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 1a

SECTION D – SECONDARY SODIUM SYSTEM PROCESS DESCRIPTION

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D. PROCESS DESCRIPTION

D.1 Process Description

This process description describes the Hazardous Waste Management Act (HWMA)/Resource Conservation Recovery Act (RCRA) storage, removal, and treatment activities for the secondary sodium system (SSS) piping/components. The SSS piping/components comprise one tank storage/treatment ancillary unit called the Secondary Sodium System (SSS) piping/components. The SSS piping/components are located in the east side of Bldg. 766.

The Department of Energy (DOE), in response to the Secretary of Energy and Congress, directed Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) to maintain the Experimental Breeder Reactor-II (EBR-II) Primary Sodium System (PSS) and SSS in an industrially and radiologically safe condition and subsequently to complete the Plant Closure Project by March 2002. Part of the tasks for the HWMA/RCRA management of the residual sodium in the PSS and the SSS is to place these systems in stable configurations that can be easily maintained with minimal monitoring and maintenance, while HWMA/RCRA storage and treatment activities (removal and deactivation of sodium residuals) continue to be completed over several years. The process identified by MFC, and agreed upon by DOE, for reaching this stable configuration was the passivation of the sodium residuals. The EBR-II Plant Closure Project Implementation Plan (1) defined the EBR-II Plant Closure scope through March 2002, (2) defined industrially and radiologically safe, and (3) provided the rationale for passivation of the sodium. Passivation of the sodium residuals results in the formation of a surface layer of sodium carbonate (Na_2CO_3) on all exposed sodium surfaces that will minimize effects on the residual sodium remaining in these systems against the unlikely event of uncontrolled intrusions of ambient air and/or water vapor. Passivation of the sodium residuals was initiated under an Interim Status (40 Code of Federal Regulations [CFR] 265) treatment permit and was completed in January 2006. As identified earlier, the Plant Closure Project ended March 2002. HWMA/RCRA treatment (removal and deactivation) and storage activities continued beyond March 2002.

On August 31, 2009, the EBR-II Complex Permit and operational control of the permitted units (located in MFC-766, -767, -795, -793E and -793F) were transferred to the Idaho Cleanup Project contractor for closure and decontamination and decommissioning of these facilities. RCRA clean closure of buildings MFC-793E and -793F has been completed, approved by the DEQ, and information on these buildings has been removed from the permit.

RCRA closure of the remaining permitted units will be completed in two phases. The 45-day notification for initiation of closure activities was submitted on January 28, 2010. Phase I involves the treatment/removal of sodium, sodium passivation residuals, and sodium potassium (NaK) alloy currently in the system. Although completion of the sodium treatment is now under closure, the Closure Plan (Section I) refers back to the treatment requirements specified in Section D for the treatment of the sodium/residuals remaining in the system. System modifications will be included in the P.E. closure certification, as described in Section I-2(a). The treatment evolution was initiated during calendar year 2010. This treatment involves addition of water/steam into the system under controlled conditions to react the remaining sodium. In addition, additives (e.g., citric acid, sodium citrate) are used to remove the sodium passivation residuals and neutralize the resulting treatment solutions. Waste characterization of the treatment residuals will be completed via sampling prior to disposition of the residuals. Monitoring of the treatment residuals for pH will be used as indicator parameter that the treatment is completed as designed. Following waste determination, the treatment residuals may be dispositioned to the ICDF evaporation pond if they meet the WAC for the evaporation pond, or disposed at another appropriate disposal facility. If the closure performance standards are met, the liquids will be nonhazardous and may be used in the grout formulation for the final end state of the unit.

RCRA closure of the Primary Sodium Tank system, Intermediate Heat Exchanger, and Secondary Sodium Drain Tank have completed closure activities, PE certification of closure, and the closures have been approved by the DEQ. The remaining portion of the overall system is the secondary sodium system piping/components addressed in this permit.

Phase II will consist of the activities described in Attachment 8, the RCRA Closure Plan for the permitted systems.

In conjunction with the Phase I closure activities, the EBR-II Complex is also undergoing decontamination and decommissioning (D&D) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. D&D activities include isolation of the buildings from all MFC Complex systems (e.g., electrical, communication, alarms, etc.), removal of hazardous materials (e.g., asbestos, lead, etc.), and other activities as necessary to facilitate preparation of the EBR-II Complex for its final end state as determined under the CERCLA process. As these activities are completed, compensatory measures will be instituted and documented in the operating record to maintain compliance with the permit. For example, as the electrical isolation of the buildings

is completed, temporary power will be provided and the outages necessary to complete the changeover will be recorded in the operating log.

D.1.1 Storage

D.1.1(a) Sodium Boiler Building

The SSS piping/components system is confined to the east side of the Sodium Boiler Building (SBB, Bldg. 766). The EBR-II SSS includes all of the EBR-II secondary sodium system components and piping (ancillary equipment). The major secondary system components are the following:

- Sodium Surge Tank (1,200-gal, 25’ 4” long x 3’ diameter)
- Relief Tank (1,200-gal, 25’ 4” long x 3’ diameter)
- Main Sodium Linear Induction Pump (35-gal)
- “Shell sides” of the nine heat exchangers (seven evaporators and two superheaters, 220-gal each, 30’ 2” long x 56” diameter)
- Piping and valves of the secondary cooling and drain systems (5,037 gallons).

The SBB is a rectangular reinforced concrete structure consisting of two distinct sections separated by a reinforced concrete wall. The east side of the SBB is known as the boiler wing and consists of a basement and first floor. This wing of the building houses the sodium surge tank, main sodium linear induction pump, heat exchangers (evaporators and superheaters), and piping.

Basic system description of the SSS piping/components and its associated ancillary equipment are provided in Subsection D.2.

D.1.2 Removal

Tasks have been identified for reaching stable configurations of the Na and sodium–potassium alloy (NaK) systems that can be easily maintained with minimal monitoring and maintenance, ancillary equipment for the SSS piping/components system has been placed in layup. Ancillary equipment layup is, for the most part, isolation of the equipment from the primary sodium tank and the Secondary Sodium Drain Tank (SSDT) in preparation for removal or deactivation/treatment of the sodium residuals. For those systems that will not undergo in-situ deactivation/treatment (described in subsequent sections), the ancillary equipment

(e.g., piping, components, dead legs) containing bulk Na or NaK and residuals may be removed.

Deactivation/treatment

Deactivation/treatment is the treatment process by which the sodium residuals remaining in the SSS piping/components are designed to be converted to a nonhazardous waste residue. Deactivation/treatment of the sodium residuals has been accomplished by the reaction of exposed sodium surfaces with water vapor and carbon dioxide (CO_2) to form sodium bicarbonate ($NaHCO_3$). It shall be understood that all references to Na_2CO_3 in this permit includes sodium bicarbonate ($NaHCO_3$). The reaction of Na with moist CO_2 is shown below:

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

$$CO_2 + NaOH \rightarrow NaHCO_3$$

In 2006/2007 a portion of the residual sodium within the primary and secondary sodium systems of EBR-II was deactivated using a steady flow of humidified carbon dioxide. The in-situ process, now known as "carbonation," converts the residual sodium into solid sodium bicarbonate (baking soda) with the release of gaseous hydrogen. Carbon dioxide is present in a large excess and dilutes the hydrogen produced so that the measured hydrogen concentrations during treatment are always below the flammable limit in air of 4 vol%. In the EBR-II SSS piping/components, less than 500 gal of residual sodium remains after carbonation.

To provide assurances that the sodium has been deactivated, a rinse of the SSS with treatment solution will be performed as part of the closure of the piping/components.

Sodium and NaK Treatment System

System Overview

The Treatment System(s) include fluid handling equipment, piping, instrumentation, and the system (vessel and/or piping) to be treated, along with necessary interfacing modifications. Each treatment system has one of two major configurations: aqueous treatment configuration or steam treatment configuration. The major components comprising a Treatment System are depicted in the EBR-II Permit Appendix D-1 EDF-9426 Steam Treatment of Non-Passivated Residual Sodium in Piping and Vessels, and include:

- Treatment Fluid Delivery: delivers treatment solution, water or steam.

- Nitrogen supply: provides inert gas for diluting and removing process gaseous by-product (primarily hydrogen with possible carbon dioxide).
- Vessel/Piping to be treated: contains residual sodium and NaK with various levels of bicarbonate passivation.
- Scrubber: removes and neutralizes particulates that may form or be levitated during treatment (anticipated to be primarily sodium hydroxide, sodium bicarbonate and/or sodium carbonate).
- Condenser: reduces moisture of gas stream for protection of downstream instrumentation.
- Heater: re-warms gas stream to near ambient temperature.
- HEPA filter: final removal of any remaining particulates in gas stream.
- At a minimum, instrumentation for detection, indication and recording of the following parameters: TI (temperature indication), LI (level), PI (pressure), pH, O2 (oxygen), H2 (hydrogen), and flow meter. Optional additional monitoring may include: RH (relative humidity), C02 (carbon dioxide), CAM port (continuous air monitoring), 3H port (for tritium sampling), and Gamma radiation.

Fluid Delivery System Controls and Operation

For the aqueous treatment configuration, the treatment rate is controlled by metering the flow of treatment solution (water with possible additives) into piping/ components/tanks. Fluid metering equipment is not depicted in Exhibit D-1. For the steam treatment configuration, the treatment rate is controlled by the rate of steam flow into the system.

With these configurations, the treatment rate is estimated by multiplying the measured hydrogen concentration by the mass flow of off-gas. Total sodium treated is estimated using the time-integration of this value.

Off-gas Treatment System Controls and Operation

For both steam and aqueous treatment configurations, the off-gas treatment system monitors, cleans, neutralizes and removes particulates from the gas stream leaving the vessel/piping being treated.

System Safety Monitoring and Control

As treatment continues, safety and process controls monitor oxygen, pressures, temperatures, liquid level, pH, and flow, pressure drop across filter, and hydrogen gas concentrations. If any of these parameters, whether associated with the fluid

delivery system, components to be treated, off-gas treatment system, or cross-checks there between, fall outside pre-determined bounds, associated alarms will activate and slow-down or shut-down procedures will be initiated.

Basis for Treatment Capacity

The basis for quantifying sodium treatment capacity for the two treatment configurations is as follows:

Steam Treatment

The component which limits throughput of the steam treatment configuration is the steam boiler, which has a capacity of 100 pounds per hour of steam. Using the 1:1 stoichiometry of the reaction of water and sodium, along with a solid sodium density of 8.10 lbs/gallon this equates to the following rate of sodium treatment:

$$\frac{100 \text{ lb } H_2O}{\text{hr}} \times \frac{22.99 \text{ lb/mol Na}}{18.01 \text{ lb/mol } H_2O} \times \frac{\text{gal Na}}{8.10 \text{ lb Na}} \times \frac{24 \text{ hr}}{\text{day}} = 378 \frac{\text{gal Na}}{\text{day}}$$

Aqueous Treatment

The component which limits throughput of the aqueous treatment configuration is the Scrubber, which has a capacity of 250 SCFM, in combination with the targeted hydrogen concentration limit, which is 15% by volume in nitrogen. The exhaust stream will be further reduced to a hydrogen concentration below 4% within 1 meter from the exhaust vent diffuser.

This equates to a hydrogen (H_2) flow rate of:

$$\frac{250 \text{ SCF exhaust}}{\text{min}} \times \frac{15 \text{ SCF } H_2}{100 \text{ SCF exhaust}} = 37.5 \frac{\text{SCF } H_2}{\text{min}}$$

Which, using the ideal gas law, at one atmosphere and at 74°F (23.35°C) equates to the following rate of sodium treatment:

$$\frac{37.5 \text{ SCF } H_2}{\text{min}} \times \frac{28.3 \text{ liter } H_2}{\text{SCF } H_2} \times \frac{\text{mol} \times \text{K} \times 1.0 \text{ atm}}{0.0821 \text{ atm-L} \times 296.5\text{K}} \times \frac{\text{mol Na}}{0.5 \text{ mol } H_2} \times$$

$$\frac{22.99\ \text{gm Na}}{\text{mol Na}} \times \frac{\text{lb Na}}{454\ \text{gm Na}} \times \frac{\text{gal Na}}{8.10\ \text{lb Na}} \times \frac{1440\ \text{min}}{\text{day}} = 785\ \frac{\text{gal Na}}{\text{day}}$$

For both configurations, sodium hydroxide generation rate, the amount of acid required for scrubber neutralization, heat generation, HEPA filter particle capture rate, and nitrogen requirements have been calculated and determined to be well within reasonable engineering limits.

D.2 Basic System Description

The following subsection provides information regarding the major system and components for the SSS (Table D-1) as shown in the table. The piping and instrumentation diagrams or schematics for the system are provided in the specified attachment.

D.2.1 Secondary Sodium System Piping/Components

This process description generally describes the SSS piping/components in the east side of the SBB (Bldg.-766). The purpose of the SSS was to provide a nonradioactive heat transfer medium for transferring heat from the PSS to the steam system. The EBR-II SSS includes the all of the EBR-II SSS components and piping (tank ancillary equipment). The major SSS components described in subsequent sections and their associated appendix attachments are shown in Table D-1.

Table D-1. Secondary Sodium System.

Secondary Sodium System			
East Wing Components		**A.**	**Permit Application Appendix 2, Attachment**
Surge Tank		B.	SSS-7
C.	Evaporators and Superheaters	D.	SSS-9
E.	CO_2 Supply	F.	SSS-11

D.2.1(a) Secondary Sodium System Piping/Components Treatment of Removed Components

For in-situ treatment of piping, access for addition of treatment solutions (water/steam/additives) will be accomplished via several methods depending on the specific piping configuration. Where blocked piping segments/components have been removed, tie-ins or jumpers will be provided at/across the remaining piping to facilitate treatment. Piping elbows or sections may also be removed and replaced with tie-ins or jumpers to provide access.

The following steps/precautions will be taken when removing and handling sodium/NaK filled piping segments/components. The appropriate PPE (portable eyewash station) and fire response equipment (metal X fire extinguisher) will be staged near the work area. Unnecessary combustibles and any moisture on the floor will be removed. A clean and dry metal catch pan will be staged under the area where cutting will occur. Whenever possible cuts will be made from the high points of the system down, with a visual inspection completed prior to cutting. Cutting will be completed via mechanical means (e.g., porta-band saw or wheeled cutter). The cutting will be stopped when the cut temperature approaches 200° F to allow the equipment to cool and ensure the sodium does not melt. The ends of piping or removed sections will be bagged to minimize exposure to air. Work areas will be inspected for signs of alkali metals outside of an acceptable storage container at the end of each shift and the areas cleaned up as needed.

D.2.1(b) Secondary Sodium Recirculation System

The SSS recirculation system was a fill and overflow system that took suction from the SSDT and supplied sodium from the SSDT to the sodium surge tank. As an overflow system (when the sodium surge tank was at its overflow level), the system returned sodium to the SSDT (Permit Application, Appendix 2, Attachment SSS-7). The recirculation system consists of two sodium circulating pumps, interconnecting piping, and valves (see Permit Application, Appendix 2, Attachment SSS-8).

Isolation of the east wing components from the west wing components (the SSDT) has been accomplished. The isolation was accomplished by physically cutting a section of each of the six drain lines, capping and then seal welding the caps. This was completed in preparation for the east wing components to undergo in-situ deactivation.

D.2.2 Support Systems

D.2.2(a) Suspect Exhaust System

Sodium Boiler Building

Because tritium is the only radioactive constituent of concern, the exhaust lines in the secondary sodium system do not contain HEPA filters to control particulate emissions.

D.2.2(b) Argon/Carbon Dioxide/Nitrogen Supply System

An argon storage tank provides argon for the EBR-II Complex. Fresh argon was used as a blanket gas to limit the danger of a sodium/air reaction in areas where sodium may be exposed to air. The system is used to supply inert gases (argon, nitrogen) to piping/components in east side of building MFC-766.

East Wing Components

The east wing components that had previously been supplied argon cover gas via the sodium surge tank, were converted to CO_2 gas which was used for the deactivation of the residual sodium in the east wing components (see Permit Application, Appendix 2, Attachment SSS-11). Conversion back to argon or nitrogen has been implemented as part of closure activities. The cover gas is regulated and maintained under pressure.

D.2.2(c) Fire Suppression System

Secondary Sodium MET-L-X System

The east wing secondary MET-L-X components have undergone system layup. With the sodium in the east wing components drained and the residual sodium solid, an evaluation by the MFC Fire Protection Engineer identified the MET-L-X system for the east wing components was not necessary. Portable MET-L-X fire extinguishers are appropriately staged during treatment and cutting or removal of components.

Smoke detectors and fire alarms in MFC-766 and MFC-799 will remain operational through closure certification. Fire hydrants are available adjacent to the building, and the INL Fire Department station at MFC has a response time of less than 3 minutes. Upon completion of sodium treatment in MFC-766, MET-L-X fire extinguishers will be replaced with ABC extinguishers. Tank system components and containers containing elemental sodium are maintained under inert cover gas.

D.2.2(d) Argon or Nitrogen

Argon or nitrogen is used for a blanket of cover gas for the sodium. The cover gas supply tank is a double-wall stainless-steel tank with insulation between the inner and outer wall. The capacity of the tank is 30 tons.

D.3 Tank Systems

D.3.1 Existing Tank Systems

The EBR-II Complex contains the SSS piping/components. This tank system is considered to be an *existing tank system* in accordance with the preamble in 51 *Federal Register* 25446, Section IV.B.4, *Design and Installation of New Tank Systems* (40 CFR 264.192), because these tank systems were being used for storage of radioactive sodium (now a MW) prior to the promulgation date of the regulations (July 14, 1986). The tank systems were installed and tested between 1957 and 1963.

The existing tank system meets secondary containment requirements in accordance with IDAPA 58.01.05.008 and 40 CFR 264.193. The MFC-766 Building, east side, provides containment for the SSS piping/components. The concrete basement of the building is lined with welded 3/8" carbon steel for secondary containment. The dimensions of the secondary containment are 69.5' long x 43.25' wide x 2.92' high, and the volume is 65,653 gallons. The secondary containment has been:

- Designed, installed, and operated to prevent any migration of MW or accumulated liquid out of the systems to the soil or ground water – welded liner within the concrete basement
- Designed to detect (or allow detection) of releases of MW and accumulated MW until the collected material is removed – visual daily inspections are performed
- Constructed and lined with materials that are compatible with the MW placed in the tanks systems and have sufficient strength and thickness to prevent failure – welded 3/8" carbon steel
- Constructed of a base that is sufficient to provide support to the secondary containment system – concrete building foundation
- Provided with leak detection capability (remote monitoring and/or visual inspections) that will detect the failure of either the primary or secondary

containment or the presence of any release of MW or liquids in the secondary containment within 24 hours.

- In addition, secondary containment pans (metal, clean, dry) are placed in the work area whenever access to the piping or removal of components is required.

D.3.1(a) Assessment of Existing Tank System(s) Integrity [IDAPA 58.01.05.012; 40 CFR 270.16(a), 264.191]

Because this tank system meets the definition of an existing tank system with secondary containment, it does not require a written assessment as to their integrity. Information on the tank system is provided in this subsection. Information on the tank system integrity and external corrosion protection has been provided in this subsection and Subsection D.4.1(b).

Secondary Sodium System Piping/Components

The SSS piping/components comprises hundreds of feet of pipe of various sizes. The piping that contains sodium is made of schedule 304 stainless steel. Numerous anchors, sway braces, guides, and supports are used on the SSS piping in the SBB. As a result of the water hammer overpressurization event, an integrity assessment for the SSS piping/components will be completed prior to continuing treatment.

D.3.1(b) External Corrosion Protection [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(e) and 264.192(f)]

All of the SSS piping/components are protected from external corrosion. All the tanks and ancillary equipment are located above ground and within the east side SBB (Bldg. 766).

D.3.2 Description of Feed Systems, Safety Cutoff, Bypass Systems, and Pressure Controls [IDAPA 58.01.05.012; 40 CFR 270.16(c)]

The following subsection describe the feed system, safety cutoff, bypass systems, and pressure controls.

D.3.2(a) Secondary Sodium System Piping/Components Feed Systems

Cover gas enters the east wing of the SBB through the south wall into a main line that supplies the cover gas to the SSS (see Permit Application, Appendix 2, Attachment SSS-10).

SBB East Wing

For the SBB east wing components, there were two functions and pathways of the cover gas. The functions were to provide a cover gas for the sodium residuals in the east wing components and to provide a carrier gas for the moisture when deactivating the sodium residuals.

Cover gas was provided to the east wing components through the argon supply line, which was modified to accommodate inert gases instead of argon, to the SBB. The modification provided the supply of CO_2 to the east wing components instead of an argon cover gas. As seen in Appendix 2, Attachment SSS-11, CO_2 was supplied from the CO_2 tank and enters the supply line.

The carrier gas during deactivation, was provided from the CO_2 storage tank to the inlet connection on the humidification cart. The dry CO_2 was bubbled through a tank of water (located on a humidification cart) before being introduced into the CO_2 manifold. From the CO_2 manifold, lines into the secondary sodium drain lines were established for deactivating the residual sodium. Further description of the deactivation of the secondary sodium is provided below.

Secondary Sodium Residuals Deactivation by Moist CO_2

A portion of the SSS was deactivated using a steady flow of humidified carbon dioxide. As part of the active treatment and storage operations at the EBR-II Complex, deactivation of the SSS will be accomplished before implementation of the closure activities (see Attachment 8, Section I, Closure Plan, of this Permit) for the EBR-II Complex.

SBB East Wing Deactivation

The surge tank, located in the east wing of the SBB, serves as the distribution center for the deactivation of the residual sodium in the east wing components. The evaporators and superheaters have vent lines that connect to the secondary sodium surge tank. These vent lines served dual purposes. When the secondary sodium system was drained to the SSDT (e.g., maintenance) argon cover gas replaced the sodium. As the SSS was filled from the SSDT, the vents provided the pathway for the argon cover gas to be removed from the system as sodium replaced the gas. These vent lines off the surge tank, after converting the cover gas to CO_2, now provide the pathway for the cover gas supply to maintain a dry CO_2 atmosphere within the east wing components.

For the deactivation of the east wing components, the vent piping off the superheaters and the evaporators provided the discharge pathways for the deactivation process. The purge pathway was established by the addition of a CO_2 manifold at the isolated drain lines of the east wing components. A vent manifold provided the exhaust pathway for the H_2 gas generated during deactivation of the secondary sodium residuals. The H_2 gas was vented to the atmosphere on the north side of the SBB. Permit Application, Appendix 2, Attachment SSS-14, provides an example of two of the purge and vent pathways that have been established for deactivation of the residual sodium in the east wing components.

The hydrogen and oxygen gas was monitored in the exhaust during the deactivation process. To minimize the possibility of a H_2 explosion, water vapor was introduced at a controlled level and O_2 was excluded from the system. Measurement of the H_2 is the primary tool for monitoring the progress of the deactivation reactions. Measurements, with H_2 and O_2 monitors, were taken off the vent manifold (the highest point), where H_2 is likely to be present (see Permit Application, Appendix 2, Attachment SSS-15). Remote alarms for the H_2 and O_2 monitors were located in the EBR-II Control Room and a local alarm was provided on the humidification cart containing the humidifier. The H_2 and O_2 monitors were set to alarm at 4 and 1 vol%, respectively. The cover gas has been changed back to argon or nitrogen to support further sodium treatment as part of closure activities.

D.3.3 Diagram of Piping, Instrumentation, and Process Flow [IDAPA 58.01.05.012; 40 CFR 270.16(d)]

The remaining eastside piping and current piping and instrumentation drawing (P&ID) for piping, instrumentation, and process flow are provided at the end of this Section.

D.3.4 Containment and Detection of Releases [IDAPA 58.01.05.008; 40 CFR 264.193]

Secondary Sodium System Piping/Components Leak Detection

Leak detection in the east side of the SBB will be performed by daily visual inspections of the tank system (includes ancillary equipment) and the secondary containment as specified in Section F.

Response to spills that may occur at the SBB is addressed in Attachment 7, Section G, Contingency Plan.

D.3.4(a) 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 264.193(b) through (f)]

D.3.4(a)(1) Secondary Sodium System Piping/Components Secondary Containment

The basement of the SBB east side has welded carbon steel lined floors and walls 2.92 ft in height. The steel liner was installed to prevent the concrete from spalling in the event of a sodium leak.

D.3.4(a)(2) Tank Age Determination [IDAPA 58.01.05.008; 40 CFR 264.193(a)]

The reactor building and the SBB provide the systems and equipment to safely store and convert sodium to a low-level radioactive waste. Design and construction of the EBR-II Complex for its previous mission of reactor research and development was started in 1957 and completed in 1964. The tank systems associated with EBR-II were installed at various times during this period.

Table D-2. Secondary Sodium System Piping/Components Secondary Containment.

Secondary Sodium System Secondary Containment
The SSS piping/components are located in the east wing of the Secondary Sodium Building (SBB), MFC-766. The east side of the SBB is constructed of reinforced concrete floor and walls. A carbon steel liner covers the floor and to a height of 2.92 ft up each of the walls. The dimension of the secondary containment are 69.5’ x 43.25’ x 2.92’, the capacity is 65,653 gallons. All of the seams are welded to ensure a continuous protective liner. The steel liner is compatible with the sodium contained in the system and was installed to prevent the concrete from spalling in the event of a sodium leak. The reinforced concrete foundation provides sufficient support to the piping system to prevent failure due to settlement, compression, or uplift. Leak detection is accomplished through visual inspections of the area. The secondary containment was designed to contain over 20,000 gal, which is in excess of 100% of maximum capacity of the piping/components. The secondary containment forms a continuous impermeable barrier to prevent lateral as well as vertical migration of the waste.

Leak Detection.

For the SSS piping/components, the secondary containment is not equipped with a leak detection system. Therefore, leak detection is performed by visual inspections of the secondary containment in accordance with in Attachment 4, Section F-2, Inspection Schedule. Records of the inspections are maintained as part of the operating records. Response actions to spills or leaks of waste are detailed in Attachment 7, Section G, Contingency Plan.

D.3.4(a)(3) 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 show that the secondary containment system for the SSS piping/components provides containment volume greater than 100 percent of the capacity of the piping/components.

D.3.4(a)(4) 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)]

The primary and secondary ancillary equipment will be inspected as described in Attachment 4, Section F-2, Inspection Schedule. All the piping is welded.

D.3.5 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)]

During closure activities drip pans, hot taps, and sleeves, etc., will be utilized to provide containment of potential spills.

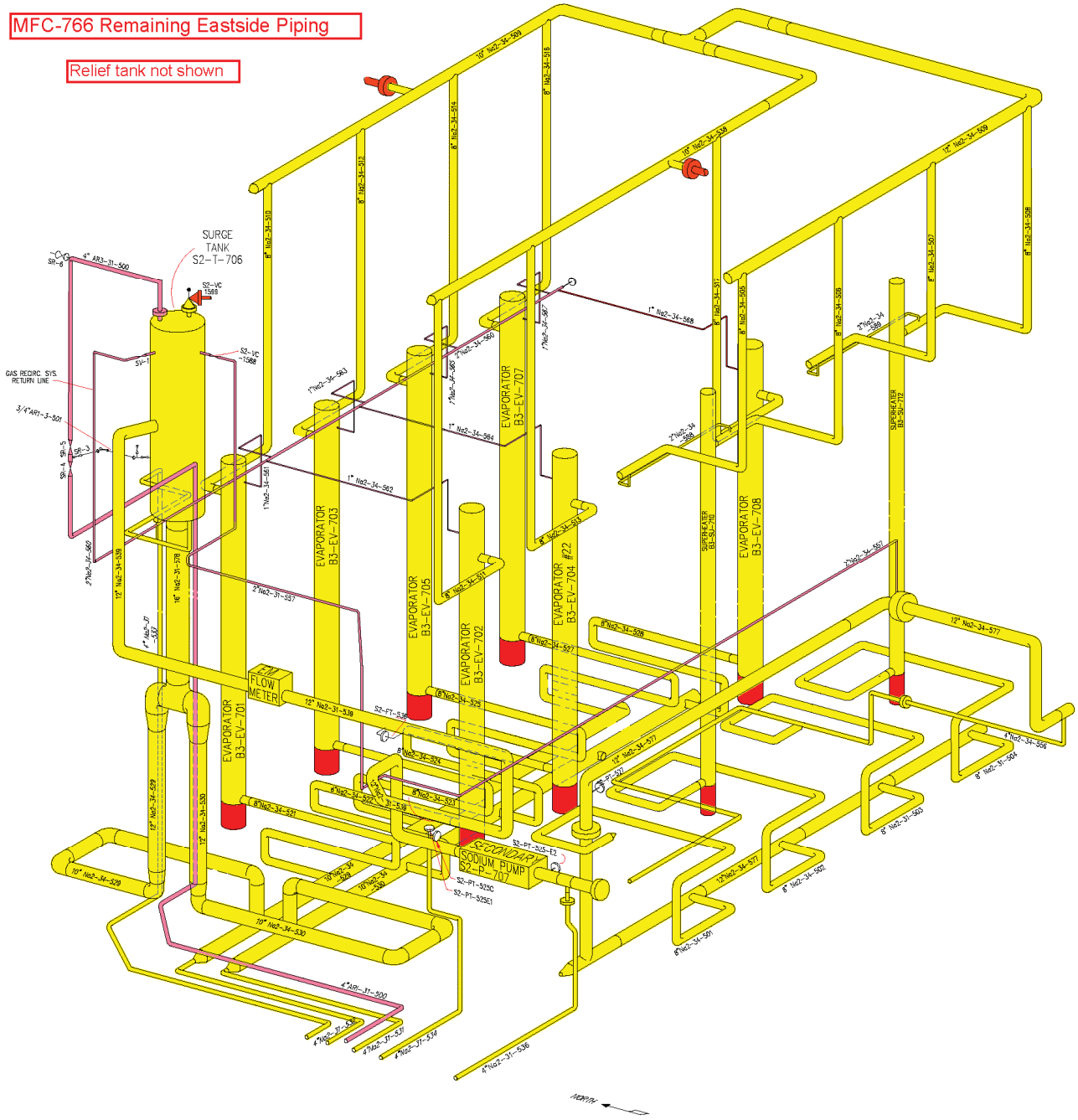

Figure D-1. MFC-766 Remaining Eastside Piping

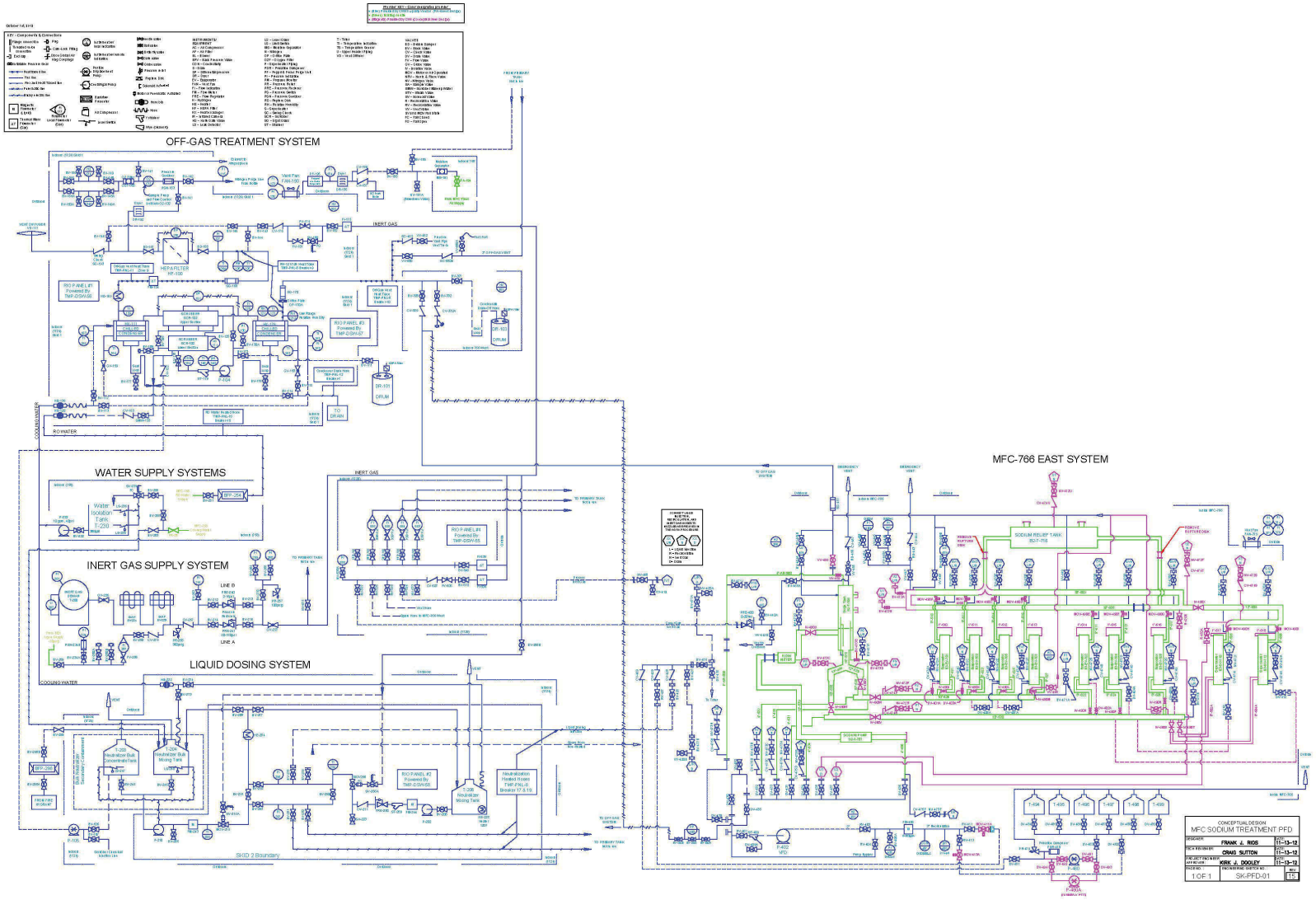

Figure D-2. Sodium Treatment System Process Flow Diagram