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RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

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FOR

RDP Spent Resin Dewatering Equipment Package

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Note: Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides of provided for process description purposes only.

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1 Scope

1.1 Project Description and Location

The River Protection Project-Waste Treatment Plant (RPP-WTP) is a complex of waste treatment facilities where the US Department of Energy (DOE) Hanford Site tank waste will be pretreated and immobilized into a stable glass form via vitrification. The WTP Contractor will design, build, and start-up the RPP-WTP pretreatment and vitrification facilities for the DOE Office of River Protection (ORP). The waste treatment facilities will pretreat and immobilize the low-activity waste (LAW) and high-level waste (HLW) currently stored in underground storage tanks at the Hanford Site.

The Hanford Site occupies an area of about 560 square miles and is located along the Columbia River, north of Richland in the state of Washington. The RPP-WTP Facility will be constructed at the East End of the 200 East Area of the Hanford Site. The counties of Benton, Franklin, and Grant surround the Hanford Site.

1.2 System Description

The Spent Resin Collection and Dewatering Process System (RDP) supports the Cesium Ion Exchange Process System by removing spent ion exchange (IX) resin from the IX columns. The RDP system is the point of verification that spent IX resin meets waste acceptance criteria and can be transferred out of the facility for disposal as regulated mixed (radioactive and dangerous) waste. The process consists of removing the spent resin from IX columns, suspending and sampling the resin, and transferring it to a disposable dewatering container (DWC). The RDP system also includes the process for dewatering the resin once it is in the DWC.

This specification establishes the requirements for the design, fabrication, quality assurance, inspection, testing, qualification, and labeling of the Spent Resin Dewatering Equipment Package for use in the RPP-WTP Pretreatment Facility. This specification also provides the interface information for the RWH (Radioactive Solid Waste Handling) system for handling the dewatering container, shipping cask, fill head and any handling occurring during process (see Appendix A). This specification permits cost effective alternative design proposals. Alternatives may be proposed that provide enhancements affecting equipment in configuration, size, number, and function.

The scope of work for the Seller includes all work defined in this specification and its addenda and attachments. Work shall include, but is not limited to, the following. Provide fully detailed designs, drawings, supporting calculations, supporting analyses, procedures, and all labor, materials, fasteners, tooling, equipment, apparatus, instrumentation, shop drawings, and services necessary to manufacture, test, inspect, label, package and ship the Spent Resin Dewatering Equipment Package in accordance with (IAW) this specification and Section 2 of the Material Requisition (MR).

1.3 Work by Others

The Seller will not provide the following components or services:

- Transportation
- Material unloading and storage at job site
- Installation labor
- Piping and ductwork external to the equipment skid

- Service air
- Service water
- Electric power supply and wiring external to the equipment skid
- System programmable logic controller

1.4 Definitions

Buyer: Bechtel National, Inc. for the River Protection Project – Waste Treatment Plant.

Seller: Manufacturer, assembler, fabricator, vendor, supplier, or equal who provides equipment, systems, components, services, or other products for delivery or direct benefit to the Buyer.

Manufacturer: Refers to any company manufacturing equipment.

Modularization: A module is a group of components that can be manufactured and installed as a unit. These modular units are structurally self-supporting, allowing the module to be handled by crane. Whenever practical, modules will contain all the equipment associated with the process, including vessels, piping, and supports.

1.4.1 Acronyms

• AISC	American Institute of Steel Construction
• AMCA	Air Movement and Control Association
• ANSI	American National Standards Institute
• ASD	Manual of Steel Construction (Allowable Stress Design)
• ASME	American Society of Mechanical Engineers
• ASTM	American Society for Testing and Materials
• AWS	American Welding Society
• cfm	Cubic Feet Per Minute
• CFR	Code of Federal Regulations
• DBE	Design Basis Earthquake
• DOE	Department of Energy
• DOT	Department of Transportation
• DWC	Disposable Dewatering Container
• fps	Feet Per Second
• gpm	Gallons Per Minute
• HLW	High Level Waste
• IAW	In Accordance With
• ICN	Integrated Control Network
• in	Inch(es)
• IX	Ion Exchange
• LAW	Low Activity Waste
• MDS	Mechanical Data Sheet
• MR	Material Requisition
• MSDS	Material Safety Data Sheet
• NEC	National Electric Code
• NEMA	National Electrical Manufacturers Association
• NQA	Nuclear Quality Assurance
• ORP	Office of River Protection
• P&ID	Piping and Instrumentation Diagram
• psig	Pounds Per Square Inch Gauge (pressure measurement)

- PTF Pretreatment Facility
- QAM Quality Assurance Manual
- QAP Quality Assurance Program
- QL Quality Level
- RCRA Resource Conservation And Recovery Act of 1976
- RDP Spent Resin Collection and Dewatering Process System
- RFQ Request For Quote
- RPP-WTP River Protection Project-Waste Treatment Plant
- RWH Radioactive Solid Waste Handling
- SC Seismic Category
- SDDR Supplier Deviation Disposition Request
- SSC Structure, System, and/or Component
- UBC Uniform Building Code
- UL Underwriters' Laboratories, Inc.
- US NRC United States Nuclear Regulatory Commission

1.5 Mechanical Data Sheets

Vendor will provide mechanical, electrical and instrument Mechanical Data Sheets (MDS). The data indicated on the MDS shall be used only for mechanical design considerations, such as materials of construction, vessel wall thickness calculations, stress and fatigue analyses. The Seller shall complete all MDS's for Buyer's review. The process design of the Spent Resin Dewatering Equipment Package shall be based on the process data provided in this specification.

2 Applicable Documents

Work shall be performed IAW the referenced codes, standards, and documents listed below which are an integral part of this specification. When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. If a date or revision is not listed, the latest issue, including addenda, shall apply. When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent governing.

2.1 Government Documents

Federal

HNF-EP-0063	Hanford Site Solid Waste Acceptance Criteria
DOE-RL-92-36	Hanford Site Hoisting and Rigging Manual
DOE-RL-2002	Hanford Sitewide Transport Safety Document

U.S. Nuclear Regulatory Commission (NRC)

10 CFR-71	Packaging And Transportation Of Radioactive Material
10 CFR-835	Occupational Radiation Protection
NUREG/CR-3854	Fabrication Criteria for Shipping Containers

NUREG/CR-3019	Recommended Welding Criteria For Use in the Fabrication of Shipping Containers for Radioactive Materials shall be followed.
NRC Regulatory Guide 7.11	Fracture Toughness Criteria of Base Material for Ferritic Steel Shipping Cask Containment Vessels with a Maximum Wall Thickness of 4 inches (0.1 m), as applicable.
NRC Regulatory Guide 7.12	Fracture Toughness Criteria of Base Material for Ferritic Steel Shipping Cask Containment Vessels with a Wall Thickness Greater Than 4 Inches (0.1 m) But Not Exceeding 12 Inches (0.3 m), as applicable.

2.2 Industry Standards

American Society for Testing and Materials (ASTM)

ASTM A-36	Material Tests for Structural Metal Shapes and Plates
ASTM 500 Grade B	Material Tests for Structural Metal Tubes
ASTM A-570 Grade 50	Material Tests for Sheet Metal

American Society for Mechanical Engineers (ASME)

ASME B16.5	Steel Pipe Flanges
ASME B31.3-1996	Process Piping

ASME Boiler & Pressure Vessel Code

American National Standards Institute (ANSI)

ANSI N14.5-1997	Leakage Tests on Packages for Shipment
ANSI N14.6	Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds or More

Underwriters Laboratories, Inc. (UL)

UL-508	Industrial Control Equipment
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Air Movement And Control Association International, Inc. (AMCA)

AMCA 99-86	Standards Handbook
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2.3 Reference Documents/Drawings

The latest revision of the following documents shall be used unless otherwise noted in Section 2 of the MR.

SPECIFICATIONS

Bechtel National

24590-WTP-PW-P30T-00001	WTP End Prep Detail For Field Butt Welds
24590-PTF-M6-RDP-P0002	Ion Exchange Spent Resin Collection And Dewatering

24590-WTP-3PS-FB01-T0001	Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks
24590-BOF-3PS-ME00-T0001	Engineering Specification for Water Cooled Centrifugal Chillers
24590-WTP-3PS-P000-T0001	Engineering Specification for Piping Material Classes
24590-WTP-3PS-MV00-TP002	Engineering Specification for Seismic Qualification Criteria for Pressure Vessels
24590-WTP-3PS-MV00-TP001	Engineering Specification for Pressure Vessel Design and Fabrication
24590-WTP-3PS-MVB2-T0001	Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers
24590-WTP-3PS-SS00-T0002	Welding of Structural Stainless Steel and Welding of Structural Carbon Steel To Structural Stainless Steel
24590-WTP-3PS-MUMI-T0002	Engineering Specification for Low Voltage Induction Motors
24590-WTP-3PS-NWP0-T0001	General Welding and NDE Requirements for Supplier Fabricated Piping
24590-WTP-3PS-PS02-T0001	Engineering Specification for Shop Fabrication of Piping
24590-WTP-3PS-AFPS-T0001	Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment
24590-WTP-3PS-M000-T0002	Engineering Specification for General Specification for Mechanical Handling Equipment Design and Manufacture
24590-WTP-3PS-G000-T0003	Packing, Handling and Storage Requirements
24590-WTP-3PS-G000-T0001	General Specification for Supplier Quality Assurance Program Requirements
24590-WTP-3PS-JQ07-T0001	Engineering Specification for Instrumentation for Package Systems
24590-WTP-3PS-EKP0-T0001	Engineering Specification for Electrical Requirements for Packaged Equipment
24590-WTP-3PS-G000-TP002	Engineering Specification for Positive Material Identification (PMI)
24590-WTP-3PS-SS00-T0001	Engineering Specification for Welding of Carbon Structural Steel

3 Design Requirements

3.1 Basic Function

3.1.1 The dewatering equipment package serves the following functions in the RDP system:

- Provides bulk dewatering of spent IX resin in the DWC simultaneous to filling of the DWC from Spent Resin Slurry Vessels (RDP-VSL-00002A/B/C).

- Provides final dewatering of spent IX resin in dewatering container to required water content (less than 1% vol./vol. free water).
 - Provides transfer of all dewatered transport liquid back to the Spent Resin Slurry Vessels.
- 3.1.2 The Dewatering Equipment Package shall demonstrate the ability to backflush piping and equipment components. All trapped residuals shall be removed minimizing potentially contaminated areas.
- 3.1.3 The package shall dewater SuperLig SL-644 resin (registered trademark of IBC Advanced Technologies, Inc.) for Cesium (Cs) ion exchange.
- 3.1.4 The components of the Spent Resin Dewatering Equipment Package are found in Table I.

Table I: Equipment List

ITEM	PLANT ITEM NUMBER
Dewatering Pump	RDP-PMP-00011
Condenser Vessel	RDP-VSL-00004
Chiller Unit	RDP-CCL-00001 & RDP-CHU-00001
Blower	RDP-BLWR-00001
Piping	See Figure 5
Dewatering Container	"Not Tagged"
Container Fill-Head	24590-PTF-PY-RDP-SP-00001
Transportation Cask	24590-PTF-HC-RDP-CASK-00001
Skid Structure	"Not Tagged"
Instrumentation & Controls	See Figure 5
Valves	See Figure 5
Electrical Equipment	"Not Tagged"

- 3.1.5 The Seller shall provide the following:
- An analysis of operating life for all components that are subject to service conditions. Show all assumptions and references.
 - All special lifting equipment required for installation and maintenance of the Spent Resin Dewatering Equipment Package.
 - Design envelope parameters (differential pressure and flow rates) to be used in design of the dewatering skid package.
 - One lot of any special tools required for installation and maintenance.
 - Procure all materials and equipment unless otherwise stated by the Buyer.
 - Identify all interfaces for external connections with equipment and services supplied by the Buyer.
 - All special lifting equipment required for handling the dewatering container, cask before, during and after the dewatering process.

3.2 Performance

- 3.2.1 The dewatering package shall process 7,500 gallons of resin slurry delivered in a batch process. Batch delivery shall be continuous uninterrupted flow based off Table II, with simultaneous bulk dewatering to prevent resin from settling in transfer lines between slurry vessels and the DWC. The flow rate, depending on the pipe size, can be determined in Table II.

Table II: Pipe size & Associated Flow Rate

Pipe Size (in)	Min: (gpm)	Max: (gpm)
1.5	38.07	57.11
2	62.76	94.13
2.5	89.54	134.31
3	138.26	207.38

- 3.2.2 Due to processing timing requirements in other parts of the RDP system, the dewatering process duration shall be kept to a minimum and shall not exceed 3 days to complete.
- 3.2.3 The slurry delivered to the dewatering container will contain 2 to 15% vol./vol. Solids. It will be delivered up to 140 gpm with a velocity of 5 to 8 fps. Delivery pressure shall not exceed 50 psig.
- 3.2.4 Cooling water will be supplied at 55 psig and 80 °F. It shall be returned at no less than 45 psig, and not above 95 °F. Demineralized flush water shall be supplied at 72.5 psig and 77 °F.
- 3.2.5 The equipment package components shall be compatible with the regulated mixed (radioactive and dangerous) spent resin waste containing residual Cesium 137 of a maximum 60 microcuries per gram. The normal total-batch-activity is approximately 66 Ci (Curie's) of Cesium 137.
- 3.2.6 The Equipment Skid and sub components, Fill Head, Containers and Cask shall be load tested at 150% of the measured weight as follows:
- The assembly lifting lugs
 - After completion of the load test, the lifting lug attachment welds shall be inspected by dye penetrant examination.

3.3 Environmental Conditions

- 3.3.1 The Dewatering Equipment Package will be located indoors in plant rooms maintained between 59 °F min. and 113 °F max. with a relative humidity of 10-95% during normal operation.
- 3.3.2 The Dewatering Equipment Package components, properly protected, may be stored outdoors at ambient extreme temperature range of -23 °F to 113 °F and relative humidity of 5-100%.

3.4 Mechanical Design

3.4.1 Dewatering Skid (RDP-SKID-00001)

- 3.4.1.1 The dewatering skid shall be installed in a room adjacent to the dewatering container. See Figures 1-3 for the Layout Schematics identifying equipment locations. Skid dimensions shall not exceed 8 feet in width, 10 feet in height, and 14 feet in length.
- 3.4.1.2 The dewatering skid shall be shipped preassembled or as convenient modular units as determined by the Seller.

- 3.4.1.3 The Dewatering Equipment Package shall be designed as a completely assembled package with its accessories and auxiliary equipment forming an integral unit in which all components are properly matched. Except for minor modifications, the package shall include standard manufactured products commercially available.
- 3.4.1.4 The Dewatering Equipment Package and appurtenances will be used in a plant that has a design life of 40 years. All components that require maintenance or replacement during the design life shall be identified. The Dewatering Equipment Package shall be designed to facilitate ease of “hands on” maintenance and replacement of components prone to wear.
- 3.4.1.5 Maintenance will be performed after the Dewatering Equipment Package has been flushed and decontaminated while in shutdown mode. Any equipment components prone to failure must possess features to allow decontamination prior to maintenance reducing radiation exposure.
- 3.4.1.6 The dewatering equipment skid and individual equipment components shall be self-supporting, capable of carrying all static loads and the stress imposed during shipment, installation, and operation. The Seller shall identify the structural components seismic requirements and provide lateral supports for seismic restraint of the dewatering equipment skid. The equipment package skid weight shall not exceed 50,000 lbs.
- 3.4.1.7 The Condenser vessel, dewatering pump, blower unit, chilling equipment, and skid structure shall be designed to meet seismic category III. Seismic category III equipment shall be IAW AISC ASD and UBC (Zone 2B). The Seller shall perform thermal and static stress analyses for all structures, systems, and components. The Seller shall provide design calculations IAW 24590-WTP-3PS-FB01-T0001. The Seller shall specify the installation requirements including bolt sizes, location, and loads. Skid Anchor points are identified in the Figures 1-3 for the equipment skid.

3.4.2 Dewatering Pump

- 3.4.2.1 The dewatering pump shall return transport liquid to vessels RDP-VSL-00002A, 2B, and 2C through approximately 350 feet of pipe and an elevation increase of approximately 30 feet. The pump suction lift from the dewatering container is approximately 10 feet with approximately 50 feet of pipe on the suction side. The pump shall be capable of self priming. The dewatering pump capacity shall be sufficient to support a continuous feed to the dewatering container.
- 3.4.2.2 The pump drive motor shall be IAW 24590-WTP-3PS-MUMI-T0002.
- 3.4.2.3 The Seller shall provide data sheets showing pump capacity, flowrates, pressures, and all relevant characteristics.
- 3.4.2.4 The pump shall be located and installed on RDP-SKID-00001.

3.4.3 Condenser Vessel

- 3.4.3.1 The Condenser Vessel shall condense and separate water vapor from air that is drawn from the DWC via RDP-BLWR-00001. The collected water shall be transferred to vessels RDP-VSL-00002A, 2B, and 2C by the dewatering pump. The internal maximum pressure created by the operating process shall be incorporated into the design of the vessel. The Condenser Vessel shall include chilling lines used in moisture separation. The pressure inside the chilling lines must exceed the working pressure within the Condenser Vessel to minimize the effects of utilities contamination in the event of pipeline failure.
- 3.4.3.2 The Condenser Vessel shall include a de-entrainment system to separate water droplets from the moving airstream. Qualification parameters shall include efficiency of de-entrainment system and differential pressure-performance characteristics.
- 3.4.3.3 The Condenser Vessel shall be designed IAW the Buyer's MDS, 24590-WTP-3PS-MV00-TP001, 24590-WTP-3PS-MV00-TP002 and 24590-WTP-3PS-FB01-T0001.
- 3.4.3.4 Vessel configuration, materials, pressures, temperatures, and all relevant characteristics shall be provided. A Vessel name plate shall be attached (see Figure 4).
- 3.4.3.5 The vessel shall be located and installed on RDP-SKID-00001.

3.4.4 Chiller Unit

- 3.4.4.1 The Chiller must be an off-the-shelf air-cooled unit utilized and manufactured in commercial industry. The pressure inside the chilling lines must exceed the working pressure within the Condenser Vessel. The working pressure of the coolant shall exceed the pressure requirements of the chiller lines to minimize the effects of cross contamination in the event of pipeline failure. The Chiller Unit includes RDP-CCL-00001 and RDP-CHU-00001. The airstream passes over the chilling lines dropping in temperature causing water condensation.
- 3.4.4.2 Deleted.
- 3.4.4.3 The Seller shall provide data sheets showing chiller configuration, materials, pressures, temperatures, and relevant characteristics.

3.4.5 Blower

- 3.4.5.1 The blower circulates air through the DWC evaporating liquid, and routes the vapor through the condenser vessel (liquid removal before returning to the blower). The blower housing shall incorporate a barrier to limit damage from foreign materials contacting rotating vanes, lobes, or fins (As applicable to type of blower utilized). The blower shall be separated from the drive motor by mechanical barrier such that no shared airspace exists.
- 3.4.5.2 The blower drive motor shall be IAW 24590-WTP-3PS-MUMI-T0002.
- 3.4.5.3 If centrifugal style, the blower shall be IAW AMCA 99-86.
- 3.4.5.4 The Seller shall provide data sheets showing blower capacity, flowrates, pressures, volume, temperatures, weights, and relevant characteristics.

3.4.5.5 The blower shall be located and installed on RDP-SKID-00001.

3.4.6 Piping

3.4.6.1 The Seller shall furnish and install pipe and pipe supports as required within the equipment skid (Section 3.4). Pipe bending tolerances shall be within 5 degrees to nominal bend radius. Piping shall be seismically designed to accommodate and interface with equipment components.

3.4.6.2 Pipe flanges shall be IAW ASME B16.5.

3.4.6.3 The Seller shall furnish thermowells and thermal insulation as required to support design and operations plan.

3.4.6.4 Piping and Pipe materials shall be IAW ASME B31.3-1996 and 24590-WTP-3PS-P000-T0001.

3.4.7 Dewatering Container & Fill Head

3.4.7.1 The Dewatering Container shall separate water from the resin. The collected water shall be transferred to vessels RDP-VSL-00002A, 2B, and 2C by the dewatering pump. All dewatering is to take place in the dewatering container. Designs that are compatible with that approach are acceptable. The dewatering package shall dewater the resin to less than 1% vol./vol. free water. The process may be qualified with an initial check. In addition, a standard operational procedure/manual is to be provided in order to ensure that the less than 1% vol./vol. free of water requirement is achieved during routine dewatering processes.

3.4.7.2 The initial contract during cold start up will require 5 containers. During commissioning the containers will be replaced when filled (semi-monthly). The projection for the entire plant life (40 years) will use roughly 1,000 containers approximately one every two weeks.

3.4.7.3 The free liquid will largely be pumped out through the screens in the dewatering container. The remainder will be removed by evaporation. The amount of removal in each step depends on screen locations in the dewatering container and the capabilities of the dewatering pump.

3.4.7.4 The internal maximum pressure created by the operating process shall be incorporated into the design of the container.

3.4.7.5 SuperLig® 644 resin used in small-scale columns to separate cesium from AW-101 and AN-107 waste samples (feed envelopes A and C) were fully eluted, washed with deionized water and washed with 0.1 M NaOH. The samples were then analyzed to determine the concentration of Resource Conservation And Recovery Act of 1976 (RCRA) listed metals, radionuclides, and inorganic cations in spent resin. The analytes detected at levels above the minimum reportable quality include Cr (670 µg/g), K (220 µg/g), Na (83,800 µg/g), ⁹⁹Tc (6.74 µg/g), ²³⁸U (14.8 µg/g), ⁶⁰Co (1.31 µCi/g), and ¹³⁷Cs (60 µCi/g).

3.4.7.6 The dewatering container shall fit within the transportation cask (see cask requirements for size constraints). The dewatering container shall be filled to 90% of its total internal volume with either resin or void filler. Any void space filling material shall be selected and used IAW Appendix E of the Hanford Site Solid Waste Acceptance Criteria (HNF-EP-0063). The dewatering container's minimum volume is 665 gallons.

- 3.4.7.7 The Dewatering Container shall be designed IAW the Sellers MDS and 24590-WTP-3PS-FB01-T0001.
- 3.4.7.8 The dewatering container and burial shall meet the requirements of “Hanford Site Solid Waste Acceptance Criteria” (HNF-EP-0063) chapter 4.
- 3.4.7.9 Lifting attachments shall be provided for removing the container from the cask, and for removing the lid from the container and replacing it back again. The lifting attachment shall be designed to be removed from the crane hook remotely without operator assistance, thereby, allowing for total remote operation of container lid removal. Lifting attachments shall be designed per ANSI N14.6 and DOE-RL-92-36.
- 3.4.7.10 Dewatering container and fill-head design and operations shall be compatible with remote handling equipment provided by system RWH within the available space of the dewatering room (see Appendix A).
- 3.4.7.11 The Buyer’s MDS shall be completed and include container configuration, materials, pressures, temperatures, and all relevant characteristics shall be provided.
- 3.4.7.12 Implementing a fill-head is recommended, but not required. The fill head needs to be positioned on the container and cask though remote means.

3.4.8 Transportation Cask

- 3.4.8.1 The cask shall overwrap the dewatering container and shield the contents. It will be reusable and is not disposed with the dewatering container. The cask consists of the cask shell, bottom, and lid. The cask must be able to comply with transport requirements including 49 CFR 178.350, specifications for packaging. The design is based on Standard Industrial Packaging 2 (IP2) with applicable waivers established under the Hanford Sitewide Transport Safety Document, DOE-RL-2002. The service life of the cask shall be forty (40) years.
- 3.4.8.2 The cask shall not exceed 88 inches square by 112 inches high including lifting brackets. The weight of a cask with a loaded Dewatering Container will not exceed 35 tons (70,000 lb).
- 3.4.8.3 The cask shall be capable of shielding personnel. Personnel shall not receive more than 10 mrem/hr with a target of 2.5 mrem/hr or lower at 30 cm from the cask.
- 3.4.8.4 The internal dimensions for the cask shall be sufficient to accommodate the dewatering container.
- 3.4.8.5 The lifting device for the cask shall be in the same orientation as the Dewatering Container.
- 3.4.8.6 Transportation cask design and operations shall be compatible with system RWH within the available space of the dewatering room (see Appendix A).
- 3.4.8.7 The materials shall be compatible with, or provide adequate resistance to, the corrosive effects of materials (liquids, vapors, gases, solids, and byproducts) that they shall be in contact with throughout their life cycle. The materials shall also be selected to minimize chemical-galvanic reactions between the payload constituents and the cask.

- 3.4.8.8 The Cask shall be fabricated equivalent to ASME Boiler & Pressure Vessel Code, up to, but not including, the code stamp. The materials of construction shall meet the fracture toughness requirements of NRC Regulatory Guide 7.11 and NRC Regulatory Guide 7.12.
- 3.4.8.9 Seals and Gaskets shall be selected to withstand the radiological, chemical, thermal, and physical properties of the payload.
- 3.4.8.10 Deleted
- 3.4.8.11 The buyer must approve all fabrication drawings and travelers.
- 3.4.8.12 All welds shall be smoothed to 125 Root Mean Square (RMS). All welds and weld joints shall comply with ASME Boiler & Pressure Vessel Code, up to, but not including, the code stamp.
- 3.4.8.13 Lifting attachments shall be provided for removing the cask from the trailer, and for removing the lid from the cask and replacing it back on the cask. The lifting attachment shall be designed to be removed from the crane hook remotely without operator assistance, thereby allowing for total remote operation of cask lid removal once the cask bolts are removed. Lifting attachments shall be designed per ANSI N14.6 and DOE-RL-92-36.
- 3.4.8.14 A tiedown system shall be designed to secure the cask system to the trailer. The tiedown system shall meet the requirements of 10 CFR 71.45. The tiedown system shall be designed to allow for the safe inspection, minor repairs, and replacement of the cask lid gaskets and seals (e.g., operator does not have to go under cask lid to replace the seals).
- 3.4.8.15 The cask design and payload shall prevent a flammable gas mixture in the headspace and annulus during a period of time twice the maximum expected shipping time. Estimated maximum shipping time is 48 hours. There must be a designed provision for safely inerting or purging the container and cask.
- 3.4.8.16 Deleted
- 3.4.8.17 During, and subsequent to accident conditions, the release of materials from the cask, including the venting system shall not exceed the limits set in Paragraph 3.4.8.21.
- 3.4.8.18 Instrumentation used to verify leak-tightness shall be calibrated to national standards before and after testing.
- 3.4.8.19 The cask design shall incorporate two (2) emergency vent ports for releasing gas. These ports shall be designed to be opened with a designed special device and to vent pressure away from the operator. The design shall also eliminate radiation streaming. These vents shall be designed for helium purging of the cask interior prior to transport and receipt at lined portions of the low level burial grounds.
- 3.4.8.20 The cask lid shall be designed to be a positive fastening device that cannot be opened unintentionally. The lid design shall incorporate tamper-indicating devices.
- 3.4.8.21 Deleted
- 3.4.8.22 Deleted

3.5 Electrical Design

- 3.5.1 The dewatering skid and equipment shall be completely factory pre-wired. Hard wiring interfaces shall be identified in the electrical drawings for Buyer to locate and place utilities. Electrical and control cabinets shall be installed on the dewatering equipment skid. The Dewatering Equipment Electrical Package shall be designed and fabricated IAW UL-508 and 24590-WTP-3PS-EKP0-T0001.
- 3.5.2 Electric motors shall be determined by the Seller and motor data sheets shall be submitted to the buyer. The electric motors shall be IAW specification 24590-WTP-3PS-MUMI-T0002.

3.6 Instrumentation and Control Design

- 3.6.1 All instrumentation systems and related equipment (cabinets, racks, conduits, etc) shall meet the requirements specified in Specification 24590-WTP-3PS-JQ07-T0001. See the Purchase Order Technical Notes for exceptions.
- 3.6.2 All instrumentation for the Dewatering Equipment Package shall be provided by the Seller, including switches, sensors, detectors, transmitters, and interlocks for control and monitoring of the Seller's equipment.
- 3.6.3 Provide the following for instrumentation and controls:
- instrument data sheets
 - installation details
 - functional test setpoints
 - operating parameter setpoints
 - control requirements
 - control system block diagram schematics
- 3.6.4 Packaged systems will be integrated into the WTP Integrated Control Network (ICN). The Buyer will provide a control platform on behalf of the Seller. The Buyer supplied control platform will regulate and operate the Dewatering Equipment Package. The Seller will provide the instrumentation fully wired up to the terminal blocks (Foundation Fieldbus spur blocks). The seller shall provide a RIO enclosure or panel to wire non fieldbus instrumentation (Classic I/O: AI/AO/DI/DO). The following ABB or buyer approved equivalent equipment should be included in the seller provided RIO enclosure or panel:
- 1) Redundant CI840 Fieldbus Communication Interface Profibus DP/V1
 - 2) AI810 Analog Input Module (if required)
 - 3) AO810 Analog Output Module (if required)
 - 4) DI810 Digital Input Module (if required)
 - 5) DO810 Digital Output Module (if required)
 - 6) TU810 Compact Module Termination Units (as required)
 - 7) Profibus to Fiber Converter (Hirschmann OZD-Prof1 12M G12 or buyer approved equivalent)

- 8) Redundant Power Supplies (SD823 24vdc 10A and SD822 24vdc 5A) (2 each)
- 9) SS822 Voting Unit (2)

The RIO enclosure should be mounted as part of the dewatering skid.

The seller shall follow 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems* For enclosure requirements

The seller will also provide all of the functional and performance requirements for development of the software as specified in Section 3.5 of 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*. The Buyer will provide the control cabinet (with the controllers and software pre-programmed into the controllers) to the Seller to perform the factory acceptance tests at the vendor's facilities. The Buyer will provide any ABB-manufactured equipment listed above to the Seller for installation into the Seller's I/O cabinet.

- 3.6.5 All software will be provided on the Buyer's control platform. Development of software will be performed by the Buyer. The Seller shall provide to the Buyer all functional and performance requirements for software development in the Dewatering Equipment Package.
- 3.6.6 The Seller shall interface with the control platform and perform factory acceptance tests at the Seller's facility. The factory acceptance tests shall be IAW Specification 24590-WTP-3PS-JQ07-T0001.
- 3.6.7 All instrumentation equipment shall be fully assembled, wired, and mounted before delivery.
- 3.6.8 The Instrumentation for the Dewatering Equipment Package shall be IAW the Pipe Schematic (see Figure 5) and include the following:
 - Dewatering pump shut-off signal caused by DWC screen plug-up and low moisture indication as well as pump protection controls for high pressure or high temperature.
 - Dewatering pump and flow control valve shut-off interlock on container fill-up, screen plug-up, differential pressure, and resin overflow signal.
 - The resin slurry level and water level in the DWC shall be maintained by control-valve and dewatering-pump signals.
 - Level measurement shall be performed in RDP-VSL-00004. The instrumentation shall monitor level and provide signals to initiate and shutdown liquid transfer via the dewatering pump.
 - Pressure measurement shall be performed to assess condition and performance.
 - Moisture measurement shall be performed to identify completion of resin dewatering to required conditions (1 % vol/vol free water in the DWC).

4 Materials

4.1 Material Requirements

- 4.1.1 Certified Material Test Reports (CMTR) and Certificates of Conformance (C of C) will be required for all materials.

- 4.1.2 Piping, pumps, valves, and other components which come in contact with the transport liquid shall follow the recommendations listed in 24590-WTP-3PS-M000-T0002 (Appendix C “Radiation Resistant Materials”).
- 4.1.3 All structural metal shapes and plates shall be ASTM A-36. All structural metal tubes shall be ASTM-500 Grade B. Sheet metal shall be ASTM A-570 Grade 50.
- 4.1.4 All materials used to fabricate the Dewatering Equipment Package shall be able to withstand the radiation levels expected as specified in this specification.
- 4.1.5 The Seller shall show material designation on relevant submittal drawings.

5 Fabrication

The Seller shall obtain written notice from the Buyer prior to the start of fabrication activities. Fabrication of vessels, pipework, and mechanical handling shall be performed IAW 24590-WTP-3PS-MV00-TP001, 24590-WTP-3PS-PS02-T0001 and 24590WTP-3PS-M000-T0002. Lap joints for vessel construction are not permitted.

5.1 Welding

- 5.1.1 Use of backing strips on vessel welds and nozzle rings on nozzle welds are not permitted. Welding shall be performed IAW the following specifications:

Welding of vessels:

24590-WTP-3PS-MV00-TP001 and 24590-WTP-3PS-MVB2-T0001

Welding of piping:

24590-WTP-3PS-NWP0-T0001 and 24590-WTP-3PS-PS02-T0001

Welding of structural stainless steel:

24590-WTP-3PS-SS00-T0002

Welding of carbon structural steel:

24590-WTP-3PS-SS00-T0001

5.2 Preparation of nozzles for field welding

- 5.2.1 Preparation of nozzles for field welding shall be IAW 24590-WTP-PW-P30T-0001.
- 5.2.2 Nozzles for field welding shall be no less than 3.5 inches to the edge for compatibility with the automatic welders.

6 Inspections and Examinations

All inspections and examinations shall be performed meeting the requirements of the references in this specification. Specific inspection and examination methods identified as optional in the references shall not be performed unless required below. The Seller shall notify the Buyer in advance of examinations or

tests. The Buyer may send representatives to witness or perform independent examinations or tests. The Seller shall maintain a positive system for identifying inspection and testing status of items and systems.

6.1 Non-Destructive Examinations

- 6.1.1 Vessel NDE shall be IAW the requirements in specification 24590-WTP-3PS-MV00-TP001.
- 6.1.2 Pipework welds shall be inspected IAW the requirements outlined in specification 24590-WTP-3PS-PS02-T0001.
- 6.1.3 Hydrotesting shall be performed before acceptance testing.

6.2 Dimensional Inspections

- 6.2.1 The Seller shall develop and implement a procedure to dimensionally inspect each fabricated item IAW the applicable references in this specification. The procedure shall include the type of measuring device(s) to be used and identify how they will be checked for calibration status. Dimensions shall be within tolerances identified on the skid construction drawings.
- 6.2.2 The Seller shall record all dimensional data, indicating the actual dimensions, the temperature, the date and time of inspections, and signatures of the certified inspection personnel.

6.3 Visual Weld Inspections

- 6.3.1 Visual weld inspections shall be performed and comply with specifications:
 - Carbon structural steel:
24590-WTP-3PS-SS00-T0001
 - Structural stainless steel:
24590-WTP-3PS-SS00-T0002

6.4 Liquid Penetrant Test

- 6.4.1 Dye penetrant examinations shall be performed and comply with specifications:
 - Carbon structural steel:
24590-WTP-3PS-SS00-T0001
 - Structural stainless steel:
24590-WTP-3PS-SS00-T0002

6.5 Radiography

- 6.5.1 Radiographic examinations shall be IAW the applicable references identified in this specification.

6.6 Final Inspection

- 6.6.1 The Seller shall develop and implement a procedure for final inspection of each fabricated item. The inspections shall be performed after completion of all fabrication, cleaning, and testing, and just prior to final packaging. The inspections shall include inspection of all surfaces for contamination. Visible evidence of contamination is not acceptable. The Seller

shall prepare a final inspection report for each item, which documents the results of the final inspection. The Seller shall include the final inspection report in the documentation package for each piece.

7 Testing

All testing shall be performed meeting the requirements of the references in this specification. Specific testing methods identified as optional or non-mandatory in the references shall not be performed unless required below. Functional and performance tests of all mechanical equipment shall be performed by the Seller. Testing procedures shall be submitted for Buyer's review. The Buyer reserves the right to witness all shop tests and shall be given a minimum of 10 days written notice prior to each test date. All Seller supplied lifting yokes shall be load tested to 3 times the design load.

7.1 Shop Tests

7.1.1 Shop tests shall be performed IAW the following Buyer specifications:

A "Full Test" shall be performed on each electrical motor:

24590-WTP-3PS-MUMI-T0002

Testing of instrumentation and controls systems:

24590-WTP-3PS-JQ07-T0001

Vessel testing criteria:

24590-WTP-3PS-MV00-TP001

7.2 Site Tests

7.2.1 Buyer's startup personnel will perform tests after initial installation. Buyer may request Seller's assistance during testing and startup.

8 Preparation for Shipment

The fabricated equipment package shall be shipped as a single skid. The delivered package shall include all equipment and accessories fully assembled, wired, and skid mounted requiring only connection to the Buyer's electrical and control systems, and piping. If shipping size is a limitation, units may be fabricated and delivered in sections or subassemblies after permission to proceed has been obtained from the Buyer.

Specific shipping-preparation requirements as identified in the applicable references of this specification shall be followed. All remaining equipment included in this specification shall be packaged, shipped, and stored IAW 24590-WTP-3PS-G000-T0003.

8.1 Special Protective Coating

8.1.1 Seller fabricated equipment and components shall be prepared and coated IAW specification 24590-WTP-3PS-AFPS-T0001.

8.2 Tagging

8.2.1 Tagging shall be IAW 24590-WTP-3PS-G000-T0003.

8.2.2 Instruments shall also be identified with Buyer provided tag numbers if applicable.

8.3 Cleanliness

8.3.1 Remove all dirt, oil, and grease, loose mill scale, weld spatter and other foreign matter on surfaces to be painted.

9 Quality Assurance

9.1 Quality Assurance Requirements

9.1.1 Seller's Quality Assurance Program (QAP) Manual shall be submitted to buyer for review and shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements Data Sheets listed in Section 2 of the MR. The Seller's QAP Requirements are included in specification 24590-WTP-3PS-G000-T0001.

9.1.2 The successful bidder must pass a pre-award survey by the Buyer. Seller shall demonstrate that its quality program is in compliance with the procurement quality requirements listed in the Supplier Quality Assurance Program Requirements Data Sheet. The Seller shall allow the Buyer, its agent, and DOE access to their facility and records pertaining to this purchase order for the purpose of QA Audits and Surveillance at mutually agreed times.

9.2 Supplier Deviations

9.2.1 Each Supplier shall be required to identify and promptly document all deviations from the requirements of the procuring documents. In addition, the Supplier shall be required to describe the recommended disposition based on appropriate analysis. Submittals of request for deviations from lower-tier suppliers shall be through the Seller to RPP-WTP. Seller-proposed deviations from procurement documents shall be initiated by use of Supplier Deviation Disposition Request (SDDR) form attached to the MR.

10 Configuration Management

The Dewatering Equipment Package components covered by this specification are identified with Equipment Numbers shown in the drawings submitted with the Material Requisition.

11 Documentation, Submittals, and Design Reviews

The Seller shall submit all detailed designs, drawings, documentation, procedures, instructions, calculations, analyses, manufacturer documentation, manufacturer data, inspection reports, test reports, certifications, certificates, manuals and MSDS, including applicable codes, standards, drawings and reference documents of this specification and MR. The Buyer will Provide 30%, 60%, 90%, and Final Design Reviews. All major repairs shall be documented in a verification report and submitted to the Buyer for review. The Seller shall submit a schedule and Quality Verification documents to Buyer Engineering according to the quantities shown in Forms:

G-321-E Engineering Document Requirements

G-321-V Quality Verification Document Requirements attached to the MR.

11.1 Installation and Handling Documentation

- 11.1.1 The seller shall provide installation manual/documents IAW 24590-WTP-3PS-G000-T0003.
- 11.1.2 The seller shall provide site storage and handling manual IAW 24590-WTP-3PS-G000-T0003.

11.2 Vessel Documentation

All Documentation and Submittals pertaining to pressure vessel fabrication shall be submitted IAW 24590-WTP-3PS-MV00-TP001 (See Paragraph 11.5 for vessel welding submittals).

11.3 Piping and Instrumentation Diagrams

- 11.3.1 Piping and Instrumentation Diagrams (P&IDs) and line size calculations shall be submitted for Buyer's review. Pipe line material number and size shall be identified and selected from specification 24590-WTP-3PS-P000-T0001.

11.4 Electrical

- 11.4.1 All Documentation and Submittals pertaining to Electrical Components shall be submitted IAW Specifications 24590-WTP-3PS-EKP0-T0001 and 24590-WTP-3PS-MUMI-T0002.

11.5 Instrumentation and Controls

- 11.5.1 All Documentation and Submittals pertaining to Instrumentation and Controls shall be submitted IAW Specification 24590-WTP-3PS-JQ07-T0001.

11.6 Welding

- 11.6.1 All Documentation and Submittals pertaining to welding shall be submitted IAW Specifications:
 - Pressure vessels:
24590-WTP-3PS-MVB2-T0001
 - Carbon structural steel:
24590-WTP-3PS-SS00-T0001
 - Structural stainless steel:
24590-WTP-3PS-SS00-T0002
- 11.6.2 Visual Inspection and Dye Penetrant Examination Records shall be submitted for structural stainless steel work. These records pertain to the examinations required from 24590-WTP-3PS-SS00-T0002.
- 11.6.3 All Documentation and Submittals for Seller fabricated piping shall be submitted IAW the following specifications 24590-WTP-3PS-NWP0-T0001 and 24590-WTP-3PS-PS02-T0001.

11.7 Performance Test Reports

Functional and Performance tests of all mechanical equipment shall be documented in report format and submitted to the Buyer.

11.8 Equipment Mounting Details

Anchor, attachment, and mounting details for all equipment skid components shall be provided for Buyer's review.

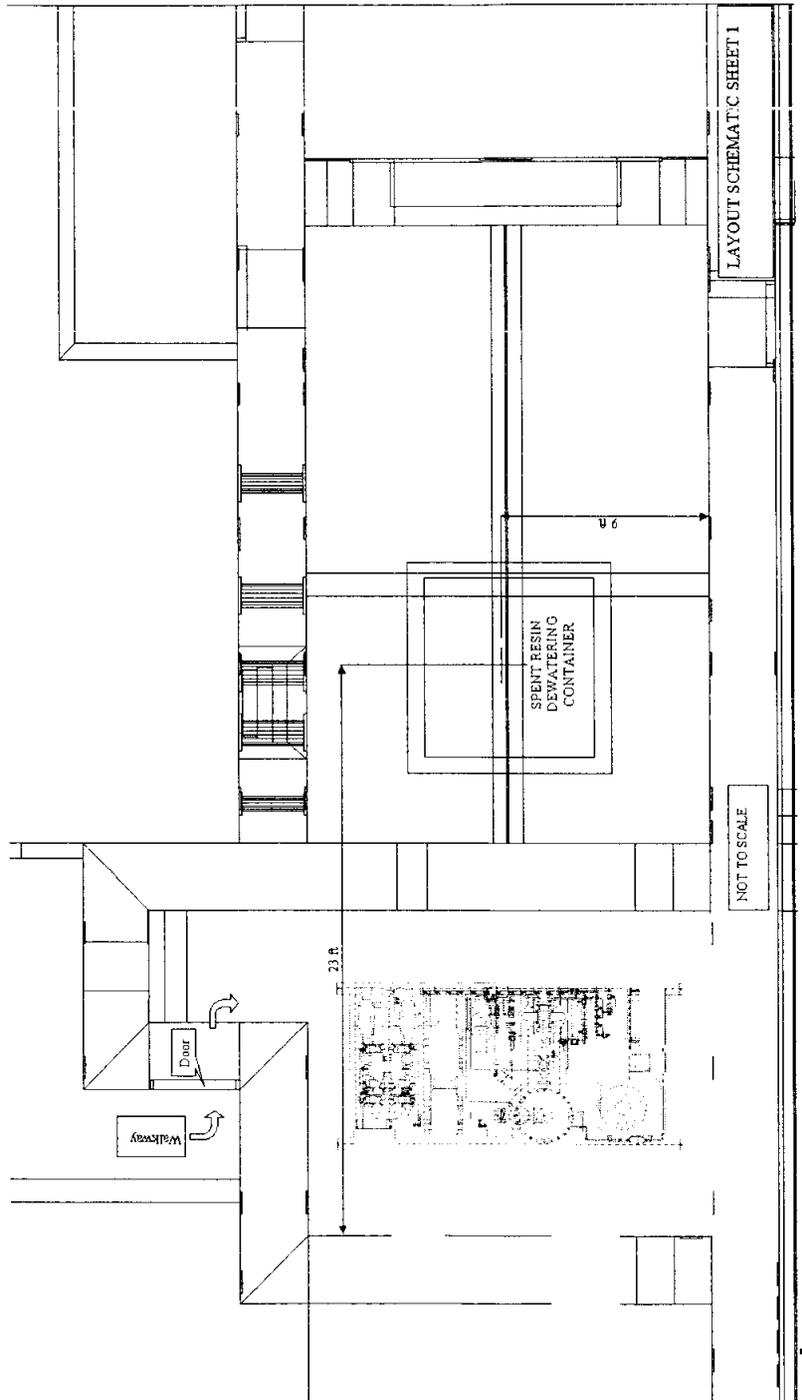


Figure 1: Dewatering Equipment Skid Plan View

DEWATERING EQUIPMENT SKID SIDE VIEW

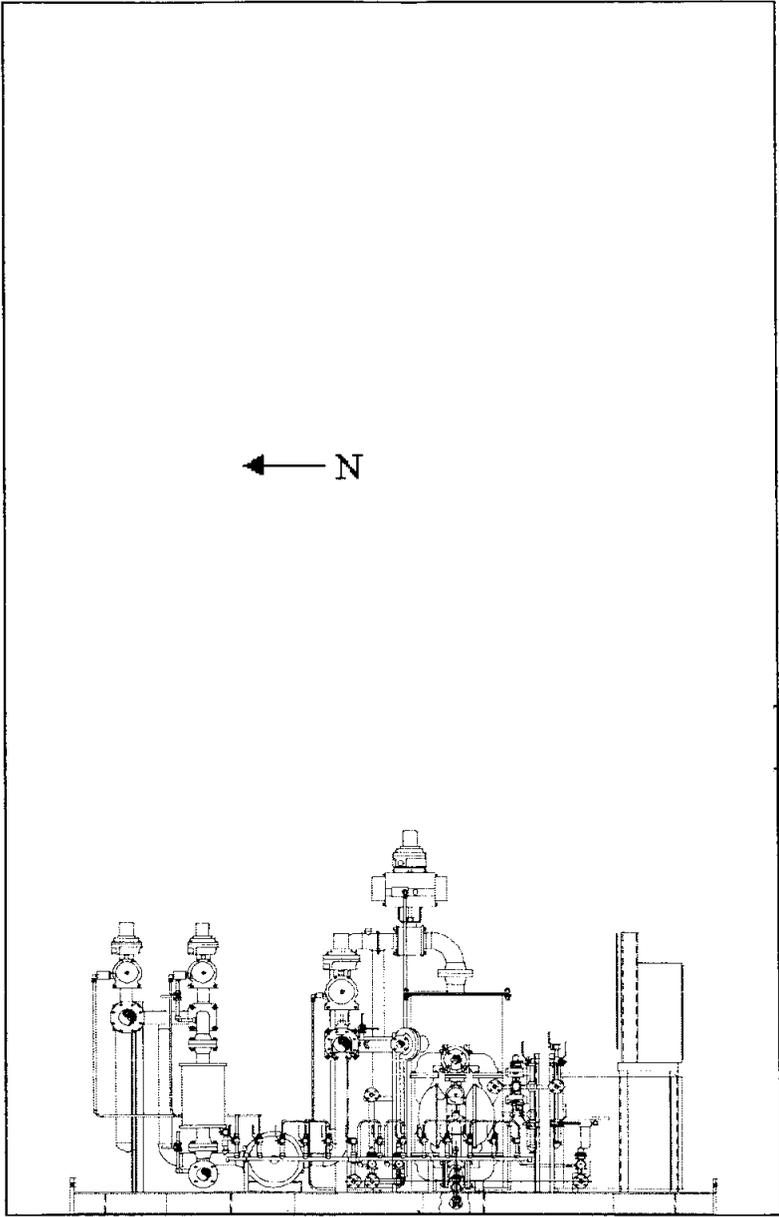


Figure 2: Dewatering Equipment Skid Side View Located in Room P-0119

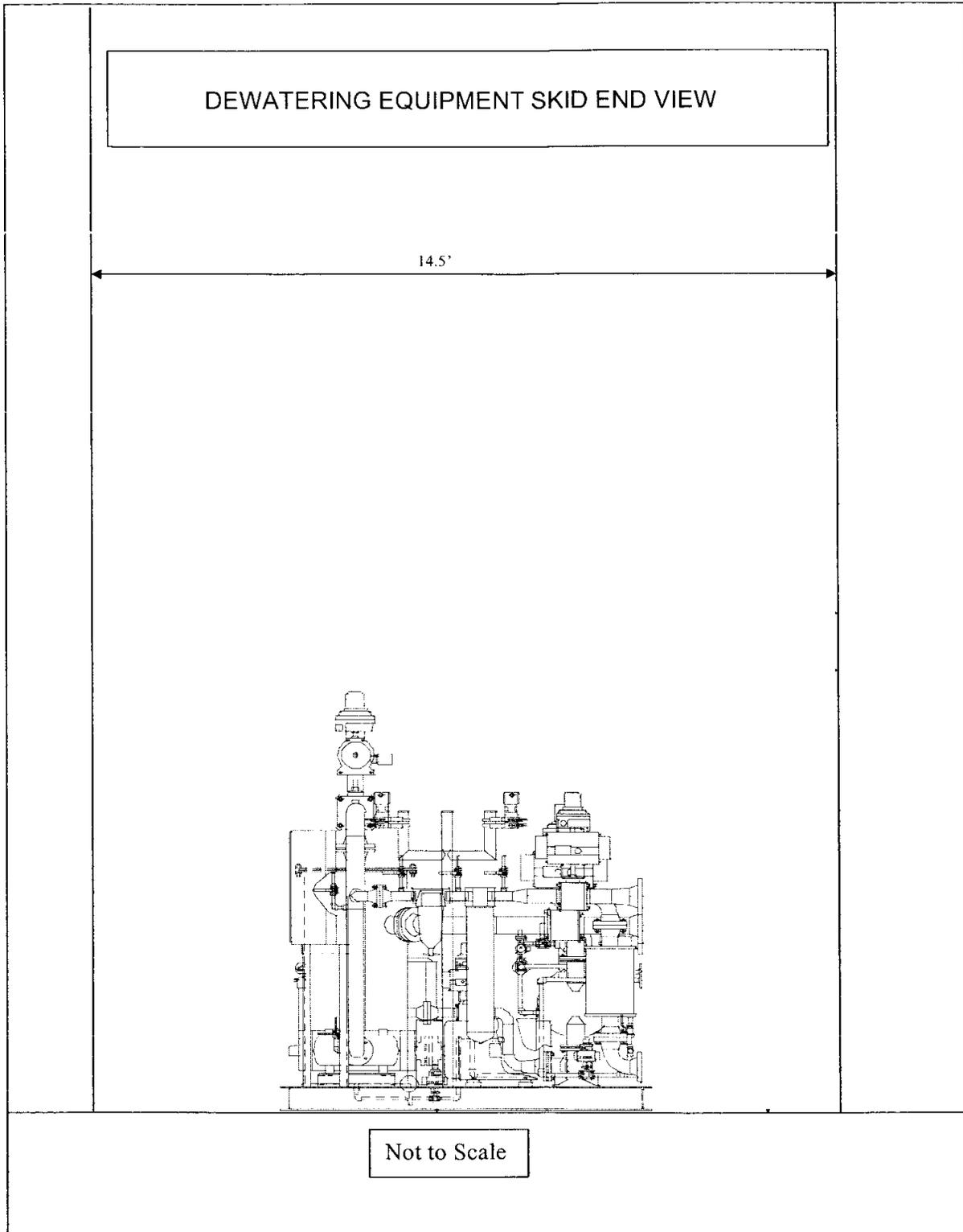


Figure 3: Dewatering Skid Location Along South Wall in Room P-0119

LAYOUT FOR SPENT RESIN DEWATERING ROOM P-121A

Please bear in mind that these sketches are relatively rough with regard to some of the strange lines, features, and alignment that may appear. However, these sketches were extracted from our plant model and are to scale. They show equipment and room features as close to the current design as we have right now. Please contact us if anything is unclear.

The following sheets contain room P-0121A, Spent Resin Dewatering Room where the dewatering container is positioned during the process operation.

The sketches are:

- General Plan view of the Spent Resin Export Path
- Plan view of the Resin Dewatering Room (P-0121A) including its location with respect to the dewatering room skid to the west.
- Section view of the Resin Dewatering Room looking North
- Section view of the Resin Dewatering Room looking South
- Section view of the Resin Dewatering Room looking East
- Section view of the Resin Dewatering Room looking West

Notes:

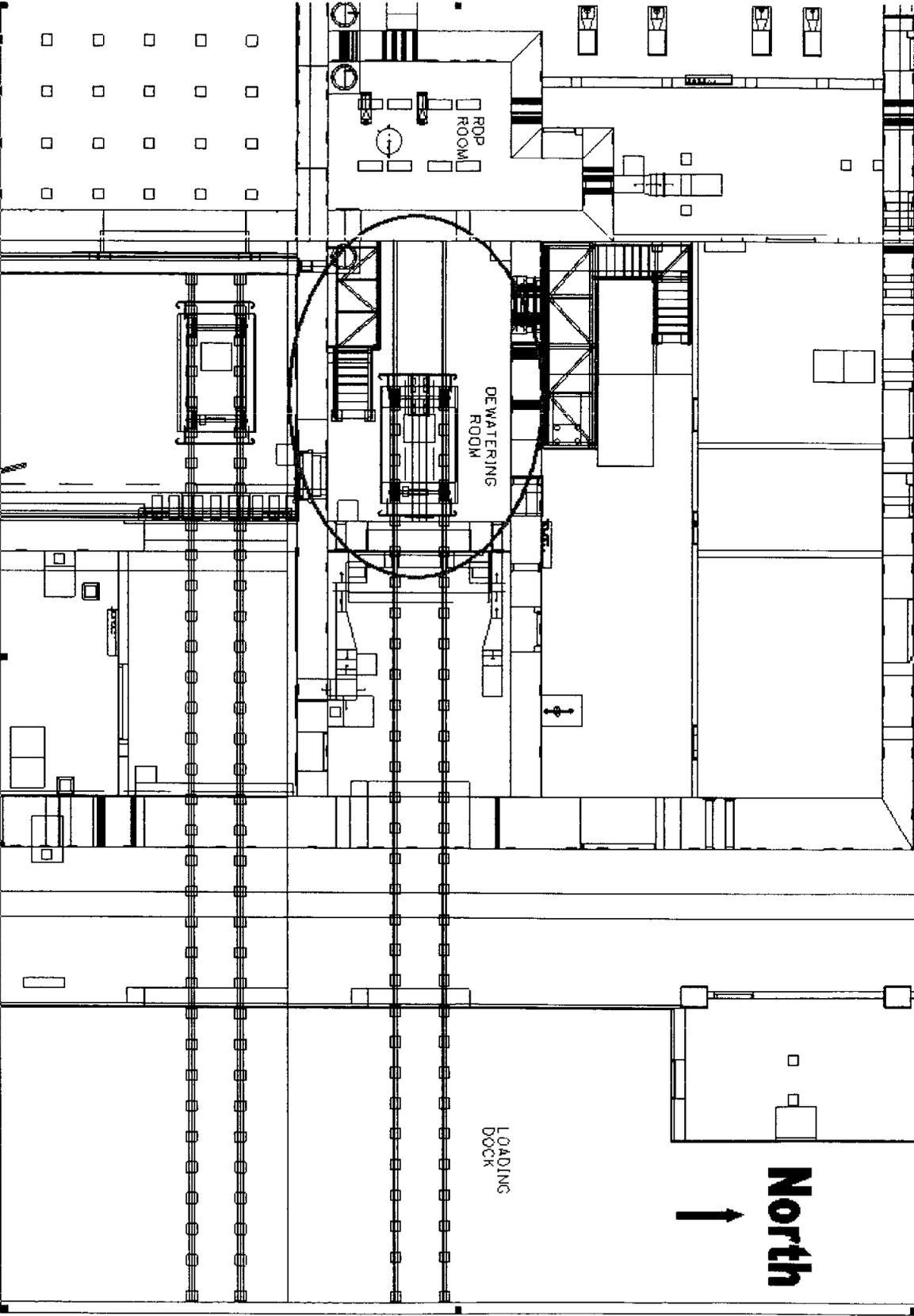
The container/cask shown in the sketches was a concept cask sized at 88" sq. x 100" high. You have provided actual dimensions which have not yet been incorporated into our design.

LOI - Local Operator Interface
MCC - Monorail Crane Control

Following the sketches are some rendered 3D visualizations of the Dewatering room. Important to note, these 3D images are about one year old and do not fully represent the current design in the DW room.

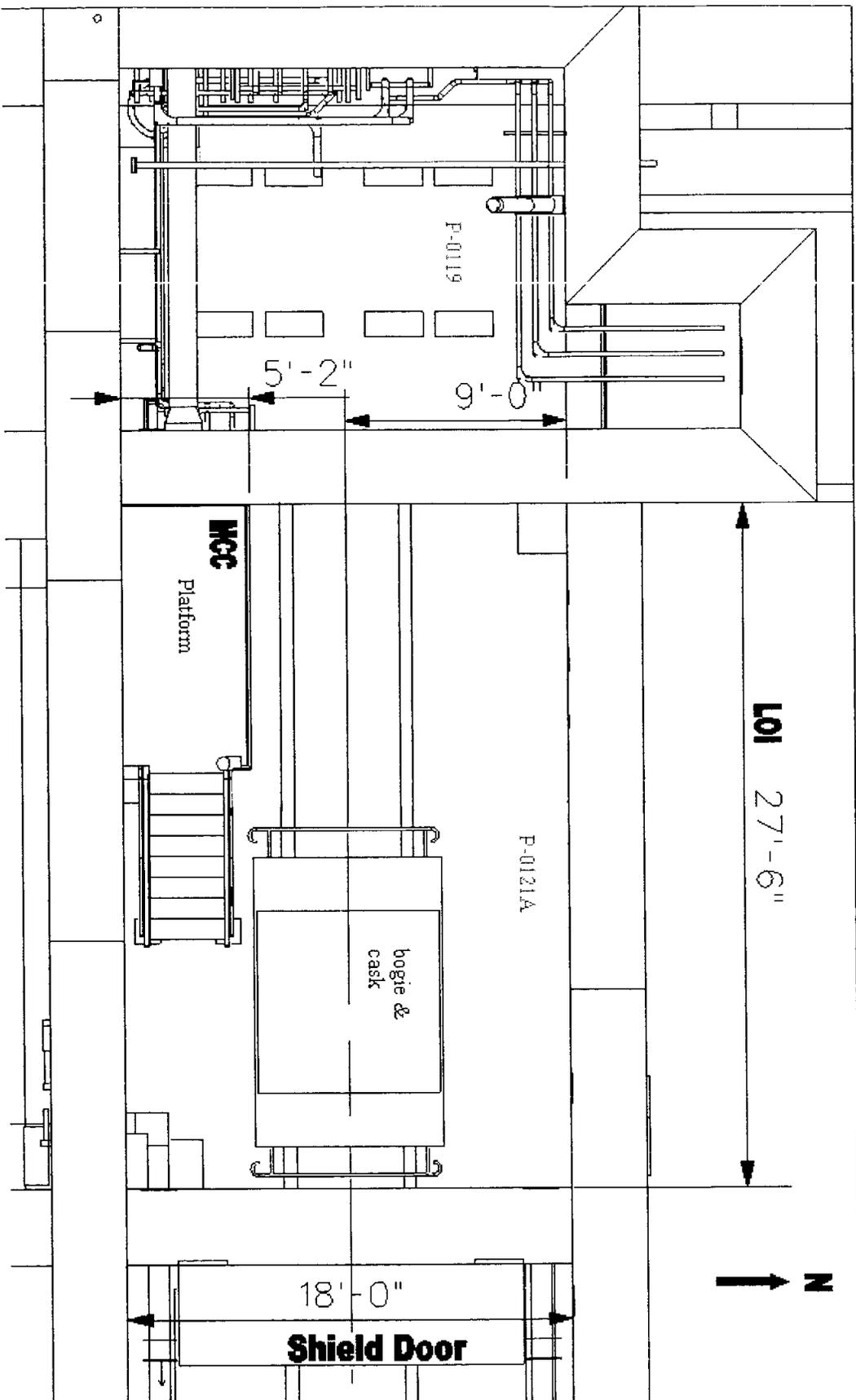
Sometimes we make reference within this layout to only the "container" or only the "cask". It is understood that the empty HIC is added to the shipping cask at the PTF dock and is handled together throughout the dewatering, export, and shipment to disposal process.

This first sketch is a general plan view of the Spent Resin Export Path from the container dewatering room (circled in red) to the loading dock. The empty container/cask and bogie travels west from the loading dock through a rollup door into a corridor. Proceeding west through another rollup door into an airlock. Once the bogie is in the airlock, the rollup door closes and the 10' x 12' shielded airlock door opens. The bogie proceeds through the shielded aperture into the dewatering room, P-0121A.



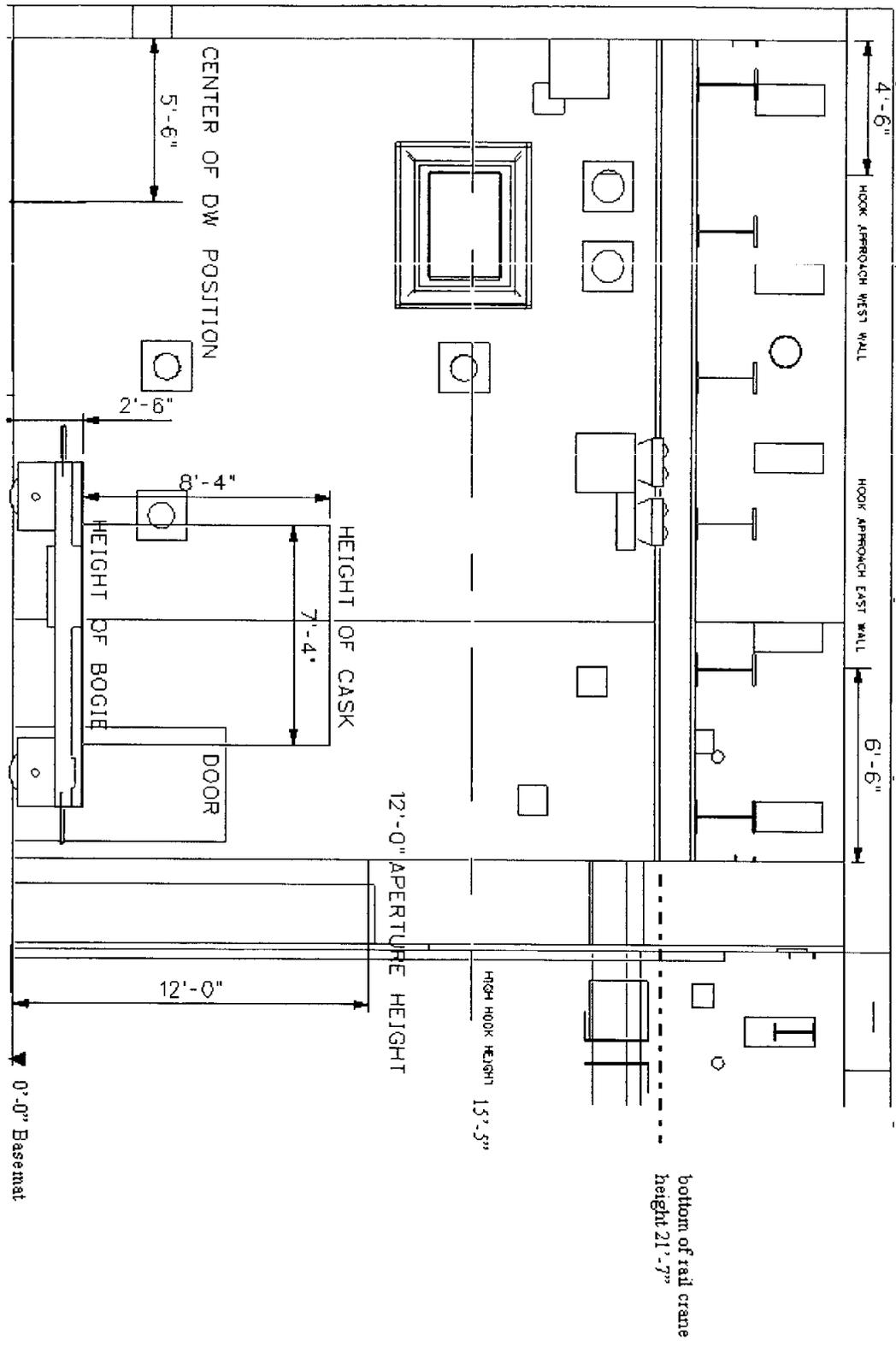
General Plan view of the Spent Resin Export Path

This next sketch shows an expanded view of the dewatering container room (with the bogie - P-0121A) and the dewatering equipment room (P-0119). Room length east to west is 27'-6"; width north to south is 18'-0". The LOI is the Local Operator Interface for remote control and camera monitors outside the room with a shielded viewing window. The MCC is the Monorail Crane Control within the room at the access platform. This control station could potentially allow operation of other equipment from within the room.



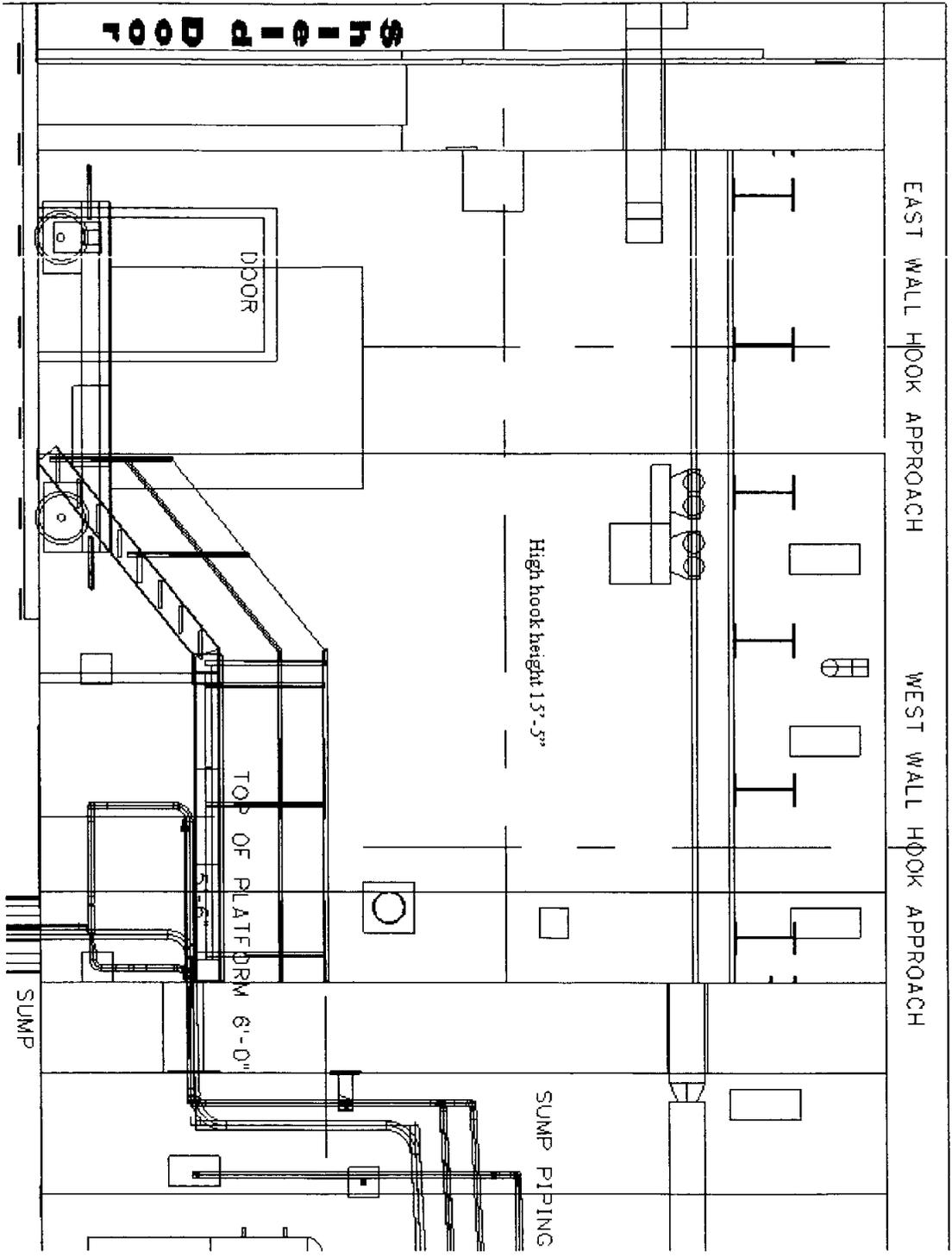
Plan view of the Resin Dewatering Room (P-0121A) including its location with respect to the dewatering room skid to the west

This sketch is a section view looking north showing the cask/container and bogie along with the monorail crane which is centered on the length of room axis. Note the high hook height and hook approaches for the monorail. The monorail crane trolley is a concept only and is not portrayed to scale.



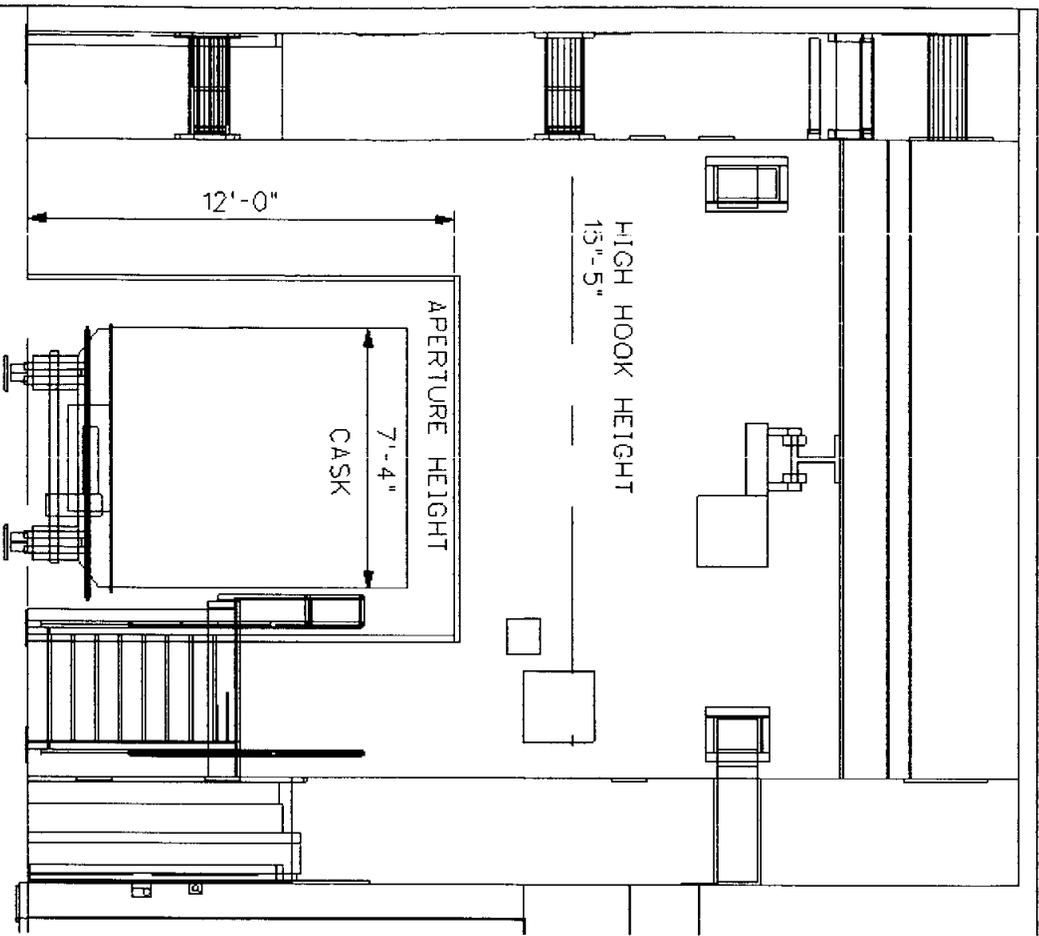
Section view of the Resin Dewatering Room looking North

This sketch is a section view looking south showing the cask/container and bogie along with the monorail crane and the access platform. This sump piping shown enters the room through the west wall and under the platform.



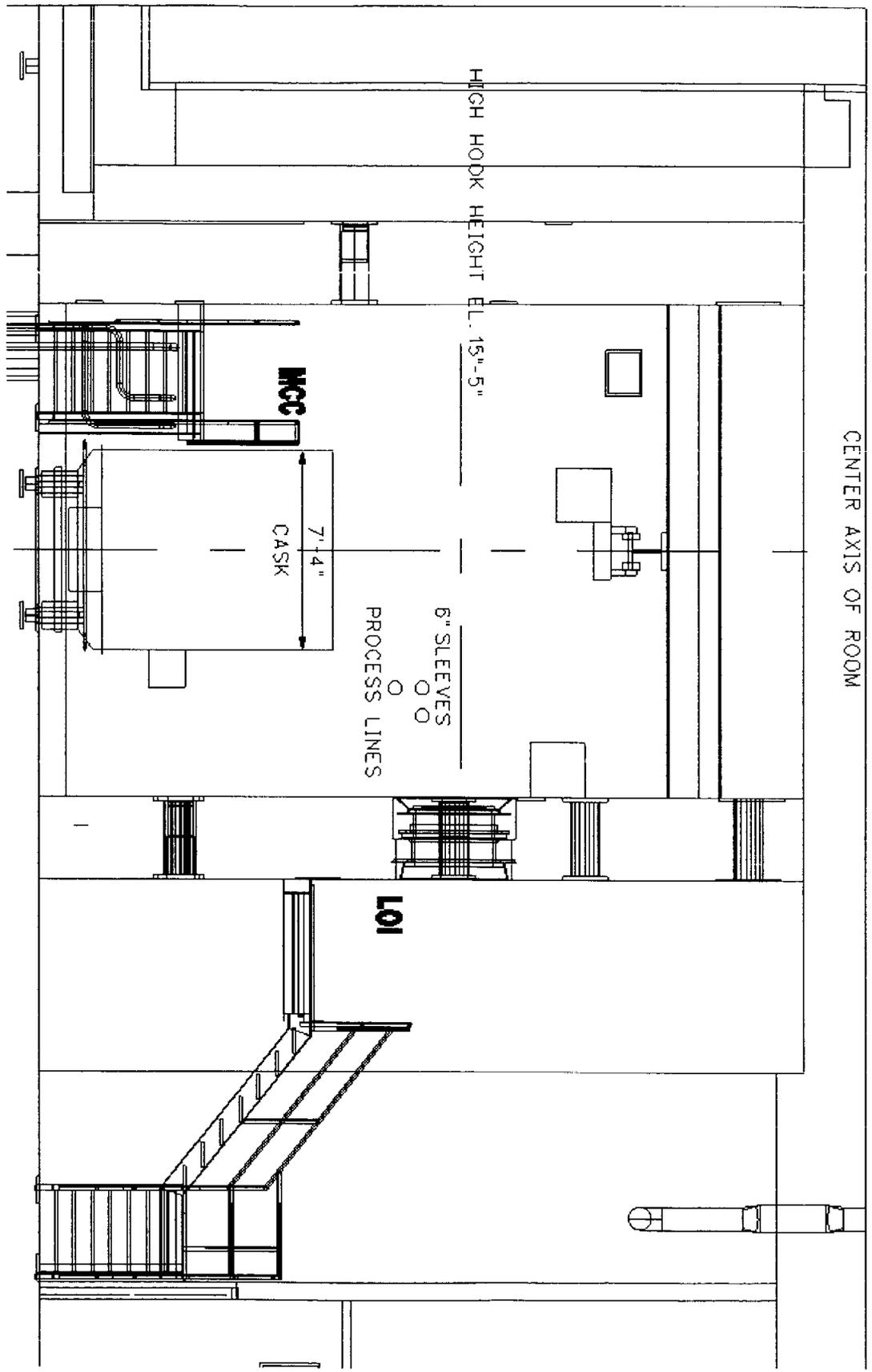
Section view of the Resin Dewatering Room looking South

This sketch is a sector view looking east showing the cask/container and bogie along with the monorail crane which is centered on the length of room axis.

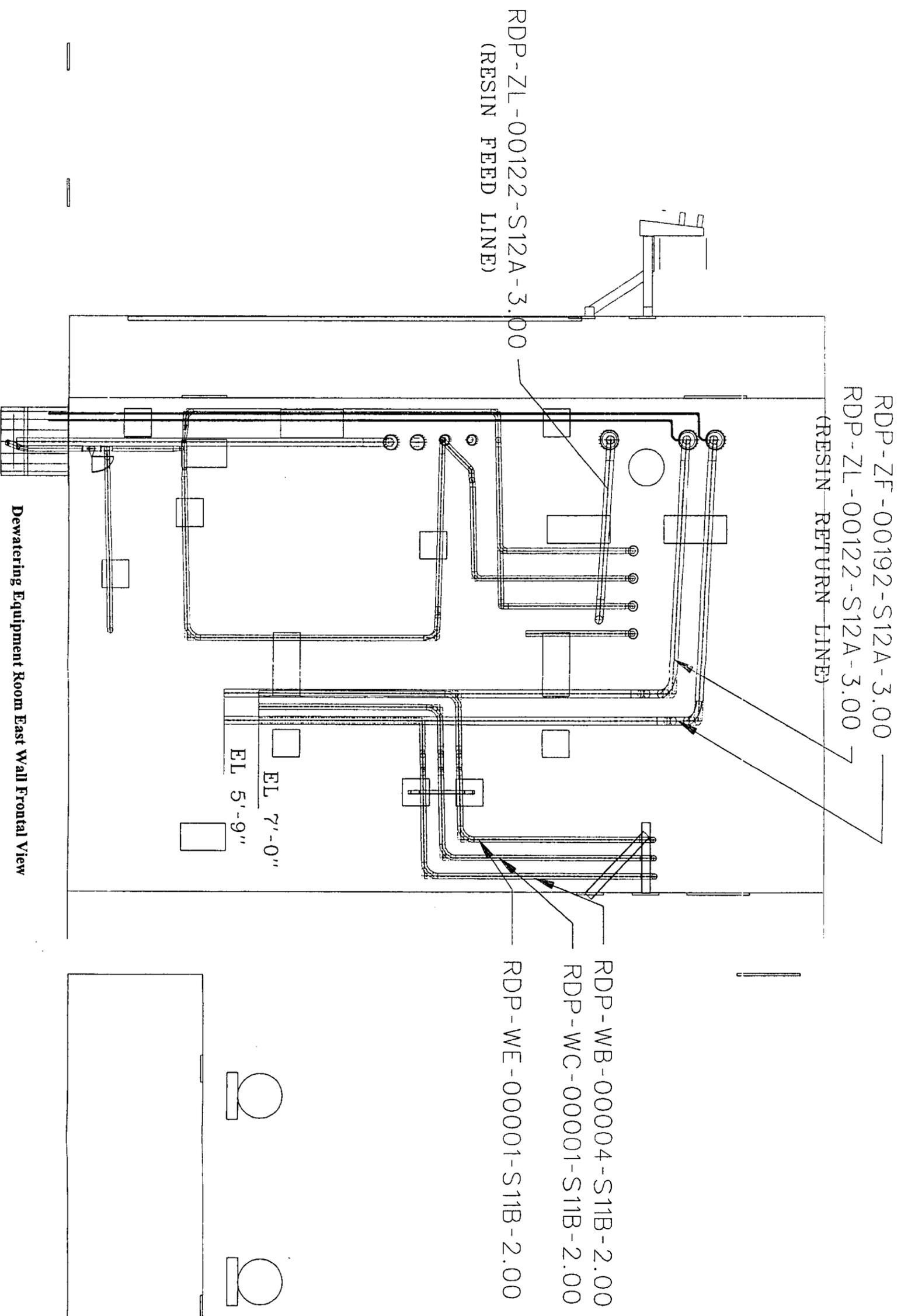


Section view of the Resin Dewatering Room looking East

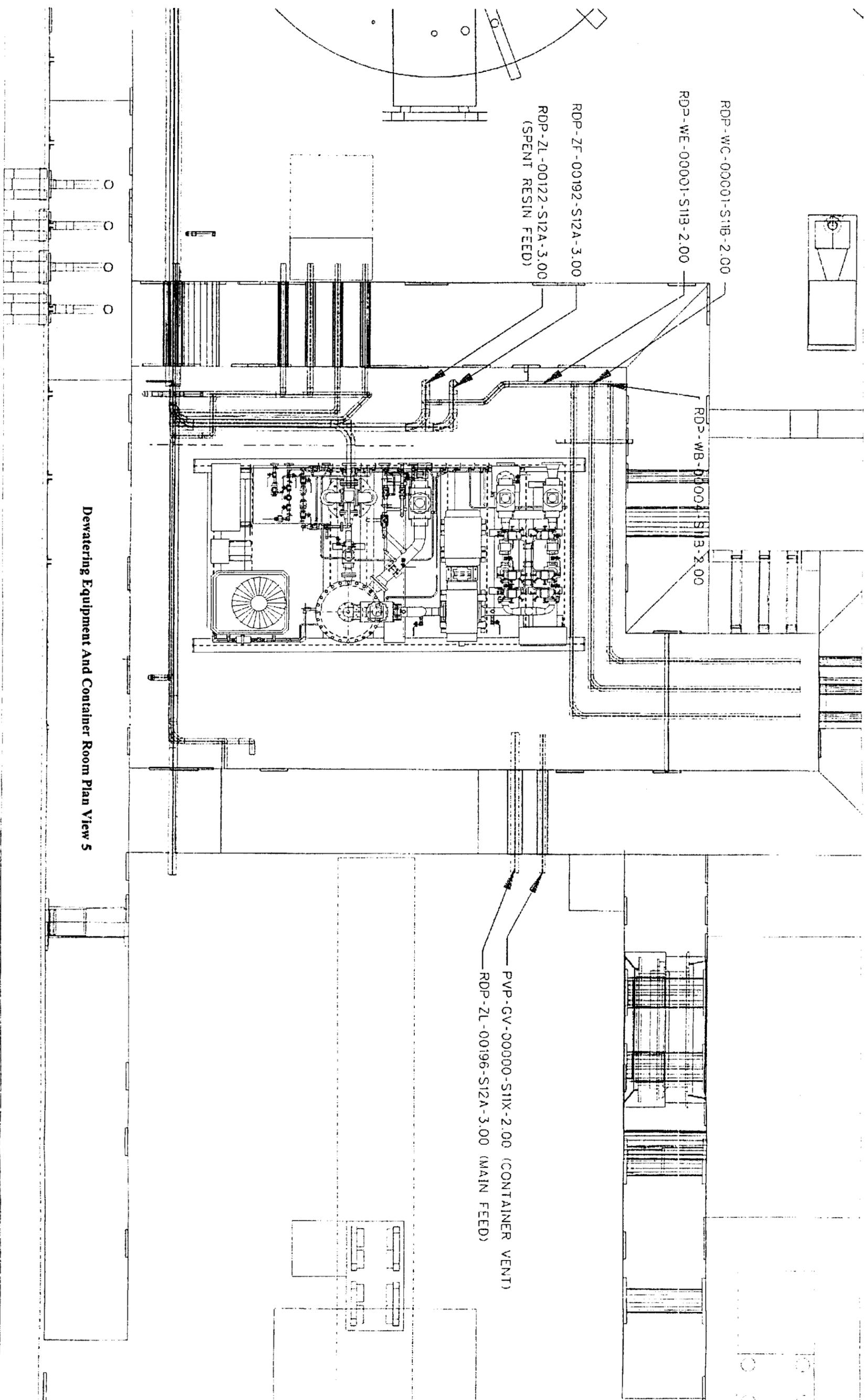
This sketch is a section view looking west showing the cask/container and bogie along with the monorail crane. Note the wall penetration sleeves for the process lines coming from P-0.19, the DW equipment room. Also shown is the outcell observation and control platform north of the container room.



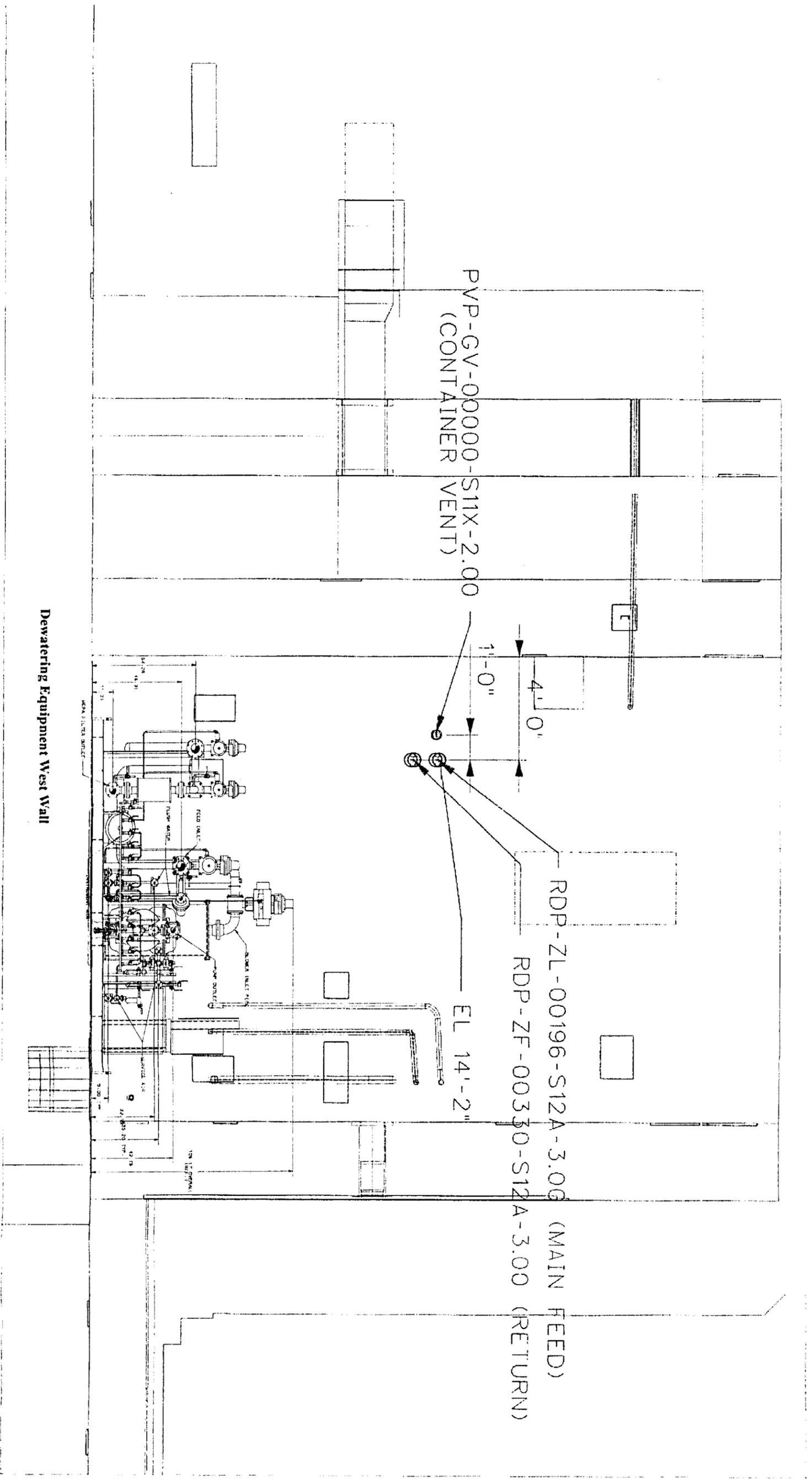
Section view of the Resin Dewatering Room looking West



Dewatering Equipment Room East Wall Frontal View



Dewatering Equipment And Container Room Plan View 5



Dewatering Equipment West Wall