HWMA/RCRA PART B PERMIT

FOR THE

IDAHO NATIONAL LABORATORY

BOOK 1 OF 1

PER-140 – MATERIALS AND FUELS COMPLEX
SODIUM PROCESS FACILITY AND
SECONDARY SODIUM SYSTEM

ATTACHMENT 1

SECTION D – SODIUM PROCESS FACILITY (SPF)
PROCESS DESCRIPION

MODIFICATION DATE: December 5, 2012

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ATTACHMENTS

Attachments D-1 through D-40 are found in Book 2 of the original Permit Application

SPF HWMA Unit Attachments, as applicable, are found in the original Permit Application are as follows:

D-1 HWMA Unit Miscellaneous Containers
D-2 HWMA Unit Container Labeling
D-3 MFC ES&H Manual, 4.4I, Hoisting and Rigging and Load Testing Programs
D-4 Drawings and Photos of HWMA Unit Secondary Containment Devices
D-6 MFC Standard Process and instrumentation Symbols F0000-0016-ED-03 (Sheet 1 of 1)
D-23 SPF Sodium Reaction System Process Flow Diagram
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D. Process Description [IDAPA 58.01.05.008 and 012; 40 CFR 264 and 270]

In accordance with the requirements of Idaho Administrative Procedures Act (IDAPA) 58.01.05.008 and 012; 40 Code of Federal Regulations (CFR) 264 and 270, this section of the Hazardous Waste Management Act (HWMA)/Resource Conservation Recovery Act (RCRA) Permit provides process-related information for the SPF HWMA units described in this Permit. For reference, the locations of the SPF HWMA units discussed in this section are shown in this Permit in Attachment 1, Section B, MFC Facility Description.

The information provided in this section is organized by subsection as follows:

- Subsection D-1, HWMA Unit Process Description Overview
- Subsection D-2, Containers and Container Management Practices
- Subsection D-3, Basic System Descriptions
- Subsection D-4, Tanks and Tank Management Practices

D-1 HWMA Unit Process Description Overview

The MFC HWMA units will be used to perform a variety of processes (services) for both on-Site[1] and/or off-Site HW/MW generators. The services conducted by ICP operations at the MFC SPF HWMA units allow for the safe and efficient handling of characteristic HW/MW (ignitable, reactive, corrosive, toxic metal) and/or listed HW/MW.

The HWMA unit waste acceptance criteria (WAC) will determine the types of HW/MW that can be received at a HWMA unit and the types of HW/MW services that can be performed.

The services performed at the HWMA units include:

- Storage of HW/MW in containers and/or tanks or as debris
  - Prior to, during and/or following verification/sampling, repackaging and/or treatment.

1. On-Site means HW/MW generated at a facility physically located on the INL site or HW/MW from a generator that is a contractor or subcontractor, and physically located on the INL site

- Verification or sampling of HW/MW to facilitate
  - Use in treatability studies
  - Storage and/or treatment at an MFC or off-Site HWMA unit
  - Acceptance at INL or off-Site disposal facilities.
- Repackaging of HW/MW to facilitate
  - Use in treatability studies.
  - Storage and/or treatment at an MFC or off-Site HWMA unit
  - Acceptance at INL or off-Site disposal facilities.
- Container treatment of HW/MW including
  - Absorption (waste with free liquids)
  - Neutralization (corrosive wastes)
  - Solidification (liquid/sludge wastes)
  - Stabilization (liquid/sludge waste with metals)
  - Melting and draining (reactive metals).
- Tank treatment of HW/MW including
  - Neutralization (corrosives)
  - Deactivation (ignitable/reactive waste).
- Debris treatment including
  - Water spraying and water washing.

The maximum HW/MW storage capacities of each HWMA unit and the annual quantities of the HW/MW to be managed (stored, verified/sampled, repackaged and/or treated) at the HWMA units are provided in the Permit, Attachment 1, Facility Description, Part A. A matrix of the EPA hazardous waste numbers (HWNs) (also known as waste codes) that can be received/managed at the SPF HWMA units, the HW/MW services (processes) performed these HWMA units, and the types HW/MW types (forms) accepted is provided in this Permit in Attachment 1, Facility Description, Section B, MFC Facility Description, Table B-1.

Brief descriptions of the services performed at the HWMA units (HW/MW storage, verification/sampling, repackaging and/or treatment) are provided below.

D-1(a) Basic HW/MW Service Descriptions

D-1(a)(1) Storage of HW/MW

Hazardous waste (HW)/mixed waste (MW), with and without free liquids, may be received and stored in containers, tanks and/or as debris while in the HWMA units prior to, during and/or following verification/sampling, repackaging and/or treatment. The HW/MW may be stored in original containers or repackaged containers or in process equipment (tanks/containers) during treatment. Services performed at the hazardous waste management area (HWMA) units during storage may include inert atmosphere container opening, sampling prior to treatment, nondestructive assay (NDA) and safety evaluations. Because the SPF HWMA units are heated and air filtered, they are well suited for these activities.

The ability to store the HW/MW in the HWMA units may be necessary following generation and/or receipt of the HW/MW prior to the preparation of HW/MW for final disposal.

The types of containers, tanks and/or containerized debris that may be received/stored at the HWMA units include (***but are not limited to***) the following:

- Cans, drums, boxes and bins
  - 1 pint to 8 gal cans
  - 5 to 71 gal drums
  - 83 to 100 gal overpack drums
  - Standard/nonstandard waste boxes
  - Steel waste bins
  - Wooden waste boxes
  - Steel container assemblies (HFEF-5 and Sodium Loop Safety Facility [SLSF] cans).
- Operational components and process equipment
  - Piping/pumps
  - Heat exchangers
  - Cold/nuclide traps
  - Shipping vessels
  - Transfer tanks

- Storage tanks
- Process tanks.

- Debris

  - Pipes
  - Valves
  - Scrap metal
  - Industrial equipment
  - Geological material.

The MFC SPF HWMA units can store HW/MW and are identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1. HWMA/RCRA designated container, tank and/or containerized debris storage areas within each of the HWMA units are shown in the facility arrangement schematics provided in this Permit in Attachment 1, Section B, MFC Facility Description, and its associated attachments. The maximum storage capacities for each HW/MW container and/or tank storage area are also listed on the referenced schematics.

D-1(a)(2) Verification Sampling of HW/MW

HW/MW stored and/or received may require verification and/or sampling prior to repackaging, treatment and/or final disposal. The activities may include the following:

- Visual examination (fingerprint analyses) of the HW/MW to ensure that the container contents have been correctly identified through process knowledge and/or non-intrusive analysis

- Sampling and analysis of the HW/MW while in the original container to establish and/or validate HW/MW characteristics

- Removal of HW/MW samples for testing and analysis purposes, NDA and safety evaluations.

The SPF HWMA units are well suited for these activities because they are heated and air filtered. Following verification/sampling activities, the HW/MW may be repackaged and will then be stored, and/or treated, or transferred to the HWMA unit where it may be opened to perform verification, repackaging, and/or container treatment.

HW/MW certifications, data, and samples all result from the process of conducting HW/MW verification and/or sampling. Data is reduced and validated in accordance with generator requirements and provided to the generator. Samples are sent to qualified laboratories for testing/analysis. Following verification and/or sampling activities the HW/MW is returned to the generator.

The SPF HWMA units can perform HW/MW verification and/or sampling services as identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1.

D-1(a)(3) Repackaging HW/MW

HW/MW stored and/or received may require repackaging. This involves removal and transfer of HW/MW from the original container to a new container, by the treatment facility, under, but not limited to, the following circumstances:

- HW/MW is stored in nonstandard containers (i.e., vessel, cold trap, tank) or in a form incompatible with an on-Site or off-Site treatment unit equipment or processes (i.e., solid, liquid)
- HW/MW may require sorting and segregating (followed by repackaging) to meet an on-Site or off-Site treatment and/or disposal facility's WAC
- Original HW/MW container is unacceptable for storage and/or disposal due to deterioration or configuration.

Repackaging activities will include:

- Sorting and segregating the HW/MW by waste type (i.e., solid, liquid, debris) into a container compatible for storage or treatment and disposal
- Transferring the HW/MW from one container to another container while meeting the definition of treatment (i.e., sizing, compaction, etc).
- Heating/melting (if necessary) the HW/MW using portable heaters
- Transferring (e.g., pumping/draining) the HW/MW from the original container (using a transfer system such as a vacuum pump) into a container compatible for storage or treatment processes.

These repackaging activities will typically be performed within a containment/confinement consisting of a work tent, controlled area and/or glovebox for radiological control.

The MFC SPF HWMA units can perform HW/MW verification and/or sampling services as identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1.

D-1(a)(4) Absorption of Free Liquids in HW/MW

HW/MW stored and/or received for verification/sampling and/or repackaging may have limited amounts of free liquids that require absorption to meet storage, transport and/or waste disposal criteria. If liquid is found in HW/MW containers during verification/sampling and/or repackaging activities, the liquid will be absorbed so that the containers can safely be stored, transported and/or disposed. Specifically during verification and/or repackaging activities, any liquid will be absorbed by rearranging the absorbent originally packed in the drum. If rearranging the existing absorbent is inadequate, additional clean absorbent will be placed in the container or, if necessary due to volume increase, the additional absorbent and the HW/MW will be transferred to a larger container. If liquid is found in a sludge drum prior to core sampling, its volume is determined. A sample of the liquid may be drawn and may be shipped to a laboratory for analysis. After coring, the unused portion of the core sample is returned to the drum. Absorbent will then be added in quantities sufficient to absorb the free liquid

Following the treatment, free liquid absorption effectiveness will be determined by conducting a visual inspection to ensure no free liquids are present in accordance with specified requirements (i.e., disposal or transport).

The MFC SPF HWMA units can perform HW/MW verification and/or sampling services, as identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1.

D-1(a)(5) Neutralization of Corrosive HW/MW

HW/MW stored and/or received may require neutralization or pH adjustment ($2 < pH < 12.5$) following an initial treatment process or prior to solidification/ stabilization in preparation for disposal. These situations could include (but are not limited to) corrosive HW/MW produced in the SPF HWMA units or containerized liquid corrosive HW/MW received at the SPF HWMA units. These corrosive solutions or liquids can be neutralized by neutralizing the corrosive liquids.

Neutralization will be performed to within an acceptable pH range (2 < pH < 12.5) to deactivate the corrosive characteristic and/or to obtain the optimum pH for subsequent solidification/stabilization of the neutralized solutions.

Following neutralization, pH will be determined by conducting pH analysis to ensure the corrosive solutions meet HWMA/RCRA Universal Treatment Standards (UTS).

The MFC SPF HWMA units perform HW/MW neutralization, as identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1. The SPF HWMA/RCRA designated container and/or tank treatment areas are shown in the facility arrangement schematics provided in this Permit in Attachment 1, Section B, MFC Facility Description. The maximum daily process rates for each HW/MW container and/or tank treatment area are provided in this Permit in Attachment 1, Facility Description, Part A.

D-1(a)(6) Solidification/Stabilization of HW/MW

Solidification or stabilization will be performed, as necessary, to meet UTS and/or disposal facility WAC. The solidification/stabilization procedure and the type and amount of solidification/stabilization agent used are based on the analysis of a representative sample of the waste and/or toxic metal contaminated HW/MW solution taken prior to solidification/stabilization. The solidification/stabilization procedure/agent used falls under one of the following practices:

- A previously approved Waste Analysis Plan (WAP) and treatment procedure
- An approved WAP and treatment procedure determined by treatability study/bench-scale testing, or recommended usage and specifications provided by agent manufacturers. Solidification/stabilization agents may include natural materials such as vermiculite, silicates, clays or cellulose, or synthetic materials such as absorbent polymers.
- Recommended usage and specifications provided by agent manufacturers. Solidification/stabilization agents may include natural materials such as vermiculite, silicates, clay or cellulose, or synthetic materials such as absorbent polymers.

Solutions requiring solidification/stabilization are transferred directly to an empty container or to a fixed solidification system. Solidification/stabilization can also be performed in the original HW/MW container, if appropriate.

Following the solidification/stabilization procedure, a representative sample is taken and is then analyzed to ensure that the HW/MW meets UTS.

The MFC SPF HWMA units can perform HW/MW solidification/stabilization, as identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1. The SPF HWMA/RCRA designated container and/or tank treatment areas are shown in the facility arrangement schematics provided in this Permit in Attachment 1, Section B, MFC Facility Description. The maximum daily process rates for each HW/MW container and/or tank treatment area are provided in this Permit in Attachment 1, Facility Description, Part A.

D-1(a)(7) Deactivating Ignitable and Reactive HW/MW

The ignitable and reactive characteristics of HW/MW can be deactivated (via water reaction) in the SPF sodium process system. In this system, the ignitable and reactive HW/MW reacts with water and ultimately forms a hydroxide solution as illustrated in the following reaction (as shown for sodium [Na]):

Direct Water Reaction in SPF

$$2Na + 2H_2O \rightarrow 2NaOH + H_2 + heat$$

The hydroxide solutions produced from these direct reactions with water drain into SPF tank storage and/or treatment systems designed to further neutralize and/or process the hydroxide solutions to a form acceptable for final land disposal.

Following the deactivation, a representative sample of the hydroxide solution may be taken and analyzed to ensure that UTS can be met.

The MFC SPF HWMA units can perform deactivation, as identified in this Permit in Attachment 1, Section B, MFC Facility Description, Table B-1. HWMA/RCRA designated tank treatment areas within the SPF HWMA units are shown in the facility arrangement schematics provided in this Permit in Attachment 1, Section B, MFC Facility Description. The maximum daily process rates are provided in this Permit in Attachment 1, Facility Description, Part A.

D-1(a)(8) Heating and Melting for Repackaging

HW/MW received or stored in non-standard containers such as shipping vessels, process vessels, or tanks, may be incompatible with the SPF HWMA unit's treatment system or equipment and may require transfer or repackaging into a compatible feed or transfer container prior to continued treatment.

Heating and melting of the HW/MW (e.g., Na) may be necessary using portable strap heaters or steam. Once the HW/MW is melted, it can be transferred by pumping and vacuum draining from the original container into a container compatible with the HWMA unit's treatment processes. This activity may be performed within a containment consisting of a work tent and/or glovebox for radiological control.

D-1(b) Flow Path of HW/MW Services

The purpose of this subsection is to briefly describe the services that the MFC SPF HWMA units provide. Brief descriptions of these services are provided in following subsections.

D-1(b)(1) HW/MW Generator Specifications

To acquire SPF HWMA unit services, the generator specifies the desired services and specific requirements, which is needed. HWMA unit personnel then determine whether the desired services can be performed. If HWMA unit personnel determine the desired services can be performed, then the generator provides information needed to verify that HWMA unit WAC can be met. This detailed information is provided to the Integrated Waste Tracking System (IWTS) Profile as described in this Permit in Attachment 2, Section C Waste Analysis Plan.

D-1(b)(2) HWMA Unit Approval to Accept HW/MW

HWMA unit personnel review and approve transfer/shipments of HW/MW to the SPF HWMA unit based on the generator's certifications.

D-1(b)(3) HW/MW Receipt at HWMA Units

Upon HW/MW receipt at the SPF HWMA units transfer area(s), HW/MW containers are inspected to ensure that received HW/MW is consistent with the generator's description of the HW/MW (such as labels, identification numbers, container condition, and radiation levels). Any noncompliant conditions or inconsistencies are documented as required by HWMA unit-specific procedures and the generator is contacted for assistance in the resolution. If discrepancies cannot be resolved, HW/MW is returned to the generator.

D-1(b)(4) Transfer of HW/MW to Storage

If as-received HW/MW is acceptable, it is transferred to a storage area until the requested services can be performed.

D-1(b)(5) Verification, Repackaging, and/or Container/Tank or Debris Treatment

Containers of HW/MW are transferred from the HWMA unit where it is stored to the HWMA unit where it will be opened and/or transferred to perform verification, repackaging, and/or container/tank or debris treatment. A variety of products result from the process of conducting verification, repackaging, and/or treatment. These include data, samples, repackaged generator HW/MW, and/or treated final HW/MW packaged for final disposal. Data is reduced and validated in accordance with generator requirements and provided to the generator. Samples are sent to qualified laboratories for testing/analysis. HW/MW is then packaged and transferred/shipped to the generator or another facility for disposal.

D-1(b)(6) Transfer of HW/MW to Storage Following Verification, Repackaging, and/or Container, Tank or Debris Treatment

Following completion of verification, repackaging, and/or treatment, the HW/MW is transferred to appropriate storage (HWMA/non-HWMA) until it is transferred/ shipped to a disposal facility.

D-1(b)(7) HW/MW Shipment to Generator

Containers of verified, repackaged, and/or treated HW/MW are prepared for transfer/shipment to the generator and may be placed in a staging or transfer area, pending shipment to the generator. Appropriate documentation is prepared for the HW/MW to be returned to the generator.

D-2 Containers and Container Management Practices [IDAPA 16.01.05.012; 40 CFR 270.15]

HW/MW (with and without free liquids) are currently stored or will be received from a variety of on-Site and off-Site facilities as described in this Permit in Attachment 1, Section B, MFC Facility Description. The HW/MW containers may be stored prior to, during, and/or following verification, repackaging, and/or treatment.

Types of Containers. The types of containers that may be received/stored at HWMA units are listed in Subsection D-1 and summarized in Table D-1.

Storage Area and Maximum Capacities. The maximum container storage capacity for each HMWA unit is provided in this Permit, Attachment 1, Facility Description, Part A. Container storage areas and maximum container storage capacities are also

shown on the HWMA unit facility arrangement schematic provided in this Permit in Attachment 1, Section B, MFC Facility Description.

Table D-1. Examples of Containers Accepted at HWMA Units.

Container Type	Description
Department of Transportation (DOT) Carbon-Steel Drums	Carbon-steel, 71-gal DOT-approved 7A closed-head drums that are externally-coated 16 gauge carbon steel with a crimped cover closure and 2 in. steel plug in the head. The internal dimensions of the drums are 22.5-in., diameter, by 33.25-in. tall. Carbon-steel, 55-gal DOT-approved 17C and UN-approved 1A2-Y1.7/150 open-head drums that are externally-coated 16 gauge carbon steel with a 2-in. steel plug in the head. The internal dimensions of the drums are 22.5-in., diameter, by 33.25-in. tall. These drums may have installed 90-mil molded polyethylene liners with an open or closed head.
DOT High-Density Polyethylene Drums and Pails	The polyethylene drums are high-density polyethylene, 55-gal, UN-approved 1H1/Y1.9/100 closed-head drums with threaded closure. The internal dimensions of the drums are 23.25-in., diameter, by 33.25-in. tall. The pails are high-density polyethylene, 5-gal, UN-approved 1H1/X1.8/100 closed-head pails with threaded closure and an external handle. The internal dimensions of the pails are 14.75-in., diameter, by 11.6-in. tall. Other types of drums and pails may be used to store liquids in HWMA units. Container types are selected after ensuring compatibility of the container with the HW/MW described on the IWTS Profile and with transportation and waste acceptance criteria (WAC) defined by HWMA units or another receiving facility.
DOT Steel Bins	A rectangular 12-gauge steel bin used for shipment of waste or DOT-approved containers of waste and meets the requirements of 49 CFR 178.350 (DOT 7A). When used as an “overpack,” it holds eight 55-gal drums in two layers of four drums each, or ten 30-gal drums in two layers of five drums each. The bins are nominally 4 x 5 x 6 ft. This category covers a range of sizes and some structural variations. At the time of use, one bin type, entitled M-III, met DOT 7A requirements. The M-III bins now meet DOT requirements for a strong-tight container.

Table D-2. Examples of Containers Accepted at HWMA Units (continued)

Container Type	Description
DOT Steel Box TX-4	A mild-steel-welded construction box, developed by Lawrence Livermore National Laboratory, with a gasketed bolted closure that is used in packaging contact-handled transuranic (CH TRU) waste. The container is a steel sheet supported by an external framework of four 4 x 2-in. square tubing (the container corners are reinforced with 2-in. angle stock, skip welded). Four 3-in. steel channels support the container, allowing standard forklift access. This box comes in a range of sizes ranging from 74 to 92-in. long, 46 to 52-in. wide, and 36 to 57-in. high. This box may be lined with two 40-mil. or one 80-mil. Polyvinyl chloride (PVC) liner. The top of the liner is then folded over the top and outside of the box and secured with duct tape.
Standard Waste Box (SWB)	A steel container that is nominally 71 x 55 in. and 37-in. tall. This box may be used to package waste or to overpack any container that does not meet the WAC as long as the dimensions are compatible. The lid is then bolted to the box.
DOT 7A Steel Overpack Box	A box constructed of carbon steel supported by an external framework of four 4 x 2-in. square tubing (container corners are reinforced with 2-in. angle stock). It may be used for overpacking plywood boxes and damaged fiber-reinforced plywood (FRP) boxes. Two 2 x 1-in. steel channels support the container for forklift access. The dimensions of this box are 92 x 56 in. and 55-in. tall. A variety of other sizes may be used (i.e., special sizes will be fabricated to handle a variety of overpack needs).
Wooden Box	A box constructed of plywood. At the time of use in the 1970s, this box met DOT 19A packaging requirements. It comes in a range of sizes but generally is 7 x 4 ft and either 2 or 4-ft tall. The lid is either nailed or glued shut.
FRP Box	A box constructed in the same manner as the wooden box previously described and has the same range of dimensions. However, the exterior of the box is coated with at least 1/8 in. of fiberglass-reinforced polyester.

D-2(a) Containers With and Without Free Liquids

Containers with and without free liquids are managed in the same manner with the exception of providing secondary containment for containers with free liquids.

D-2(a)(1) Description of Containers [IDAPA 58.01.05.008; 40 CFR 264.171 and 264.172]

Examples of containers of HW/MW that are currently stored in HWMA units or are candidates for storage (they will be transferred from another on-Site or off-Site facility) are summarized in Table D-1.

This listing is not inclusive but serves as a representative listing of the types of containers that may be received. Containers that are not in good condition (e.g., apparent structural failures or bulging), or whose contents are not compatible with the HW/MW they are storing, will not be accepted at HWMA units. HWMA units will only accept those containers that can be stored safely. In the event a container is not in good condition, it will be returned to the generator for repackaging or, if safe to do so, will be repackaged at an appropriate HWMA unit.

Incompatible wastes, either solids or liquids, will be stored in accordance with the HW/MW separation precautions described in this Permit in Attachment 6, Section F, Procedures to Prevent Hazards.

The different types of HW/MW containers currently stored in HWMA units or in other on-Site and off-Site facilities that may be transferred to HWMA units for storage and treatment are described in the following paragraphs. Photographs of several different types of containers described in Table D-1 are provided in the Permit Application in Attachment D-1.

D-2(a)(2) Container Management Practices [IDAPA 58.01.05.008; 40 CFR 264.173]

Containers used to store HW/MW in HWMA units will be received, handled, managed and stored in a manner that reduces the likelihood of a HW/MW release as described in the following subsections.

D-2(a)(2)(a) Acceptance Criteria

Prior to the transfer of HW/MW to a HWMA unit, the HW/MW generator transferring the HW/MW must submit a completed IWTS Profile, or equivalent, and the HWMA Unit Waste Acceptance Checksheet, or equivalent, must be approved (ref. this Permit, Attachment 2, Section C, Waste Analysis Plan). These forms are used to document details on the physical, chemical, and radiological characteristics of the HW/MW (which provides a detailed characterization of the HW/MW) to ensure it can be safely stored and processed with the existing HW/MW at an appropriate HWMA unit.

D-2(a)(2)(b) Labeling

Each container of HW/MW accepted at an HWMA unit is labeled with the labels (as applicable) shown in Table D-2. A photograph of the labels is shown in the Permit Application in Attachment D-2.

Table D-2. HWMA Unit HW/MW Container Labels.

Label Type	Description
EPA Hazardous Waste Label	Identifies generator information and EPA identification and HWNs
INL Barcode Label	Indicates the HW/MW container number that is included in the IWTS electronic database (or equivalent) and HW/MW inventory maintained by the INL

D-2(a)(2)(c) Handling

HW/MW container handling practices will include the use of trained and qualified rigging and hoisting operators and trained material handling personnel for the placement or removal of HW/MW containers to/from HWMA units, as applicable. Any hoisting and rigging activities (including periodic inspections, load testing, certification, and hoisting and rigging of critical items/loads) will be performed in accordance with the requirements identified in facility-specific procedures.

Heavy equipment (i.e., forklifts and cranes) used for handling HW/MW containers in HWMA units are selected based on their unique ability to handle a particular size and type of HW/MW container. Typically, all large forklift-handled HW/MW containers will be placed on pallets to facilitate lifting and handling with a forklift without using additional hoisting and rigging tackle. However, in some cases, hoisting and rigging tackle (such as slings, wire rope, shackles, or drumlifters) may be used. Forklifts and hoisting and rigging tackle used for handling HW/MW containers will be periodically inspected and load tested by qualified personnel, including a visual inspection of the equipment for wear, damage, deformation, and current test certification in accordance with applicable procedures.

D-2(a)(2)(d) Container Integrity

Before a HW/MW container is unloaded from the transporting equipment at a HWMA unit, HWMA unit facility personnel will inspect the container for damage, leaks, general appearance, markings, and labeling. A used, new, or reconditioned

container will be accepted if HWMA unit facility personnel finds it to be sealed and in good condition (structurally sound, free of leaks). Upon acceptance, the HW/MW container will be placed in the appropriate HWMA unit storage area. Inspections are documented on the HWMA Unit HW/MW Transfer Inspection Log (ref. this Permit, Attachment 4, Section F, Inspections).

D-2(a)(2)(e) Waste Placement

In accordance with National Fire Protection Association (NFPA) 101, The Life Safety Code (LSC) for Industrial Occupancies and Occupational Safety and Health Standards (OSHA), a minimum of 3 ft of aisle space will be maintained for any means of ingress or egress into a HWMA unit. Placement of containers within the facility in accordance with this minimum aisle spacing requirement will ensure unobstructed movement of personnel, fire protection equipment, spill control equipment and decontamination equipment to any area of the facility operation in an emergency.

Adequate aisle space will also be maintained around containers to facilitate inspections of the containers and the storage, verification, repackaging and/or treatment areas.

As some HW/MW containers are irregular and nonuniform in size and shape, the number of HW/MW containers in an HWMA units storage area depends on the floor space occupied by the particular HW/MW containers and the secondary containment pallets or pans used (if storing liquids) to elevate containers of liquid HW/MW off the floor. No stacking of HW/MW containers with free liquids is allowed.

Container storage areas within the HWMA units are shown on the facility arrangement schematics provided in this Permit in Attachment 1, Section B, MFC Facility Description.

D-2(a)(2)(f) Maintenance during Storage

After HW/MW containers are placed in a HWMA storage unit, they are not opened or handled except when it is necessary to add or remove waste in accordance with IDAPA 58.01.05.008; 40 CFR 264.173(a). In addition, because HW/MW containers are not routinely handled or moved after placement in storage, the likelihood of an accident resulting in container rupture is minimized.

D-2(a)(2)(g) HWMA Unit Decontamination/Cleaning Between Waste Containers

Following verification, repackaging, and/or container treatment, all MW is removed from the HWMA unit where the activity is performed. Following removal of MW, decontamination and/or cleaning will be performed, if necessary. The decontamination and/or cleaning will be conducted consistent with the closure plan closure performance standards. Following this decontamination and/or cleaning future waste managed in the HWMA unit will only acquire the EPA hazardous waste numbers assigned to the waste and the unit is considered to be free of all hazardous constituents in accordance with IDAPA 58.01.05.005; 40 CFR 261.

D-2(a)(2)(h) Inventory and Accountability

As described this Permit in Attachment 2, Section C, Waste Analysis Plan, the IWTS electronic database (or equivalent) is maintained by HWMA unit personnel and will include each HW/MW container received at an HWMA unit. A current inventory is maintained for each HWMA unit. For each HW/MW container, the database includes (but is not limited to) the following information:

- Container's unique reference number
- Container's location
- HW/MW description and hazardous constituents
- MW radionuclide composition
- Weight of the HW/MW
- Packaging
- Type of container
- Net and gross volume
- Gross weight
- Generating process
- Storage date.

D-2(a)(2)(i) Container Treatment

HWMA unit personnel conducting container treatment processes are trained and follow established procedures and/or guidelines for each treatment technique. This information will be provided in the WAP or in a HWMA unit-specific procedure. Treatments that may be conducted include absorption, neutralization and/or solidification/stabilization.

These container treatments will enable certain HW/MW to meet HWMA/RCRA UTS and WAC regarding pH, free liquids, and toxic metals. The HW/MW to be treated may contain both solids and liquids; therefore, different treatments will be selected accordingly. The general process is described below.

Container treatment procedures or WAPs will be developed, as required, and used based on treatability study (bench scale) testing results and information provided from commercial treatment agent vendors. The HWMA unit-specific treatment procedure will specify treatment process steps such as the amount of treatment agent(s) to be added, required pH, rate and order of HW/MW and treatment agent addition, rate and time of mixing, curing time (if appropriate), temperature control (if appropriate), and any other information important to proper treatment process control or desired outcome.

HWMA unit personnel will conduct the container treatments in accordance with the established treatment procedure or WAP. Container treatment procedures may be performed on the original container unless the original container integrity will not meet the WAC. In this case, the HW/MW will be transferred to a new container. Container size selected will depend on the volume of HW/MW and treatment agents to be added. The selected container will also be compatible with the HW/MW and treatment materials.

Upon treatment completion, treatment effectiveness will be determined in accordance with generator specifications and/or WAPs.

Following treatment, the HWMA unit where the container treatment was performed will be cleaned and inspected if required by facility-specific procedures.

The treatment will be documented in the HWMA unit operating record and may include the following information:

- Original container content code
- Container identification number

- Date of treatment
- Treatment conducted (absorption, neutralization, solidification)
- Treatment procedure or WAP used
- Type and amounts of treatment agents used
- Results of the treatment conducted (pH tests/visual verifications/free liquid test)
- Any additional comments by HWMA unit personnel.

This information will be used to update the applicable database regarding a specific HW/MW container. HW/MW characteristic information on a HW/MW container will be updated to ensure tracking of the initial HW/MW container and account for the final outcome of the container contents.

As an example, information on free liquid absorption process is presented as follows:

Absorption (free liquids). In order to meet a WAC for free liquid, absorbents will be added to absorb the free liquid. Typically, the container treatment procedural steps that may be used during the absorption/treatment process are as follows:

- The volume of free liquid to be absorbed will be determined and recorded.
- Adjustment of pH will be performed (if necessary) in accordance with the neutralization procedure described previously.
- Required amounts of absorption agents will be added in accordance with the treatment procedure.
- The absorbent will be added to the free liquids and mixed in accordance with the method specified in the treatment procedure.
- Treated HW/MW will be visually inspected for signs of free liquids. If no free liquids are present, the treatment will be considered successful. If liquids are present, additional absorbent material will be added and the HW/MW will be remixed in accordance with procedural steps.

The type(s) of absorbent used will vary with the type of liquid and will be selected based on:

- Recommended usage and specifications provided by manufacturers
- Results of treatability studies and/or bench-scale testing
- Compatibility with the HW/MW.

Compatibility constraints of commercially available absorbents will be observed with the material being treated. Absorbents may include (but are not limited to) natural materials such as vermiculite, silicates, clays, or cellulose; or synthetic materials (such as activated carbon or polypropylene).

D-2(a)(2)(j) Container Management during Verification, Repackaging, and/or Container Treatment

Standardized maintenance and housekeeping operations will be conducted for the HWMA units where container verification, repackaging, and/or container treatment is performed. Startup, operation, and maintenance of commercially available items will comply with the manufacturer's instructions and recommended practices.

Before conducting container verification, repackaging, and/or container treatment activities, there will be checks of the HWMA unit to ensure emergency equipment is available and that confinement enclosures (if used) are intact and equipment is operating within prescribed limits.

D-2(a)(3) Secondary Containment System Design and Operation [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.15(a)(1) and 264.175(a) and (d)]

Secondary containment for containers with free-liquids may consist of a portable secondary containment device such as spill pallets, fabricated spill pans, or an overpack depending on the type, size, and configuration of the "free-liquid" container. A standard waste box (SWB) may also provide secondary containment. Attachment D-4 (the Permit Application) provides photographs and drawings of devices that can be used to provide secondary containment.

Secondary containment may also be provided by seal-welded (lined) or epoxy-coated concrete floors. The SPF HWMA units have lined floors or epoxy-coated floors that provide an impermeable surface and a method to collect spills of leaks. Seal-welded floors are maintained as secondary containment in SPF tank storage/treatment areas, see floor plan schematics in this Permit in Attachment 1, Section B, MFC Facility Description.

Both portable and fixed secondary containment devices or floors are designed to have sufficient capacity to contain 10% of the total volume of containers stored within/on the secondary containment or 100% of the volume of the largest container within its boundary, whichever is greater. Descriptions of secondary containment design, drainage, capacity, run-on, and free-liquid removable specifications for the pallets, pans, and overpacks is provided in the following subsections.

D-2(a)(3)(a) Requirements for the Base or Liner to Contain Liquids [IDAPA 58.01.05.008; 40 CFR 264.175(b)(1)]

Portable Secondary Containment Devices. Spill pallets, pans, and overpacks/boxes, will be used in container areas when the floors in the area do not serve as secondary containment. These devices are constructed of materials that are compatible with the ignitable, reactive, corrosive, toxic metal, and/or listed HW/MW that will be stored in/on the containment system to contain any spilled or leaking free liquids. The materials used in the construction of the secondary containment systems and dimensions, volumes, and capacities are as follows:

Portable Spill Pallets. Typically, portable spill pallets are constructed of translucent high-density polyethylene, which is compatible with a wide variety of HW/MW. The pallets have a support structure and a support grate used to elevate the containers off the base to prevent contact between the container and spilled or leaking HW/MW. The grate allows for visual detection of accumulated liquids during inspections.

Fabricated Spill Pans. Fabricated spill pans are typically constructed of steel. All of the seams will be welded in accordance with approved procedures. The welds will be visually inspected to ensure that the welds are free of cracks and holes. All containers stored in the spill pans will be elevated off the base of the pan to prevent contact between the container and spilled or leaking HW/MW. The spill pans may be designed to have a platform used to support the container and elevate the containers off the base. The platform will be grated to allow for visual detection of accumulated liquids during inspections.

Fabricated Overpacks. Typically, fabricated overpacks are constructed of steel, with continuous welds on the inside. All of the seams will be welded in accordance with approved INL procedures. The welds will be visually inspected to ensure that the welds are free of cracks and holes. The overpacks have cylindrical openings. The overpacks that are currently in use have an annulus filled with lead shot to provide shielding, if necessary. Containers within the overpacks may be elevated off the base.

Fixed Secondary Containment Floors. Lined rooms or storage areas with epoxy-coated floors are located in SPF. The secondary containment features of the floors in SPF are described in Subsection D-4, SPF Tanks.

D-2(a)(3)(b) Containment System Drainage [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.15(a)(2) and 264.175(b)(2)]

HW/MW containers are stored inside of the SPF HWMA units and therefore do not accumulate liquid from precipitation. Containers with free liquids are elevated within secondary containment. Note: containers may be staged directly on the floor to safely facilitate processing. HWMA unit personnel will be present during these operations.

D-2(a)(3)(c) Containment System Capacity [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.15(a)(3) and 264.175(b)(3)]

Portable Spill Pallets. Portable spill pallets used in SPF HWMA units will be designed/selected to ensure that they contain 10% of the total volume of containers stored on them or 100% of the volume of the largest container, whichever is greater. Several types of spill pallets may be used in HWMA units. An example of a spill pallet that is currently used in HWMA units for 55-gal drums is a four drum spill skid that has an 8000 lb load capacity. The exterior dimensions of the spill pallet are 51.5 x 51.5 in. and 10 in. tall. The interior dimensions at the bottom are 47 x 47 in. and 49.5 x 49.5 in. at the top. The bottom of each pallet is created to allow forklift access. The deck is 3/4 in. thick. The manufacturer specifications indicate that the pallet has 62 gal sump capacity.

These pallets are used to store 55-gal drums. No more than four 55-gal drums will be placed on the pallet at any one time. Therefore, the 62 gal sump capacity will contain either 10% of the total estimated volume of four 55-gal drums (22 gal) or 100% of the volume of the largest container (55 gal).

Fabricated Spill Pans. Fabricated spill pans used in SPF HWMA units will be designed to ensure that they contain 10% of the total volume of containers stored in the pan or 100% of the volume of the largest container, whichever is greater. Containers will be elevated above the pan base with appropriate structures made of compatible materials.

An example of the interior dimensions of a spill pan are 90 x 216 in. and 4 in. tall. Ten percent (10%) of the volume is reserved for displacement by pallets. The capacity of the spill pan is calculated as shown in Table D-3.

Table D-3. Secondary Containment Capacity of Fabricated Spill Pan.

Secondary Containment	Dimensions
Interior dimensions of spill pan	$90 \times 216 \times 4$ in. (tall)
Containment volume of spill pan	(90 in)(216 in)(4 in)(1 gal/231 in^3) = 336 gal
Volume displaced (by pallet)	0.10×336 gal= 33.6 gal
Available capacity of spill pan	336 gal - 33.6 gal = 302.4 gal

This fabricated spill pan would have sufficient capacity to provide secondary containment of containers with a total volume of 3,024 gal (90% of 3,360 gal) or a single container holding a waste volume of up to 302 gal.

Fabricated Overpacks. Fabricated overpacks that may be used in SPFHWMA units during the solidification process (for a 55-gal drum) are designed to ensure that they contain 100% of the volume of the container for which they provide secondary containment. The dimensions and capacity of the overpacks are provided in Table D-4.

SWB. SWBs may also be used as secondary containment vessels. The capacity of an SWB when used as secondary containment vessel is 570 gal. Typically, the SWBs will be loaded within ten (10) days of transfer out of a HWMA unit. When used as a secondary containment vessel, the SWBs will be limited to containment of less than the volume of the SWB. Operation protocol at the HWMA units enables removing any free liquids resulting from leaks and spills.

For long-term storage, the SWB will be equipped with an interior support structure of sufficient height to allow for container elevation above the volume of a spill of 100% of the contents of the largest container plus the volume of liquid displaced by the interior grating or support structure. The capacity of an SWB when used as a secondary containment vessel is calculated as shown in Table D-4.

Table D-4. Secondary Containment Capacity of SWB.

Containment	Capacity
Total SWB volume	570 gal
SWB internal height	36.7 in.
SWB gal per inch of floor space	570 gal/36.7 in. = 15.5 gal/in.
Capacity of the largest stored container	55 gal
Estimated volume of liquid displaced by support structure	20%

Based on the information in Table D-4, the minimum height of the support structure is 4.3 in., as calculated below:

55 gal/15.5 gal/in. + 0.2 (55 gal/15.5 gal/in.) = 4.3 in.

To accommodate for a margin of error, a support structure will be used in the bottom of the SWB.

D-2(a)(3)(d) Control of Run-On [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.15(a)(4) and 264.175(b)(4)]

The likelihood of run-on into the secondary containment pallets, pans, and overpacks used for containment of HW/MW in SPF HWMA units is controlled by elevation. The topography of the area where the HWMA units are located is high relative to its surroundings and drains away from the facility (ref. this Permit, Attachment 1, Section B, MFC Facility Description). Additional elevation above ground level is provided by the secondary containment platforms and/or supports. Elevation and secondary containment measures will effectively ensure all HW/MW containers are kept from contact with standing liquids.

D-2(a)(3)(e) Removal of Liquids from Containment Systems [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.15(a)(5) and 264.175(b)(5)]

Several measures will ensure that the secondary containment pallets, pans, and overpacks will not overflow because of spills, leaks, or accumulation of precipitation. The capacity of the pallets, pans, and overpacks will be sufficient to contain 10% of the volume of the containers within their boundary (if there are more than one) or 100% of the volume of the largest container, whichever is greater. The accumulation of run-on and precipitation in the secondary containment pans is

prevented because of their physical location in the enclosed HWMA unit's storage areas.

In the unlikely event that liquids accumulate in the secondary containment pans, they can be identified during the daily and weekly inspections.

For example, in SPF, because of the potential for corrosive liquids spills or leaks and because water reacts with the ignitable and reactive HW/MW that may be typically stored in the SPF HWMA units (Na and sodium-potassium alloy [NaK], which form sodium hydroxide [NaOH] and potassium hydroxide [KOH], respectively), pH measurements will be used to determine if the water is chemically contaminated. If the pH is determined to be < 2 or >12.5, it will be neutralized and disposed of in accordance with the spill cleanup procedures previously described. Any spill materials will be packaged in drums and stored at HWMA units until further disposition.

D-2(a)(4) Test for Free Liquids [IDAPA 58.01.05.012; 40 CFR 270.15(b)(1)]

The presence or absence of free liquids in the HW/MW stored/to be stored in the SPF HWMA units may be documented on an IWTS Profile or equivalent, (ref. this Permit, Attachment 2, Section C, Waste Analysis Plan). Certification will be made through analysis of the HW/MW or process knowledge and will be required by the HWMA units' personnel prior to HW/MW acceptance.

D-3 Basic Treatment System Description

This subsection provides basic system descriptions for HW/MW container and/or tank treatment systems (fixed in-place components) used to perform routine treatment process. The SPF HWMA units have fixed container and/or tank treatment systems. The treatment systems for these SPF HWMA units are discussed in Subsection D-3(a).

D-3(a) SPF Basic System Description

The following subsections provide information regarding the major systems for SPF as identified in Table D-5. The P&IDs for each system are provided in the specified attachment(s) in the table.

Table D-5. SPF System Descriptions.

System	Permit Application Attachment(s)	
	Process and Instrumentation Drawings	Photos/Drawings
Sodium Reaction System Flow Diagram	D-23	–
Sodium Melting and Draining System	D-24	D-25
Sodium Transfer System	D-24	D-26 and D-27
Drum Fill and Handling System	D-24	
Service and Suspect Water Systems	D-24	D-30 and D-31
Off-Gas Systems	D-24	–
Vent Systems	–	–
Steam and Condensate System	–	–
Nitrogen System	–	–
Support Systems	–	–

D-3(a)(1) Sodium Melting and Draining System

Process. Containerized Na/NaK arrives at SPF generally in 55-gal drums. The sodium melting and draining system is used to:

- Melt Na (which is solid at room temperature)/NaK in its storage container
- Remove Na/NaK from its storage container
- Transfer it to the 5000-gal sodium storage tank.

The same process occurs for the NaK, except NaK is a liquid at room temperature; therefore, ”melting” NaK is not necessary. The transfer of containerized liquid Na/NaK is by vacuum to the 5000-gal sodium storage tank.

D-3(a)(2) Sodium Transfer System

Process. The sodium transfer system is used to transfer the waste (Na/NaK) from the 5000-gal sodium storage tank to the 730-gal sodium day tanks. Following completion of the melting and draining operation from the drums to the 5000-gal sodium storage tank, the 5000-gal sodium storage tank is pressurized with nitrogen. The pressurization provides the driving force to transfer the Na/NaK from the

5000-gal sodium storage tank to the selected 730-gal sodium day tank. The transfer rate is approximately 30 gpm.

D-3(a)(3) Sodium Reaction System

Process. The sodium reaction system is used to:

- Transfer Na/NaK from the 730-gal sodium day tanks to the reaction vessel, where it is converted to a hydroxide solution
- Transfer hydroxide to the drum fill station
- Transfer 50 wt% hydroxide to the 1,000-gal caustic cooling tank and from the caustic cooling tank to the reaction vessel during startup.

When the reaction vessel is in operation, the 730-gal sodium day tank supplying the waste to the reaction vessel is pressurized with nitrogen gas. This provides the driving force for the Na/NaK transfer and injection into the reaction vessel.

In the reaction vessel, the Na/NaK reacts with water to produce sodium hydroxide/potassium hydroxide and hydrogen (H_2).

Nitrogen/steam is introduced into the injection nozzles to atomize the Na/NaK upon injection into the reaction vessel to ensure that Na/NaK will react completely beneath the surface of the hydroxide solution. The nitrogen leaves the reaction vessel via the caustic off-gas system along with the reaction-produced hydrogen and some water vapor.

The hydroxide in the reaction vessel is recirculated with approximately 1 to 2 gpm of the 8 to 10 gpm recirculated solution continuously diverted to either the drum fill station (during operation) or to the 1000-gal caustic cooling tank (during shutdown operations).

D-3(a)(4) Caustic Transfer System

Process. The caustic transfer system begins at the reaction-vessel solution caustic recirculation pump and piping where a portion of the hydroxide being recirculated is diverted to the drum fill station or to the 1000-gal caustic cooling tank. The caustic metering pump transfers the 50 wt% hydroxide solution from the 1000-gal caustic cooling tank directly to the reaction vessel, upon startup, or if backup hydroxide storage is needed. The 4000-gal caustic storage tank is used, in an emergency only, to transfer hydroxide solution to or from the caustic storage tank to the reaction

vessel. The caustic recirculation pump, metering pump, and caustic cooling tank are located in the sodium process area and the caustic storage tank and caustic transfer pump are housed in a building on the west side of SPF.

D-3(a)(5) Drum Fill and Handling System

Process. The hydroxide solution is transferred to the drum fill station through a concentric pipe heat exchanger. The heat exchanger is an inner pipe (nickel) for high temperature hydroxide and an outer pipe (stainless steel) for the coolant (water).

The high temperature hydroxide (360-375°F) flows from the caustic recirculation line to the drum fill station. At the drum fill station, the hydroxide will exit into the drums at an approximate temperature of 200 to 225°F. The reduction of the hydroxide temperature is by the counter-flow of coolant (water). Heat is removed from the cooling medium of the concentric pipe heat exchanger system via a shell and tube water heat exchanger.

The suspect exhaust off-gas system collects vapors from the enclosures (hoods) for the drum fill and capping stations. From the hoods, the effluent (consisting mainly of minute quantities of hydroxide vapor and potentially some entrained particulate) is exhausted through a baghouse and HEPA filter to the atmosphere.

The product from the caustic transfer system is placed in drums via the drum fill and handling system, which includes the drum filling station, capping station, survey and decontamination station, drum palletizing area, and storage areas.

D-3(a)(6) Service and Suspect Water Systems

Process. Two separate water systems—the service and suspect water systems—comprise the SPF water system. The service water system is a clean potable water system and has the following two main functions in the sodium process area:

- Cools the off-gas condenser
- Serves as a heat sink for the shell and tube heat exchanger.

The service water supply delivers water to SPF at approximately 100 psig through galvanized-steel piping.

The suspect water system is potentially contaminated with radioactive constituents from the processed Na/NaK. Makeup water is supplied to the 500-gal water holding

tank from the MFC deionized (DI) water system. The suspect water system's main function is to provide water, from the 500-gal water holding tank, for the following uses:

- Hydrolyze Na/NaK in the reaction vessel
- Dewater and cleanse off-gas emissions from the reaction vessel
- Maintain water level in the scrubber.

Sources of suspect water in SPF include the following:

- Condensed water vapor that is removed from the off-gas streams of the reaction vessel
- Water associated with any cleanup activities associated with potentially-contaminated areas or surfaces.

The water system is used for cooling the vacuum pump inlets, off-gas condenser, caustic transfer system shell, tube heat exchanger, and for use in the scrubber.

D-3(a)(7) Off-Gas Systems

Two separate off-gas systems are used to control effluent release from SPF treatment operations. The system controls effluents from the sodium process area and the suspect exhaust system controls effluents from the sodium carbonate process area as described in the following subsections.

D-3(a)(7)(a) Caustic Off-Gas System

Process. The caustic off-gas system is used to contain the gases and water vapor resulting from the conversion of Na/NaK to hydroxides in the reaction vessel. It condenses and recovers water vapor for reuse and removes radioactive aerosol prior to the release of filtered gases to the atmosphere. Principle constituents in the caustic off-gas stream, as it exits the reaction vessel, are water vapor, hydrogen, and nitrogen. Hydrogen is a reaction product. Nitrogen is used to atomize the Na/NaK in the reaction-vessel injection nozzles and to purge the reaction vessel to maintain low oxygen concentrations. The caustic off-gas system processes this stream and ultimately releases hydrogen and nitrogen to the atmosphere and returns the condensed water vapor to the reaction process. Condensate is returned to the 500-gal water holding tank through a series of drain lines. The caustic off-gas system components, from the reaction vessel demister to the HEPA filters are

permitted under the SPF Permit to Construct (IDAPA 58.01.01, Permit No. PTC-011-00022).

D-3(a)(7)(b) Suspect Exhaust System

Process. The purpose of the suspect exhaust system is to control effluents that may be generated during the drum filling and capping processes. The off-gas consists primarily of hydroxide vapor and particulate. The off-gas stream from the drum fill and capping stations exits the hoods surrounding the drum into the suspect exhaust system. This effluent is processed through a HEPA filtration system prior to release to the atmosphere. The effluent gas from the baghouse then passes through a HEPA filter that removes remaining particulate prior to discharge to the atmosphere.

D-3(a)(8) Vent Systems

There are two independent vent systems associated with the sodium process area and 4000-gal caustic storage tank. All vent system piping is made of carbon steel.

In the sodium process area, the vent systems collect gaseous effluents from all of the following tanks:

- 5000-gal sodium storage tank
- 730-gal sodium day tanks
- 1000-gal caustic cooling tank
- 4000-gal caustic storage tank
- 500-gal water holding tank.

Effluent from the 5000-gal sodium storage tank includes vacuum pump exhaust, normal operational venting, or effluent from the poppet check valve. Effluent from the 730-gal sodium day tanks and 1000-gal caustic cooling tank includes normal operational venting or over-pressurization release from their respective poppet check valves. Effluent from the 500-gal water holding tank includes normal operational venting through its own HEPA filter on top of the tank. These effluent streams vent to the caustic off-gas system upstream of the HEPA filters.

In the sodium carbonate process area addition, the source of effluents are the drum fill and capping station hoods. All vent piping in this area is made of stainless steel.

D-3(a)(8)(a) Steam and Condensate System

Steam is used for:

- Atomization of the Na/NaK
- Clearing of the injection nozzles in the reaction vessel in the sodium process area.

The 175-psig steam from the site steam supply is reduced in pressure to 30 to 50 psig for the injection process in the reaction. The steam system piping is made of carbon steel. Solenoid, ball, globe, and gate valves are used in the system. Relief valves provide overpressure protection.

D-3(a)(8)(b) Nitrogen System

Nitrogen gas is used in the sodium melting and draining room and sodium process area as described below:

Sodium Melting and Draining Room: Nitrogen is applied to the drums of Na/NaK (while being heated) and flexible drain lines (when not in use). It is supplied at 3 to 5 in. H_2O.

Sodium Process Area: Nitrogen is used in the sodium process area to transfer sodium from the

- 5000-gal sodium storage tank to the 730-gal sodium day tanks. Nitrogen is supplied at 15 psig.
- 730-gal sodium day tanks to the injection nozzles. Nitrogen is supplied at 10 to 30 psig.

D-3(a)(8)(c) Support Systems

The support systems for the operation of SPF are described in the following subsections.

<u>Compressed Air System</u>

The compressed air system is used to:

- Operate the barrel tilting mechanism for the melting-draining operation

- Operate the pneumatically-actuated valves in the Na, caustic, and vacuum piping
- Operate the pneumatic tilting device to move drums of hydroxide to the drum palletizing area.

Heater System

The following five types of heaters are used throughout the process: drum strap-on heaters, disc heaters, strip heaters, mineral insulated wire, and heating tape.

Fire Suppression System

A fixed fire suppression system is provided in the sodium melting and draining room. Two ANSUL MET-L-X, Model 101-30, dry-powder fire extinguishers are provided to discharge through four modified ANSUL F-1 nozzles directly into each barrel container assembly. A single actuator is provided for each of these pairs of extinguishers. A fire hazard analysis of other SPF areas has determined that additional fire suppression systems are not required.

D-4 Tank Systems

D-4(a) SPF Tank Systems

D-4(a)(1) Existing Tank Systems

All existing tank systems are considered to be "new tank systems" in accordance with the preamble in 51 FR 25446, Section IV.B.4, *Design and Installation of New Tank Systems* (40 CFR 264.192), since these tank systems were not being used for storage or treatment of HW/MW but will be put into service as HW/MW storage or treatment tank systems subsequent to the promulgation date of the regulations (July 14, 1986).

D-4(a)(2) New Tank Systems [IDAPA 58.01.05.012; 40 CFR 270.16]

SPF presently contains four tank systems. These four systems, the HWMA/RCRA tank(s) associated with each system, and feed and ancillary systems associated with each tank are identified in Table D-6.

Table D-6. SPF Tank Systems.

Sodium Transfer System		
Systems	HWMA/RCRA Tank(s)	
	5,000-Gal Sodium Storage Tank	730-Gal Day Tanks
Feed system(s)	▪ Sodium melting and draining system container feed)	▪ Sodium from 5,000-gal sodium storage tank
Ancillary system(s)	▪ Nitrogen for pressurizing tanks ▪ Vacuum system ▪ Vent system ▪ Heater system ▪ Level indicating system	▪ Nitrogen for pressurizing tanks ▪ Heater system ▪ Vent system ▪ Level indicating system
Sodium Reaction System		
Systems	HWMA/RCRA Tank(s)	
	500-Gal Reaction Vessel–	
Feed systems(s)	▪ Sodium from 730-gal sodium day tanks ▪ Water from 500-gal water holding tank ▪ 50% hydroxide from the caustic cooling tank ▪ Steam	
Ancillary systems(s)	▪ Caustic recirculation pump ▪ Two level indicating systems ▪ Nitrogen purge system ▪ Heater system ▪ Off-gas system	
Caustic Transfer System		
Systems	HWMA/RCRA Tank(s)	
	1,000-Gal Caustic Cooling Tank	4,000-Gal Caustic Storage Tank
Feed system(s)	▪ Hydroxide solution pumped from reaction vessel ▪ Hydroxide solution pumped from 4,000-gal caustic storage tank	▪ Hydroxide solution from 1,000-gal caustic cooling tank
Ancillary system(s)	▪ Caustic metering pump ▪ Heater system ▪ Nitrogen cover gas system ▪ Vent system ▪ Level indicating system	▪ Caustic transfer pump ▪ Nitrogen cover gas system ▪ Vent system ▪ Level indicating system

Table D-6. SPF Tank Systems (continued)

Service and Suspect Water System	
Systems	HWMA/RCRA Tank(s)
	500-Gal Water Holding Tank
Feed systems(s)	▪ Scrubber overflow to 500-gal water holding tank ▪ Condensate from caustic off-gas stream to 500-gal water holding tank (include the condenser drain, the mist eliminator (vane type) drain and the hydrogen/oxygen analyzer drain, the condenser sample line, the scrubber overflow line, the moisture eliminator / pre-filter sampling line and the pre-filter housing drain lines. ▪ DI makeup water from the MFC site system to 500-gal water holding tank
Ancillary systems(s)	▪ Nitrogen system ▪ Level indicating system

D-4(a)(3) Assessment of New Tank System's Integrity [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(a) and 264.192(a)]

A written assessment is included in Permit Application, Attachment D-35 that identifies the following:

- Design standards according to which the tanks and auxiliary equipment are constructed
- Hazardous characteristics of the waste being handled
- Design considerations to ensure:
  - Tank foundations will maintain the load of a full tank
  - Tank systems will withstand the effects of frost heave.

The tank assessment provides information on the structural integrity and suitability of each tank system for handling HW/MW and has been reviewed and certified by an independent, qualified, registered professional engineer. The assessments and certifications provided in Permit Application, Attachment D-35 have been completed in three parts as described below.

The first assessment was completed on all tank systems located at SPF through the caustic process. With the modification for the >69 wt% caustic transfer piping (ancillary equipment) to the drum fill station, an addendum to this caustic process assessment has been completed.

D-4(a)(4) External Corrosion Protection [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(e) and 264.192(f)]

All HWMA/RCRA tank systems and ancillary equipment associated with sodium treatment are protected from external corrosion. The tank systems are located above ground inside buildings. External corrosion is not a factor of concern because the external tank surfaces are not in contact with soil or water.

D-4(a)(5) Description of Tank System installation and Testing Plans and Procedures [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(f) and 264.192(b), (d), and (e)]

Because all four SPF tank systems are considered new tank systems, installation and testing plans and procedures for each system are described in the following subsections. The tank systems were installed and tested between 1985 and 1989. An independent, qualified inspector or an independent, qualified, registered professional engineer, who is trained and experienced in the proper installation of tank systems, did inspect and certify that proper installation and testing of these systems has been accomplished prior to commencement of processing activities. For the >69 wt% caustic transfer system, an installation certification was completed by an independent professional engineer and is located in the SPF operating record.

The inspections and testing conducted for SPF included the following:

- A review of historical records for installation and testing of tank systems installed between 1985 and 1989
- A visual inspection, inside and outside, of currently installed tanks
- A visual inspection of components and piping, if the fiberglass insulation was removed, to inspect components and monitoring devices (such as heaters and pressure and temperature sensors)
- Integrity and leak tests for tanks and systems being modified
- Determination of the presence of weld defects, punctures, scrapes of protective coatings, cracks, corrosion, and other structural damage or inadequate construction/installation for piping being replaced or newly installed tanks, piping, and secondary containment.

All discrepancies were remedied prior to placing the system in use. The results of these inspections and tests are placed in SPF operating record files.

D-4(a)(5)(a) Sodium Transfer System

The sodium transfer system was installed and tested in the late 1980s in accordance with ASME B31.1. This system includes the following:

- 5,000-gal sodium storage tank
- Two 730-gal sodium day tanks
- Secondary containment
- Sodium piping from the:
  - Sodium melting and draining room to the 5000-gal sodium storage tank
  - Sodium storage tank to each of the 730-gal sodium day tanks
  - 730-gal sodium day tanks to the reaction vessel.

Other ancillary equipment that was inspected and tested along with the previously listed mentioned tanks and piping was the vacuum system for the sodium storage tank.

The 5000-gal sodium storage tank and two 730-gal sodium day tanks have had pneumatic tests at 45 and 150 psi, respectively, to verify structural integrity and leak tightness after fabrication was completed. All sodium and vacuum system piping and valves were pneumatically tested in October and November 1987 for 20 minutes at 150 psig with nitrogen gas to verify structural integrity and leak tightness.

At least 10% of the piping welds were radiographed and examined by an MFC Quality Control (QC) Representative in accordance with ASME B31.1. Prior to the functional checkout of the sodium transfer system, all welds received a visual inspection.

The carbon-steel liner (secondary containment pit) for the 5000-gal sodium storage tank and two 730-gal sodium day tanks was welded in accordance with AWS D1.1, *Structural Welding Code*.

The 5000-gal sodium storage tank and two 730-gal sodium day tanks were inspected inside and outside for corrosion by MFC engineers and an independent, professional

engineer in November 1995. Results of the inspection determined no additional testing of these tanks was needed.

Additional inspection and testing is not planned for the sodium transfer system.

D-4(a)(5)(b) Sodium Reaction System

The sodium reaction system was installed and tested in the late 1980s in accordance with ASME B31.1. This system includes the following:

- Reaction vessel
- Reaction vessel baffles
- Reaction vessel demister
- Condenser and mist eliminator (mesh-type)
- Scrubber
- Mist eliminator (vane type)
- Parallel prefilters (polypropylene mat)
- Parallel HEPA filters
- Piping from the:
  - Caustic off-gas exit nozzle on the reaction vessel to the condenser
  - Condenser to the scrubber
  - Scrubber to the mist eliminator
  - Mist eliminator to pre-filters
  - Prefilters to the HEPA filters
  - HEPA filters to the atmosphere.

The caustic off-gas system components from the reaction vessel demister to the HEPA filters are permitted under SPF Permit-to-Construct (IDAPA 58.01.01, Permit No. PTC-011-00022).

The reaction vessel was hydrostatically tested at 45 psi to verify structural integrity and leak tightness after fabrication was completed. A modification to the reaction vessel to provide the caustic recirculation line penetration was completed. The reaction vessel is an ASME-stamped vessel in accordance with ASME Section VIII. The modification was performed by an independent qualified inspector (R stamp holder) in accordance with the National Boiler Inspection Code requirements for alterations. The reaction vessel was visually inspected for corrosion, inside and outside, by MFC personnel.

The condenser and scrubber were hydrostatically tested to verify structural integrity and leak tightness after fabrication was completed.

All caustic off-gas piping is welded except for flanged connections to components. All welding performed during installation of the caustic off-gas piping complied with ASME B31.1. All welds received a 5-power visual inspection of the final pass.

The carbon-steel liner (secondary containment pit) for the reaction vessel and the 1000-gal caustic cooling tank was welded in accordance with AWS D1.1.

A modification to install a new 1-in. nozzle in the reaction vessel was performed. The reaction vessel is an ASME-stamped vessel in accordance with ASME Section VIII. Installation will be in accordance with the National Boiler Inspection Code requirements for alterations. The modification was inspected and certified by an independent qualified inspector (R stamp holder). The reaction vessel was hydrostatically tested at 150% of the design pressure per the requirements of the ASME Boiler and Pressure Vessel Code Section VIII, Division 1, UG-99, “Standard Hydrostatic Test.”

D-4(a)(5)(c) Caustic Transfer System

The caustic transfer system includes the following:

- 1000-gal caustic cooling tank
- Caustic metering pump
- Caustic transfer pump
- Caustic-transfer-system piping from the:
  - Reaction vessel to the 1,000-gal caustic cooling tank

- Reaction vessel to the drum fill and handling system
- 1000-gal caustic cooling tank to the drum fill station.

The 1000-gal caustic cooling tank, built in 1986, is a shell-and-tube heat exchanger tank. It was tested after fabrication to verify structural integrity and leak tightness. The shell was tested at 22.5 psi and the heat exchanger tube was hydrostatically tested at 180 psig.

All piping for the caustic transfer system was replaced with new piping, either Series-200 nickel or Series-300 stainless steel. The piping was designed, installed, and tested in accordance with ASME B31.3. The inspections and testing performed on the piping and welds included:

- Liquid-penetrant inspection of weld joints final pass
- Radiograph inspection of 10% of all weld joints
- Hydrostatic pressure test of piping.

Pipes were installed in full lengths, as much as possible, and bending of the pipe was performed where practical to minimize the number of welds. All piping was protected against entrance of foreign matter by adequate covering over all openings. All welds did receive 100% liquid-penetrant examination and a minimum of 10% of the welds were radiographically examined by an MFC QC representative in accordance with ASME B31.3.

D-4(a)(5)(d) Suspect and Service Water Systems

The suspect water tank and piping that fall under HWMA/RCRA requirements includes the following:

- 500-gal water holding tank
- Reaction vessel water injection pump
- Intermediate drain collection vessel (10 gal)
- Peristaltic pump
- Suspect and service water system piping from the:

- 500-gal water holding tank to the water injection piping adjacent to the water injection nozzle
- Water injection piping adjacent to the water injection nozzle to the reaction vessel (Series-200 nickel)
- DI/suspect waste water piping to the reaction vessel and the caustic off-gas scrubber
- Caustic off-gas condenser to the 500-gal water holding tank
- Caustic off-gas scrubber to the 500-gal water holding tank
- Additional caustic off-gas component drain lines to the 500-gal water holding tank. These drain lines are the mist eliminator (vane type), hydrogen/oxygen analyzer, condenser sample line, scrubber overflow sample line, moisture eliminator/pre-filter sampling line, and pre-filter housing drain lines.

The 500-gal water holding tank, built in 1986, was leak tested at 5 psig to verify structural integrity and leak tightness when it was fabricated. The suspect waste water piping, identified above, was hydrostatically tested in October 1987 for 20 min at 115 psig. The new additional drain lines, installed in 2000, were welded in accordance with ASME B31.3 standards and hydrostatically tested (carbon-steel, stainless-steel lines and glued chlorinated polyvinyl chloride [CPVC] piping). Visual leak checks on tygon tubing are performed.

Weld inspections included a radiograph and liquid penetrant of the final pass for that portion of the suspect water piping that is Series-200 nickel. All weld inspections were done in accordance with ASME B31.1.

D-4(a)(6) Dimensions and Capacity of Each Tank [IDAPA 58.01.05.012; 40 CFR 270.16(b)]

There are seven HWMA/RCRA-regulated tanks associated with the treatment process at SPF. The following subsections describe the dimensions and capacities of each tank.

D-4(a)(6)(a) 5000-Gal Sodium Storage Tank

The 5000-gal sodium storage tank is a 6-ft, diameter, by 24-ft, long, horizontal cylinder (approximately 5000 gal) with ASME heads. The tank is code stamped

ASME Section VIII. The design criteria are 400°F at 30 psi and full vacuum. The material is ¼-in. thick carbon steel.

D-4(a)(6)(b) 730-Gal Sodium Day Tanks

There are two 730-gal sodium day tanks (A and B). They are identical vertical cylinders 4 ft in diameter and 10-ft high (approximately 730 gal each). They also have ASME-shape heads and are code stamped ASME Section VIII. The design conditions are 400°F at 120 psig and to the ASME Code, Section VIII. The material is ¼-in. thick carbon steel.

D-4(a)(6)(c) Reaction Vessel

The reaction vessel is a 30 in. diameter by 15 ft 6-in. tall vertical cylinder (approximately 500 gal). It has ASME heads and is made of 1/4 in. thick Series-200 nickel. The design conditions are 500°F at 30 psig.

D-4(a)(6)(d) 1000-Gal Caustic Cooling Tank

The 1000-gal caustic cooling tank is a horizontal cylinder 4 ft in diameter and 11 ft 6-in. long (approximately 1000 gal). It has ASME heads and is code stamped, ASME Section VIII. The design conditions are 500°F and 15 psig. The material is 3/4-in. thick Series-200 nickel.

D-4(a)(6)(e) 4000-Gal Caustic Storage Tank (Ref. Permit Application, Attachment D-12)

The 4000-gal caustic storage tank is used for storage of hydroxide solution. This tank is a horizontal cylinder 84 in. in diameter and 13 ft long. It has ASME heads. The material is 1/4 in. thick Series-300 stainless steel. Design pressure is 5 psig.

D-4(a)(6)(f) 500-Gal Water Holding Tank

The water holding tank is a vertical cylinder 4 ft in diameter and 7 ft 4 in. high (approximately 500 gal). It has ASME heads and is made of 10-gauge Series-300 stainless steel. The design conditions are 200°F at atmospheric pressure.

D-4(a)(7) Description of Feed Systems, Safety Cutoff, Bypass Systems, and Pressure Controls [IDAPA 58.01.05.012; 40 CFR 270.16(c)]

The following subsections describe each tank feed system, safety cutoff, bypass systems, and pressure controls (ref. Permit Application, Attachment D-24 for all system drawings).

D-4(a)(7)(a) Sodium Melting and Draining System

The Na/NaK arrives at SPF in 55-gal drums. The purpose of the sodium melting and draining system is to liquefy and remove the Na/NaK from its storage container. This is accomplished by heating the Na, which is solid at room temperature, and transferring the Na to the 5000-gal sodium storage tank. The same process occurs for the NaK, except NaK is liquid at room temperature; therefore heating of the NaK is not necessary. The transfer of the liquid Na/NaK is by vacuum to the storage tank.

The Na flowpath from each drum to the 5000-gal sodium storage tank is identical. The molten Na flows from the drum through a flexible drain line, past an EM flowmeter, through a barrel flow control valve, into a drain manifold, through a manifold flow control valve, and into the 5000-gal sodium storage tank.

The system piping is Schedule-40, Series-300 stainless steel. The piping joining the two drain manifolds to the storage tank is 1 in. in diameter. The piping in each drain manifold is 3/4 in. in diameter. The temperature of the piping is controlled by the control computer.

The barrel container assemblies, which are located in the sodium melting and draining room, constitute a major part of the sodium melting and draining system. The two manifolds, which are designated A and B, have the capacity to handle four drums each. Therefore, there is a total of eight barrel container assemblies, each with its own set of heaters and thermocouples. Manifold A includes barrel stations 1 through 4; Manifold B includes barrel stations 5 through 8.

Each barrel container assembly provides the heat input needed to melt the Na so it will flow from the drum. It also has the capability to tilt the drum slightly (7°) so that very little Na is left in the drum when the draining operation is completed. The barrel container assembly is sized to hold all the Na from a drum, in the event it should rupture and release its contents. Around the rim of the container are four nozzles for discharging MET-L-X fire suppressant in the event of a leak and resulting fire.

In the sodium melting and draining room, the bungs in the drums are replaced with fittings to be used in the draining process. Two 3000-W strap heaters are clamped to the drums. These strap heaters each include an internal thermostat used to interrupt heater power in the event of an over-temperature condition. These heaters are computer controlled. The drums are then hoisted into one of the eight barrel container assemblies. The barrel container assemblies are arranged in two banks of

four. Once the drum has been positioned in the container assembly, an insulating cover is placed over the drum and two magnetically-held thermocouples are placed on the side of the drum to monitor the drum temperature. A 3–5 in. H_2O pressure nitrogen purge gas is supplied to the fitting in the small bung opening and the strap heaters are energized.

Heating of the drums is controlled by the computer. In addition to the thermostats incorporated in the strap heaters, there are three thermocouples at each barrel container assembly to monitor drum temperature as they are heating. Two of the three thermocouples are attached to the sides of the drums by magnets. The remaining thermocouple monitors the air temperature in the space below the drums. The control computer uses the input from these three thermocouples to control the drum heating sequence. The upper drum heater is energized first. The remaining heaters automatically receive power in computer-programmed sequences.

When the Na has reached 240°F, a dip tube is inserted into the drum through the fitting in the large bung opening. The dip tube is curved slightly to reach the intersection of the drum wall and bottom. The dip tube is connected to the barrel draining line.

The two barrel draining manifolds are combined into the 1-in. pipe that is, in turn, connected to the 5000-gal sodium storage tank. The manifolds and 1-in. pipe are all sloped to drain into the storage tank. One drum can be drained through each manifold simultaneously. However, drum draining cannot be initiated unless the sensors in the 5000-gal sodium storage tank indicate that the following operating parameters are met:

- Temperature is > 235°F
- Vacuum pressure is > 20 in. Hg
- There is adequate space in the 5000-gal sodium storage tank to accept two drums of Na.

In addition, a pressure switch monitors the nitrogen supply pressure to both drain manifolds. The control computer provides an alarm if the nitrogen pressure increases to 1 psig. This alarm alerts the operator of possible excessive pressure in the sodium drum.

Resistance heaters are used to raise the temperature of the barrel drain system components and piping from ambient temperature to 240–250°F and to maintain

this temperature during appropriate modes of system operation. Mineral-insulated heaters are located on the sodium piping, as well as the 5000-gal sodium storage tank vapor traps; tape pipe heaters are located on the barrel flexible drain lines; and 5000-gal sodium-storage-tank pressure sensing line and ring disk heaters are located at the barrel drain stations to provide barrel base heating.

The control system for the resistance heaters uses the control computer, programmed to perform control and alarm functions for all heater circuits. Each heater circuit is monitored by a thermocouple located at a point that represents the average temperature of the component or section of pipe being heated. The control system samples each thermocouple and compares the temperature to the control setpoint and alarm setpoints to determine whether to turn the heaters on or off or to provide an alarm.

The barrel drain system is designed to be operated automatically under the control of the control computer. The computer is programmed for control valve operations, system heatup, and vacuum pump control.

The ten flow control valves in the sodium drain lines are 3/4-in. bellows seal valves. There is a flow control valve for each individual drain station and in each manifold downstream of the last drain station. This provides redundant shutoff capability to each drain header.

D-4(a)(7)(b) 730-Gal Sodium Day Tank System Feed

The 5000-gal sodium storage tank provides a feed system to the 730-gal sodium day tanks.

Following the transfer of Na to the 5000-gal sodium storage tank, the tank is pressurized with nitrogen gas to 15 psig. This pressure is the driving force to transfer the Na from the 5000-gal sodium storage tank, at approximately a 30-gpm flowrate, through 3/4 -in., Series-300 stainless-steel piping and control valves to the selected 730-gal sodium day tank.

During operation, the 730-gal sodium day tanks, 5000-gal sodium storage tank, and interconnecting piping are maintained at 240–250°F. The transfer of Na between the 5000-gal sodium storage tank and a 730-gal sodium day tank cannot be initiated unless the following conditions are satisfied:

- Temperature of the selected 730-gal sodium day tank, storage tank, and system piping is > 225°F

- 5000-gal sodium storage tank pressure is 12–15 psig
- 5000-gal sodium storage tank contains greater than zero amount of Na
- Selected 730-gal sodium day tank inventory is < 650 gal
- Selected 730-gal sodium day tank pressure is < 3 psig
- Selected 730-gal sodium day tank sodium injection control valve is shut.

The transfer of Na from the 5000-gal sodium storage tank to the 730-gal sodium day tanks is designed to be operated automatically under the control of the computer. The computer is programmed for control valve operations and system heatup. There is a control valve in the sodium transfer line near the 5000-gal sodium storage tank. There is also a control valve on the sodium inlet line to each 730-gal sodium day tank.

The two identical 730-gal sodium day tanks (designated A and B) each have a capacity of approximately 730 gal and are located in the 5000-gal sodium storage tank pit at the south end. Fabricated from carbon steel, the tanks are provided with 9 kW of electrical heating. The tank pressure and temperature ratings are 120 psig at 400°F. Over-pressure protection is provided for each tank by a rupture disc, which vents to the atmosphere through the off-gas system HEPA filters, rated at 120 psig at 70°F. The 730-gal, sodium day tank instrumentation includes pressure, level, flow, and temperature monitoring and control. The sensors monitoring these parameters send their signals to the control computer via the STD bus computer. The computer compares the signals with predetermined levels for the parameters and initiates an appropriate response.

System temperatures, including the 730-gal sodium day tanks, piping, and assorted valves are automatically maintained via computer control of the resistance heaters. The 730-gal sodium day tanks are provided with computer-displayed high and low level alarms.

The day tanks are used on an alternating basis to supply Na to the reaction vessel. Initially both tanks are filled with Na from the 5000-gal sodium storage tank. Then one tank is pressurized with nitrogen to approximately 10–30 psig to inject Na into the reaction vessel. When that tank is empty, the other tank is pressurized to inject Na and the empty tank is refilled.

Resistance heaters are used to raise the temperature of the 5000-gal sodium storage tank and 730-gal sodium day tank components and piping from ambient temperature to 240–250°F and to maintain this temperature during system operation.

If during transfer operations, any parameter becomes out of tolerance, or a valve is not in its proper position, the computer will generate an alarm and display the status of the faulty parameter in the SPF Control Room on the computer. When the alarm condition is cleared and all conditions to be in the initial mode are satisfied, the computer will return the function to the initial mode.

D-4(a)(7)(c) Reaction Vessel System Feed(s) (Sodium Reaction System)

The Na flows from one of two 730-gal sodium day tanks, through a 730-gal sodium day tank injection control valve, through interconnecting piping (which contains a sodium filter and flow meter), through a reaction vessel injection control valve, and into an injection nozzle that introduces the Na into the reaction vessel. The Na flowrate through this system is 0.75–1 gpm.

When the sodium reaction system is in operation, the 730-gal sodium day tank supplying the Na to the reaction vessel is pressurized to approximately 10–30 psig. This pressure provides the driving force for the Na transfer and injection.

During system operation, steam and/or nitrogen is also introduced into the reaction vessel sodium injection nozzle. Both are used to atomize the Na before it enters the vessel. By atomizing the Na in the injection nozzle, it ensures that Na will react in the reaction vessel in the vicinity of the injection. The nitrogen and/or steam is also used to prevent hydroxide plugging around the injection nozzle.

The piping between the 730-gal sodium day tanks and reaction vessel is 3/4-in. Series-300 stainless steel. This piping temperature is controlled by computer. The temperature of this piping, with the exception of the injection nozzle, is maintained at 240–250°F.

Because of the highly corrosive nature of the high temperature hydroxide, the reaction vessel is fabricated of ¼-in. thick Series-200 nickel. Located in the caustic tank pit, it is 30 in. in diameter and approximately 15-ft tall. The pressure and temperature ratings are 30 psig and 500°F. The entire reaction vessel, to which electric heaters are attached, is covered with 2 in. of fiberglass insulation. The heaters are controlled by computer and are used to melt any hydroxide that has been allowed to solidify in the reaction vessel.

To start up the sodium reaction system, the following conditions must be satisfied:

- The reaction system tanks, piping, and components must be warmed up
- The appropriate 730-gal sodium day tank must contain Na
- The appropriate 730-gal sodium day tank pressure must be established.

Once these conditions are satisfied, the proper valve lineup is then established and reaction operations are initiated.

Prior to system operation, the reaction vessel is loaded with a 50 wt% aqueous solution of sodium hydroxide. Sodium is then admitted through the sodium injection nozzle to start the reaction. The heat liberated in this reaction heats the solution in the reaction vessel to boiling. The loss of water from the solution by reaction with Na and by vaporization raises the concentration of sodium hydroxide in the solution. Increasing the hydroxide concentration raises the boiling temperature of the hydroxide solution. When the sodium hydroxide concentration reaches the desired level, water is admitted through the water injection nozzle to maintain that boiling point and concentration. Thereafter, the concentration of sodium hydroxide in the solution is controlled by controlling the boiling temperature through the injection of water. The concentration of sodium hydroxide in the solution has the effect of slowing down the Na–water reaction. The higher the sodium hydroxide concentration, the slower the reaction rate. The heat of reaction is dissipated by the vaporization of water, which is condensed and reused. Hydrogen evolved from the reaction is vented to the atmosphere through the off-gas system.

The sodium injection nozzle not only divides the injected Na into fine droplets, but also provides the capability to inject steam or nitrogen, or a mixture of the two, simultaneously with the Na through an annular orifice around the sodium nozzle. This capability aids in preventing nozzle plugging and helps to clear the nozzle if plugging does occur.

The computer provides water injection based on the temperature of the reaction process. Sodium flow in each reaction vessel sodium injection line is monitored by an EM flowmeter. Each flowmeter is equipped with two sets of leads for redundancy.

During system shutdown, nitrogen at a reduced pressure (5–15 psig) is routed to the injection nozzles to prevent hydroxide from solidifying in the steam/nitrogen injection annular space.

The sodium and steam/nitrogen lines pass through a sealed annulus in the nozzle prior to the reaction vessel. A leak probe is inserted in this annulus to detect a Na or steam leak. A leak alarm would not require a system shutdown, but does require notification of the mechanical maintenance supervisor and responsible mechanical engineer. The nozzles are constructed of Series-200 nickel.

The four control valves in the reaction-vessel injection lines are 3/4-in. bellows seal valves. There is a control valve in the sodium outlet line from each 730-gal sodium day tank and a control valve in the sodium injection line to each injection nozzle.

When the sodium injection nozzle control valves are shut, nitrogen at a reduced pressure (5–15 psig) is routed beneath the valve seats to purge all sodium from the valve into the reaction vessel. This purge also prevents hydroxide from migrating down the injection line to the control valves.

The reaction vessel instrumentation includes pressure monitoring and level and temperature monitoring and control. The reaction vessel pressure is monitored for overpressure protection and provides indication and alarm on the computer monitor. Resistance heaters are used to raise the temperature of the sodium components and piping from ambient temperature to 240–250°F and maintain this temperature during system operation.

Reaction vessel level is controlled via a gas bubbler arrangement that provides a differential pressure measurement input to the computer control. The gas bubbler supplies the computer input for continuous level monitoring and level control.

Redundant reaction vessel level indication is provided by shorting probes. The probes supply the computer input for level monitoring. The probes can be utilized to supplement the gas bubbler level indication.

D-4(a)(7)(d) Caustic Transfer System

Hydroxide is discharged from the reaction vessel to the drum fill and handling system or the 1000-gal caustic cooling tank. Hydroxide solution is returned from the 4000-gal caustic storage tank to the 1000-gal caustic cooling tank by the caustic transfer pump. The caustic can be pumped back to the reaction vessel by the caustic metering pump from the 1000-gal caustic cooling tank for charging the reaction vessel during startup.

The piping and components that make up the caustic transfer system are fabricated of materials suitable for the nature and temperature of the hydroxide solution. Series-200 nickel or Monel 400 is used for those surfaces that will encounter hot

hydroxide and Series-300 stainless steel is used for those surfaces that will encounter cooled hydroxide solution.

Much of the caustic transfer system is designed to be operated automatically under the control of a computer. The control computer is programmed for control valve operation and 1000-gal caustic cooling tank heatup and provides the interlocks for caustic metering pump operation.

The caustic transfer system provides temperature indications and automatic flow control via a computer controlled flow valve and interlocks if preprogrammed parameters are not established. Operation of the reaction vessel outside of preprogrammed operating temperatures and pressures will be stopped by either automatic shutdown of processes (i.e., drum filling), alert alarm activations (i.e, outside control temperature band and/or interlocks initiated. Operation outside of operating and control band parameters will not automatically demonstrate rejection of a product drum from meeting treatment requirements. However, it will cause identifying the drum as suspect, requiring further investigation per the waste analysis plan (WAP). Computer-controlled preprogrammed operations and/or operating procedures will be initiated to prevent and/or identify possible upset conditions (i.e., caustic concentration possibly below 70 wt%). These operations are: (1) On shutdown of the sodium to the reaction vessel, an automatic closure of the drum fill drip isolation valve will be initiated and will be verified shut by an operator per procedure; (2) activate an alert alarm on the computer control console if the solenoid valves on the reaction vessel sprays are opened at any time during operating modes (i.e., Reaction Vessel to Drum Fill mode); (3) shutdown of sodium injection will initiate automatic shutting of the water injection valve to the reaction vessel preventing possible dilution; and (4) procedurally control the initiation of any shutdown activity that could potentially dilute the caustic while filling a drum.

The caustic transfer system includes caustic level monitoring and caustic concentration indication (real-time monitoring) and control. The sensors (drum scale and level probes) monitoring the level parameters during fill operations send their signals to the control computer. The computer system compares these signals with preprogrammed levels for the parameters and initiates an appropriate response. The response by the computer upon completing a drum fill is to shut the flow control valve, allow the caustic transfer line to drain and then close the downstream (drip) isolation valve and nitrogen flow though the caustic line. When an empty drum is in place on the scale and the level probes are placed in the drum, the operator initiates drum fill by pressing the drum fill button, which initiates opening the drip isolation valve. The nitrogen valve and the flow control valve are opened by the computer,

which commences filling another drum. If the flow control valve fails to fully close or closes on preprogrammed parameter conditions being outside limits, the computer will close the downstream (drip) isolation valve at the drum fill station. If deviation from the preprogrammed parameter conditions are the cause of the drip isolation valve closure, this drum will be identified by the computer as suspect. Further discussion on actions for suspect drums is contained in the WAP. In addition, there is an emergency shutdown button for the operator to initiate if necessary.

The heatup and temperature control of the caustic transfer piping/components (concentric pipe heat exchanger) is provided by the computer controlling the shell and tube heat exchanger coolant system. This shell and tube heat exchanger system raises temperature of these caustic transfer piping/components to approximately 180°F for operation.

Resistance heaters are used (as needed) to raise the temperature of the 50 wt% caustic components and piping from ambient temperature to 70–80°F. Additional description of the feed systems, safety cutoffs, bypass systems, and pressure controls for the caustic transfer system are detailed in the following subsections.

D-4(a)(7)(e) 1000-Gal Caustic Cooling Tank Feed(s)

The hydroxide solution is pumped from the reaction vessel via the caustic recirculation line to the either the drum fill station or to the 1000-gal caustic cooling tank. Approximately 1-2 gpm is diverted from the caustic recirculation line to provide a continuous feed to the drum fill station (approx. 1 gpm during drum fill) or to the caustic cooling tank when operations are shut down.

The tank is constructed of 1/8-in. thick Series-200 nickel and has pressure and temperature ratings of 15 psig and 500°F, respectively. Overpressure protection is provided by a rupture disc (rated at 15 psig at 70°F) that vents to the atmosphere through the caustic off-gas system HEPA filters.

The caustic cooling tank instrumentation includes pressure, temperature, and caustic level monitoring and control. The sensors monitoring these parameters send their signals to the control computer. The computer system compares these signals with predetermined levels for the parameters and initiates an appropriate response. The lower one-third of the 1000-gal caustic cooling tank is provided with external heaters and the entire tank is insulated. The heaters are controlled by computer and are used to melt any hydroxide in the tank during system startup. A pressure switch also monitors the nitrogen pressure in the 1000-gal caustic cooling tank.

The 1000-gal caustic cooling tank levels are monitored via shorting probes and a continuous level indicating bubbler system. These level indicating systems provide level indication on the computer monitor and supply the computer input for level control. These controls also ensure that adequate space is maintained in the tank to contain an emergency dump of hydroxide from the reaction vessel.

D-4(a)(7)(f) 4000-Gal Caustic Storage Tank Feed(s)

The 4000-gal caustic storage tank will be used to store 50 wt% hydroxide solution until it can be processed into >69 wt% hydroxide in the reaction vessel. The tank is located in a facility constructed on the west side of SPF.

Cooled hydroxide solution (–120°F) will be pumped to the 4000-gal caustic storage tank by the caustic metering pump. When caustic storage is needed, operators transfer the cooled hydroxide to the 4000-gal caustic storage tank. Hydroxide is then returned to the 1000-gal caustic cooling tank by the caustic transfer pump, as needed, for transfer to the reaction vessel.

Nitrogen is supplied at 1 psig to the 4000-gal caustic storage tank for pressure control purposes. This nitrogen blanket also prevents carbonate buildup that can occur if hydroxide and air are allowed to continually cycle through the tanks. Overpressure protection is provided by a rupture disc on the vent leading to the caustic off-gas line.

Level detection is installed on the 4000-gal caustic storage tank to monitor low level, high level, and high-high level of the hydroxide solution.

D-4(a)(7)(g) Service and Suspect Water Systems

Water is required as a feed to the reaction vessel. Water is collected and recycled in SPF to the greatest extent possible. The collected and recycled water is likely to be radioactively contaminated. Hence, the SPF water collection and recycle system is called the suspect water system. The suspect water system collects water specifically for recycle as feed to the reaction vessel. However, some water leaves the system as vapor in both the caustic and suspect exhaust streams. Makeup up for this water is provided by the MFC site DI water system.

The suspect water system collects drainage from the caustic off-gas stream. Sources of condensate are the condenser drain, the scrubber overflow drain, the mist eliminator (vane type) drain, the hydrogen/oxygen analyzer drain, the condenser sample line, the scrubber overflow sample line, the moisture eliminator/pre-filter sampling line, and the pre-filter housing drain lines.

The suspect water system includes one HWMA/RCRA-regulated tank, which is the 500-gal water holding tank. The 500-gal water holding tank is the center point of the suspect water system as it collects suspect water from all sources and supplies water feed to the reaction vessel, reaction vessel spray nozzles and the caustic off-gas scrubber.

The 500-gal water holding tank receives gravity drained water from the caustic off-gas condenser, the overflow from the caustic off-gas system scrubber, and the mist eliminator (vane type) drain. The remaining sources of liquids to be drained to the water holding tank that are too low for gravity drain are routed to the intermediate drain collection vessel (IDCV). From the IDVC, a peristaltic pump will transfer the liquid through tygon tubing into an existing connection on the water holding tank. Water may be pumped to the water holding tank from the barrel wash pad by the barrel wash return pump.

All piping and pumps are fabricated of either Series-300 stainless steel, galvanized carbon steel, or CPVC for corrosion resistance. All pumps that transfer HWMA/RCRA-regulated flows are either of the magnetically-driven seamless type and/or have secondary containment.

The 500-gal water holding tank has level monitoring instrumentation that transmits tank level information to the system computer. The valves and pumps of these systems are appropriately monitored to allow automated operations that include preventing cross-connections and maintaining the supply of suspect water in the 500-gal water holding tank as required for feed to the reaction vessel.

The IDCV is fitted with an upper level probe. This probe alarms to notify operating personnel when the peristaltic pump is not running and the caustic off-gas system is in operation. The pump runs continuously whenever the caustic off-gas system is in operation. Both the IDCV and the pump (along with the barbed tygon tubing) are located within the existing reaction vessel and caustic cooling tank secondary containment and the water holding tank/suspect waste pit secondary containment

D-4(a)(8) Diagram of Piping, instrumentation, and Process Flow [IDAPA 58.01.05.012; 40 CFR 270.16(d)]

The P&IDs for piping, instrumentation, and process flow are provided in the Permit Application, Attachment D-24.

D-4(a)(9) Containment and Detection of Releases [IDAPA 58.01.05.008; 40 CFR 264.193]

Secondary containment systems are provided for all HWMA/RCRA tank systems located at SPF. Leak detection is performed by daily visual inspections of the tank systems and their designated secondary containments. HWMA unit personnel who perform the inspections are trained in accordance with SPF HWMA unit specific procedures. The extensive nature of this training program ensures that inspectors will recognize the makeup and source of hazardous material leakage that could occur from SPF tank systems.

Response to spills that may occur at SPF is addressed in this Permit, in Attachment 7, Section G, Contingency Plan.

D-4(a)(10) Plans and Description of the Design, Construction, and Operation of the Secondary Containment System [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(g) and.

Specifications and drawings of the secondary containment systems located at SPF are included in Permit Application, Attachment D-37.

D-4(a)(10)(a) Tank Age Determination [IDAPA 58.01.05.008; 40 CFR 264.193(a)]

SPF provides the systems and equipment to safely convert Na and NaK to a low-level radioactive waste. Design and construction of SPF for its previous mission was started in 1985 and was completed in 1989. The tank systems associated with the SPF process were installed at various times during this period. Purchase requisitions and receiving reports were obtained in order to document the age of the tank systems (ref. Permit Application, Attachment D-38). The 5000-gal sodium storage tank, along with the 730-gal sodium day tanks, were received in November 1986. The 1000-gal caustic cooling tank and reaction vessel were both received in December 1986. The 500-gal water holding tank was received in October 1986 and 4000-gal caustic storage tank was received in May 1992.

D-4(a)(10)(b) Requirements for Secondary Containment and Leak Detection [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(g) and 264.193(b) and (c)]

The HWMA/RCRA tank systems in SPF have secondary containment as described in Table D-7.

Table D-7. SPF HWMA/RCRA Tank Systems and Containments.

Reaction Vessel and 1,000-Gal Caustic Cooling Tank Secondary Containment
The caustic tank pit is 21 ft 6 in. x 13 ft by 14 in. deep. This pit has a 3/16-in carbon-steel liner over a compacted-sand floor and formed concrete walls. The liner is seal-welded to the side plates of the pit to prevent migration of hydroxide solution. The total capacity of this pit, which provides secondary containment for both the reaction vessel (500 gal) and 1000-gal caustic cooling tank, is approximately 2440 gal. Secondary containment calculations are provided in Permit Application, Attachment D-36. A sump, which provides a low area for removal of liquids, is located in the southwest corner of the pit. Both the IDCV and the peristaltic pump are located within this secondary containment pit.
5,000-Gal Sodium Storage Tank and 730-Gal Sodium Day Tanks Secondary Containment
The sodium tank pit is 41 x 16 ft by 18-in. deep. This pit has a 3/16-in carbon-steel liner over a compacted-sand floor and formed concrete walls. The liner is seal-welded to the side plates of the pit to prevent migration of Na. The total capacity of this pit, which provides secondary containment for the 5000-gal sodium storage tank and both 730-gal sodium day tanks, is approximately 7360 gal. Secondary containment calculations are provided in Permit Application, Attachment D-36. A sump, which provides a low area for removal of liquids, is located in the northwest corner of the pit.
500-Gal Water Holding Tank/Suspect Waste Pit Secondary Containment
The suspect waste pit is 5 x 4 ft 6 in. x 12-in. deep and is made of formed concrete. This pit drains into the caustic tank pit. The contents of the 500-gal water holding tank, if it should leak, will be drained to the suspect waste pit. This is accomplished by providing curbing (2 to 4-in. high) in the northeast corner of the processing area. The curb enclosed area includes the 500-gal water holding tank, barrel wash supply pump, reaction vessel water injection pump, and emergency shower and eyewash station. The entire area drains into the suspect waste pit. In addition, the existing concrete surfaces in the enclosed area are painted with Amercoat or an equivalent masonry coating to provide an impermeable surface and prevent migration of waste water.
Barrel Container Assemblies
The barrel container assemblies in the sodium melting and draining room provide secondary containment for the drums that are placed in them for heating. Each assembly has a capacity of approximately 64 gal, while the drums to be heated are approximately 55 gal. Secondary containment calculations are provided in Permit Application, Attachment D-22.

Table D-7. SPF HWMA/RCRA Tank Systems and Containments (continued)

4000 gal Caustic Storage Tank
The 4000-gal caustic storage tank and secondary containment for the tank is housed in a building (ref. Permit Application, Attachment D-29) located on the west side of SPF. The building is constructed of carbon-steel sheet metal and contains a 12 x 17 x 3 ft secondary containment basin. The containment basin and floor are carbon-steel lined. The floor of the building slopes toward the containment basin. Calculated volume of the basin is approximately 4580 gal, making it adequate to contain the full volume of the tank without overfilling. If pumping of the basin is necessary, a 1 ft x 1 ft x 6-in. deep sump is located in the southeast corner. The 4000-gal caustic storage tank is insulated with fiberglass insulation to protect against temperature extremes. An additional benefit of the insulation layer is to prevent lateral movement of potential leakage outside the confines of the containment basin.

Secondary Containment Base Structural Adequacy. Structurally, the walls and floor of secondary containment are designed to resist the following forces:

- Dead loads (such as tank, tank contents, concrete, and steel liner)
- Soil pressure on external wall surfaces
- Hydraulic pressure that would occur on walls and floor should the tank contents leak in the secondary containment
- UBC Zone-2 seismic forces.

The allowable soil bearing pressure used to design SPF was 1,500 pounds per square foot (psf), which is very conservative. An allowable soil bearing pressure of 3,000 psf was used for design of the carbonate portion of SPF.

The ground-water level in the MFC area is 640 ft or more below the surface and was not considered a factor in the design of the secondary containment pits because of its depth. SPF is constructed such that the surface drainage is routed away from the structure. Consequently, water is kept from reaching the soil/gravel below the foundations and secondary containment pits. This alleviates the problem of frost heaves or decreased soil strength due to saturation.

Leak Detection. Each tank system located at SPF has a level indicating system, mainly by electrical probe. However, none of the SPF tank system secondary containments are equipped with a leak detection system. Therefore, leak detection takes place by performance of daily visual inspections of the secondary containment pit liners by SPF personnel. RCRA inspections are made daily. Records of the daily inspections will be maintained as part of SPF operating record. Response actions to spills or leaks of wastes are detailed in this Permit, in Attachment 7, Section G, Contingency Plan.

D-4(a)(10)(c) Requirements for External Liner, Vault, Double-Walled Tank or Equivalent Device [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(g) and 264.193(d) and (e)]

Volume calculations to show that secondary containment systems for the tanks used for SPF treatment and storage provide sufficient volume for the largest tank associated with its respective secondary containment are provided in Permit Application, Attachment D-36. All the secondary containment systems are in SPF buildings and constructed in such a manner that surface drainage is routed away from the structures and run-on and infiltration of precipitation is prevented. All secondary containment has been inspected to ensure that it is free of cracks or gaps. Permit Application, Attachment D-37 provides drawings of the secondary containments and shows that the tanks are situated in the secondary containment so the secondary containment surrounds the tank and prevents waste from coming into contact with surrounding soil.

D-4(a)(10)(d) Secondary Containment and Leak Detection Requirements for Ancillary Equipment [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(g) and 264.193(f)]

Ancillary equipment associated with SPF systems is accessible for daily visual inspections when the system is in operation. Ancillary equipment associated with the SPF tank systems meet the requirements in 40 CFR 264.193(f). The piping is either welded or is pressurized piping (e.g.) with automatic shut-off devices. The caustic transfer line is a drain line contained within a pressurized cooling jacket. The cooling water is at a higher pressure. If the integrity of the inner (hydroxide) pipe was compromised, the resulting leakage would be from the higher pressure cooling jacket into the hydroxide drain line. Such leakage would result in a loss of coolant and subsequent loss of coolant indication from the water heater level sensor. This provides an input signal to the computer that automatically closes the level control valve thereby meeting the requirements of 40 CFR 264.193(f)(4).

D-4(a)(10)(e) Controls and Practices to Prevent Spills and Overflows [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(i) and 264.194(b)]

Sodium transfer into SPF storage tanks will be monitored automatically and constantly by the facility computerized process control system. The 5,000-gal sodium storage tank and two 730-gal sodium day tanks have instrumentation that monitors and indicates internal pressure, level, flow, and temperature. To protect against overfilling, maximum storage amounts in all tanks will not exceed preprogrammed limits in the process control system's operating parameters, which are monitored by level alarms.

Further information on controls and practices to prevent spills and overflows is addressed in this Permit in Attachment 6, Section F, Procedures to Prevent Hazards.