPLISHED BY CONSIGNOR OR CONSIGNEE OR HIS DESIGNATED AGENT.

(14) IMPORTANT: "This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation."

Signature _____

Company _____ Date _____

(15) "Certification is hereby made to the South Carolina Department of Health and Environmental Control that this shipment of low level radioactive waste has been inspected in accordance with the requirements of South Carolina Radioactive Material License No. 097 as amended, and the Nuclear Regulatory Commission's License No. 12-13536-01 as amended, and the effective Barnwell Site Disposal Criteria within 48 hours prior to shipment, and further certification is made that the inspection revealed no items of non-compliance with all applicable laws, rules and regulations."

Date: _____ By: _____

Title and Organization _____

Telephone No. ( ) _____

CNSI USE ONLY

☐ This material meets all license requirements.

☐ This material was disposed of in accordance with license.

☐ Discrepancy: _____

_____

_____

_____

Date: _____

Authorized Signature _____ Title _____

CUSTOMER'S COPY

Form No. CNS-201
(9-83)

SEE INSTRUCTIONS ON REVERSE SIDE FOR FILLING OUT THIS FORM

Arrival Date _____ Arrival Survey No. _____

Date/Time Buried _____ H. P. Initial _____

Trench No. _____ Location Code _____

Waste Class. Code _____

_____ Personnel Exposure _____

APPENDIX C

BARNWELL WASTE MANAGEMENT FACILITY

Operated by: CHEM-NUCLEAR SYSTEMS, INC.

CONTINUATION SHEET

GENERATOR NAME ______________________

USE THIS NUMBER ON ALL CONTINUATION PAGES VOLUME ALLOCATION NO.

PAGE _____ OF _____

(16) ITEM NO.	(17) RADIO NUCLIDE EACH CONTAINER	(18) PERCENT OF ACTIVITY EACH NUCLIDE	(19) ACTIVITY EACH CONTAINER (mCi)	(20) PHYSICAL FORM	(21) CHEMICAL FORM AND NAME & % OF CHELATING AGENT	(22) WASTE DESCRIPTION	(23) WASTE FORM CLASS	(24) STABILITY CLASS (S. U)	(25) SPECIAL NUCLEAR MATERIAL (grams)	(26) SOURCE MATERIAL (pounds)	(27) DISPOSABLE CONTAINER WEIGHT (pounds)	(28) DISPOSABLE CONTAINER VOLUME (Cu. Ft.)	(29) CONTAINER TYPE	(30) RADIATION LEVELS CONTAINER SURFACE (mR/HR)	(30) RADIATION LEVELS 1 METER mR/HR	(31) CONTAMINATION CONTAINER SURFACE (DPM/100cm2) Alpha Beta Gamma	(32) D.O.T. SUB-TYPE (A1, A2, LSA, etc.)	(33) FISSILE CLASS	(34) LABELS/ MARKINGS USED
																			Radioactive –
																			Radioactive –
																			Radioactive –
																			Radioactive –
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Form No. CNS-201
(9-83)

CUSTOMER'S COPY

APPENDIX C

RPV 1-84

RADIOACTIVE WASTE SHIPMENT & DISPOSAL MANIFEST

US ECOLOGY, INC.

EXECUTIVE OFFICE: (502) 426-7160
P.O. BOX 7246 • LOUISVILLE, KENTUCKY 40207

PAGE 1 OF ______ USE THIS NO ON ALL CONTINUATION PAGES ➔ 49331

GENERATOR NUMBER ___ ___ - ___ - ___

(1) GENERATOR NAME ______
ADDRESS ______
CITY ______ STATE ______ ZIP ______
CONTACT ______ PHONE ______
USER PERMIT # ______ SHIPMENT # ______

(2) BILL DISPOSAL CHARGES TO ______
NAME ______ PURCHASE ORDER # ______
ADDRESS ______
CITY ______ STATE ______ ZIP ______

(3) AGENT BROKER ______
BROKER'S US ECOLOGY # ______
ADDRESS ______
CITY ______ STATE ______ ZIP ______
CONTACT ______ PHONE ______
BROKER SHIPMENT # ______ BROKER USER PERMIT # ______

Broker's Authorized Signature Acknowledging Waste Receipt ______ Date

(4) CONSIGNED TO
☐ P.O. BOX 638 Hanford Reservation Richland, WA 99352 509-377-2411
☐ P.O. BOX 578 HWY 95, 12 mi. So. of Beatty, NV 89003 702-553-2203
☐ OTHER
CONTACT ______
ADDRESS ______
CITY ______ STATE ______ ZIP ______
PHONE ______

(5) CARRIER ______ SHIPPING DATE ______
CARRIER EPA # (if any) ______
ADDRESS ______
CITY ______ STATE ______ ZIP ______
PHONE ______
CASK TYPE ______ CASK SURFACE EXPOSURE RATE ______ mR/hr

(6)

TOTAL FOR EACH CLASS		PROPER SHIPPING NAME & HAZARD CLASS (PER 49 CFR 172	ID NUMBER
# OF PACKAGES	WEIGHT (Pounds)		
		Radioactive Material, empty packages	UN2908
		Radioactive Material, fissile, n.o.s. – Radioactive Material	UN2918
		Radioactive Material, low specific activity, n.o.s. – Radioactive Material	UN2912
		Radioactive Material, n.o.s. – Radioactive Material	UN2982
		Radioactive Material, limited quantity, n.o.s. – Radioactive Material	UN2910
		Radioactive Material, special form, n.o.s. – Radioactive Material	UN2974
		Radioactive Material, instruments and articles – Radioactive Material	UN2911
		Thorium Nitrate – Radioactive Material	UN2976
		Uranyl Acetate (RQ-5000/2270) – Radioactive Material	NA9180
		Uranyl Nitrate, solid (RQ-5000/2270) – Radioactive Material	UN2981

(7) SHIPMENT TOTALS (DO NOT WRITE IN SHADED AREAS)

VOLUME (cu ft)	TOTAL # OF PACKAGES	SOURCE MATERIAL (kgs)	SPECIAL NUCLEAR MATERIAL (grams) U-233	U-235	PLUTONIUM	TOTAL

ACTIVITY

ACTIVITY TOTALS: ☐ Curies ☐ Millicuries (10CFR20.311)	TRITIUM	C-14	Tc-99	I-129	ALL ISOTOPES

(8) THIS IS TO CERTIFY THAT THE HEREIN NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION AND ARE IN COMPLIANCE WITH ALL REQUIREMENTS APPLICABLE AT THE DESIGNATED DISPOSAL SITE AND THAT THE MATERIALS ARE CLASSIFIED AND DESCRIBED IN ACCORDANCE WITH THE REQUIREMENTS OF 10CFR PART 61 AND PART 20.311 OR EQUIVALENT STATE REGULATIONS.

Authorized Signature ______ Title ______ Date ______

TERMS AND CONDITIONS

A. TITLE: Upon inspection and acceptance at the disposal site by US Ecology and all appropriate regulatory authorities, title to the Waste which conforms to Company's representations herein shall thereupon transfer from the Customer and be vested in US Ecology.

B. WASTE PRODUCTS: Customer represents and warrants that data set forth in this Radioactive Waste Shipment & Disposal Manifest is true and correct in all respects and in accordance with all applicable governmental laws, rules, regulations and the designated facility license.

C. INDEMNIFICATION: Customer agrees to indemnify US Ecology, its officers, employees and agents against all loss and liability whatsoever if such loss or liability results from the failure of the Waste to conform in all material respects to the data supplied on the Radioactive Waste Shipment & Disposal Manifest or this shipment fails to meet the standards prescribed by the Department of Transportation or any other governmental agency having jurisdiction over such matters.

FOR US ECOLOGY'S USE ONLY

TYPE OF CONTAINER	CONTAINER VOLUME CU. FT.	# OF PKGS.	CU. FT. PER CONTAINER TYPE
DRUMS			
OVERPACK			
55	7.50		
30	4.01		
5	0.67		
OTHER			
BOXES			
1st SIZE			
2nd SIZE			
3rd SIZE			
CASK LINERS			
OTHER			
OTHER			
SHIPMENT TOTALS			

LOAD EVALUATION

CHECK ALL THAT APPLY TO THIS LOAD. DESCRIBE INADEQUACIES IN COMMENT SECTION
☐ Manifest Waste Description Inadequate
☐ Contamination or Leakage Detected
☐ Unexpected Exposure Rates Detected
☐ No Violations Detected on this Load
☐ Bracing Inadequate
☐ Labels, Markings, etc. Inadequate
☐ Container Integrity Inadequate
☐ Other

DESCRIBE THE EXTENT OF ANY VIOLATION CHECKED ABOVE AND THE REMEDIAL ACTION TAKEN

☐ CHECK HERE IF A SUPPLEMENTAL REPORT IS ATTACHED

BURIAL DATA

CONTAINER SEPARATION ___, ___, ___
(Code all that apply to this load)
CODES: for use (DMH) ... 1; 4ft. waste (DMH) ... 2
10ft. between upright containers (Gates) ... 3
10ft. cover/sloping applied 1% to inflation ... 4
Other ... 5; No requirement ... 6

WASTE CATEGORY	HIGH B.W.	CLASS A	CLASS B	CLASS C
DEPTH IN FEET				

Date Received ______
Date Disposed ______
Trench No. ______
☐ This material meets licensed limits.
☐ This material was disposed of in accordance with license.
AUTHORIZED INITIALS

US ECOLOGY INVOICE # ___ – ______
US ECOLOGY CUSTOMER # ______ (Must agree with Agent named in Block 2)
US ECOLOGY INVOICE DATE ___ MO ___ DY ___ YR
DISCREPANCY CODE(S) ___, ___, ___, ___, ___

BATES #

CONSIGNEE ORIGINAL COPY

(MUST ACCOMPANY WASTE IN TRANSIT)

APPENDIX C

GENERATOR NO ______________________

GENERATOR NAME ______________________

AGENT/BROKER ______________________

US ECOLOGY, INC.

CONTINUATION SHEET

REV. 1/84

MANIFEST # __________

PAGE ______ OF ______

[illegible]	[illegible]	(11) Container Volume (Cu Ft)	(12) Container Weight (pounds)	(13) Physical Form	(14) Waste Description (See Note #1)	(15) Solidification or Absorbent Media (See Note #2)	(16) Chemical Form/ Chelating Agent (10CFR20.311)	Check Below if > 0.1% Chelating Agent by Weight	(17) Radionuclide (10CFR20.311)	(18) Activity ☐ Curies ☐ Millicuries (10CFR20.311)	(19) D.O.T. Sub-Type (A₁, A₂, LSA, etc.)	(20) Special Nuclear Material (Grams)	(21) Source Material (Kilograms)	(22) Waste Form Class 10CFR 61.55	(23) Stability class (See Note #3) 10CFR 61.56	Radiation Levels mR/hr (24) Disposal Container Surface	(25) Reserved for US Ecology Use Only	(26) Disposal Container At 1 Meter	(27) Transport Index	(28) Fissile Class	(29) D.O.T. Label 49CFR173.444
																					Radioactive -
																					Radioactive -
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(30) PAGE TOTALS

NOTE #1 - Waste Description Codes

2 Dry Solid
3 Solidified Liquid
4 Biological
7 Filter Media
8 Dewatered Resins
9 Solidified Resins
10 Absorbed Aqueous Liquid
11 Absorbed Organic Liquid
12 Scintillation (or organic) Liquid in Vials in Absorbent
13 Aqueous Liquid in Vials in Absorbent
14 Animal Carcasses in Absorbent
*99 Other

* ANY USE OF "OTHER" AS A DESCRIPTION MUST INCLUDE A WRITTEN AND SIGNED EXPLANATION ATTACHED TO THIS MANIFEST.

NOTE #2 - Solidified or Absorbent Media Codes

2 Speedi-Dry
3 Celatom (MP-78)
4 Floor Dry/Super Fine
5 Hi-Dri
6 Florco or Florco X
7 Instant-Dri
8 Safe-T-Sorb
9 Dri-Dri (Safe n Dri)
10 Zonolite Grades 2, 3, 4
11 Dow Media
12 Cement
13 Asphalt
14 Delaware Custom Media
15 Envirostone
16 Krohite
*99 Other

NOTE #3 - NRC Stability Class Code

S - Stable
U - Unstable

CONSIGNEE ORIGINAL COPY

(MUST ACCOMPANY WASTE IN TRANSIT)

APPENDIX C

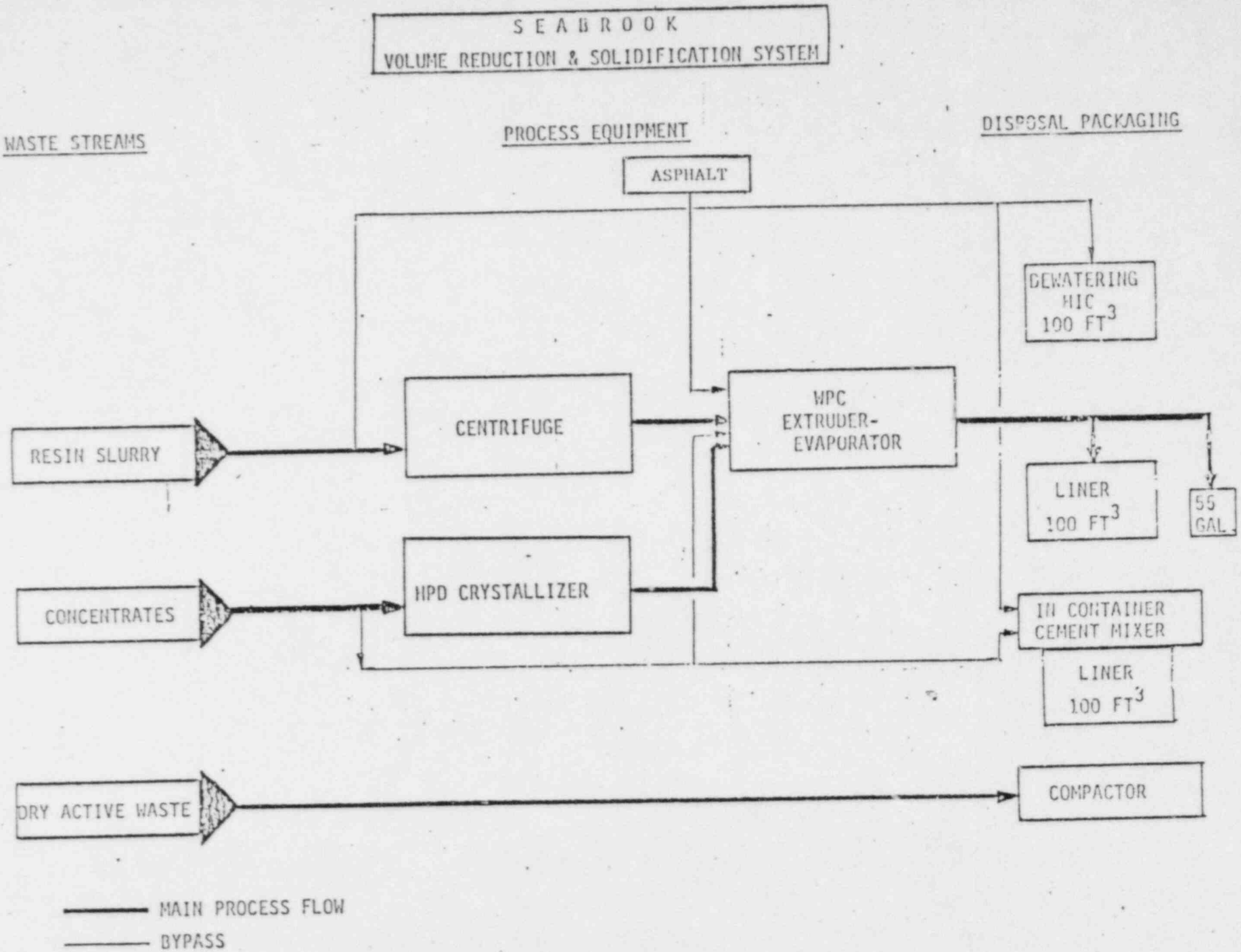

SEABROOK
VOLUME REDUCTION & SOLIDIFICATION SYSTEM
WASTE STREAMS
PROCESS EQUIPMENT
DISPOSAL PACKAGING
ASPHALT
DEWATERING
HIC
100 FT3
RESIN SLURRY
CENTRIFUGE
MPC
EXTRUDER-
EVAPORATOR
LINER
100 FT3
55
GAL
CONCENTRATES
HPD CRYSTALLIZER
IN CONTAINER
CEMENT MIXER
LINER
100 FT3
DRY ACTIVE WASTE
COMPACTOR
MAIN PROCESS FLOW
BYPASS

FIGURE 1

FIGURE 2

FORM
VRS. PROCESSING SHEET

DATE _____
TANK _____
BATCH NR. _____
MIN. ASPHALT FEED _____ gpm
MAX. WASTE FEED _____ gpm

pH _____

% SOLIDS _____
SP GRAVITY _____
TEMP. _____

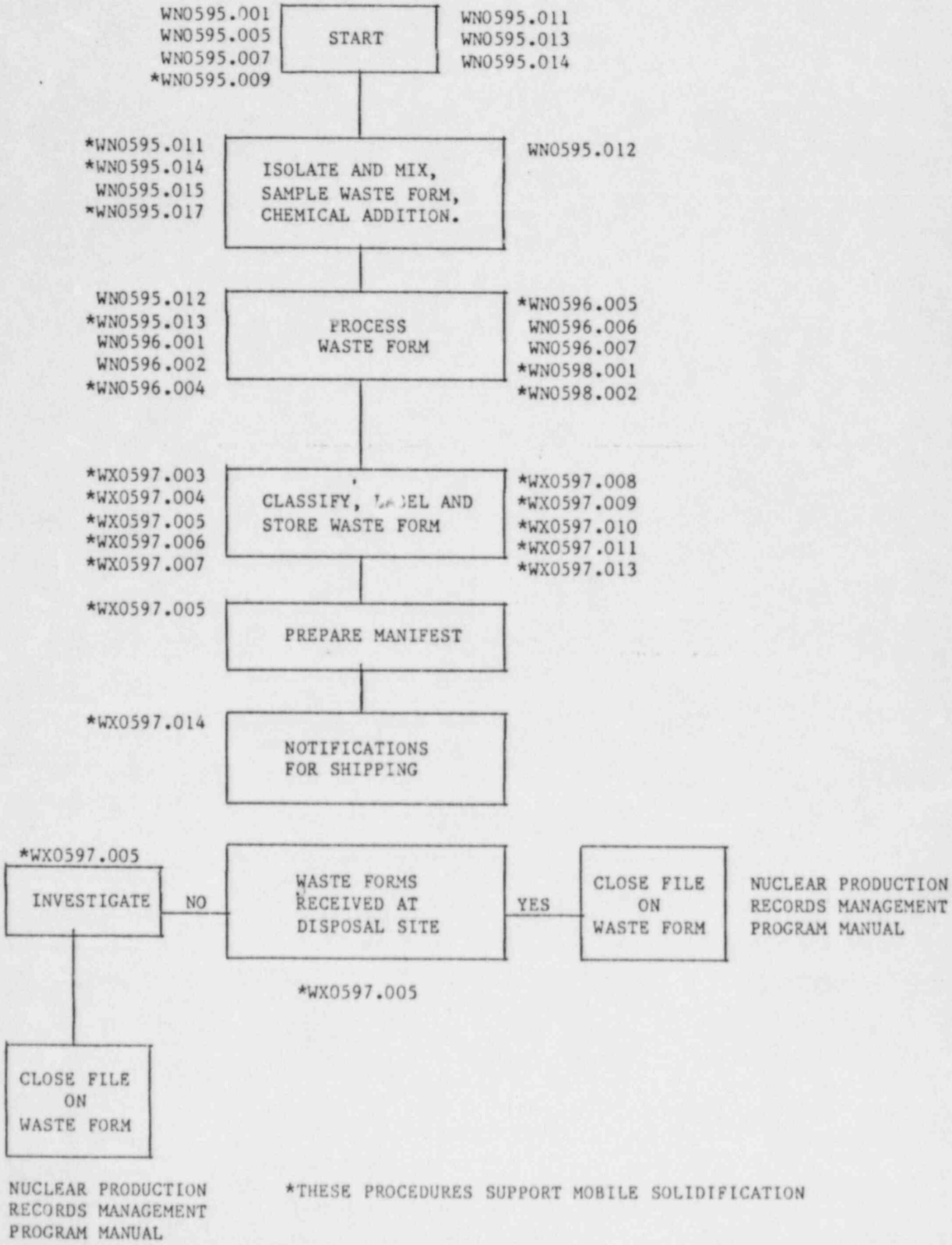
DRUM NO. _____
TANK START LEVEL _____
TANK START TIME/DATE _____
INIT. _____

TANK STOP LEVEL _____
TANK STOP TIME/DATE _____
INIT. _____

TIME	WASTE FLOW RATE (GPM)	ASPH FLOW (GPM)	DRUM LEVEL	TEMPERATURE PROFILE						
				1	2	3	4	5	6/7	8

FIGURE 3

SEQUENCE OF EVENTS FOR SOLID RADWASTE PROCESSING



*THESE PROCEDURES SUPPORT MOBILE SOLIDIFICATION