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☐	Quality Assurance			
☐	Safeguards & Security			
☐	Startup			
☐	Transportation & Logistics			

* Validation not required for alpha/preliminary design description documents.

History Sheet

Rev	Reason for revision	Revised by
0	Initial issue. 24590-LAB-3ZD-60-00003, Rev 0 supersedes 24590-LAB-3YD-60-00003, Rev 1, *Facility Description for the Analytical Laboratory.*	C. Knauss/D. Reid
1	Full revision to incorporate Phase 2A work scope, including: Removal of code & standard-driven requirements Development of sections 4.1.5, 4.1.6, 4.2.1 through 4.2.5, and 4.5 (sections 4.2.6, 4.3, and 4.4 are preliminary at this revision) Update to Appendix A test criteria Incorporates 24590-LAB-3ZN-60-00003 Resolves CR #24590-WTP-GCA-MGT-15-01416 (Action #9)	R. Gill/P. Suyderhoud
2	Incorporated Operational Requirement Document (ORD) Requirements. Edited requirement statements to reflect the upper tier requirements accurately. Removed requirements that are supported by SDDs. (3.5.2.6, 3.7.1.1, 3.8.3.2, 3.8.5.15, 3.8.5.16) Deleted redundant and inaccurate requirements. (3.5.2.1, 3.5.2.2, 3.5.3.1,3.5.3.3 thru 3.5.3.7, 3.6.3.1, 3.6.3.3, 3.6.3.4.1, 3.6.3.4.2, 3.6.4.3.4.4 and 3.6.3.7.1 thru 3.6.3.7.9) Relocated Programmatic requirements to Appendix F.	D. Mears

Contents

Appendices

Tables

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1 Introduction

1.1 System Identification

This facility design description (FDD) defines the technical and operational requirements of the analytical laboratory (Lab). This document defines the waste analysis requirements, environmental compliance requirements, and authorization basis requirements of the facility as currently known and understood. This document describes the facility operating modes and requirements pertinent to the design of the Lab facility, exclusive of internal systems.

1.2 Limitations and Scope

The scope of this document is to provide an authoritative source for the collected set of requirements applicable to the Lab facility, inclusive of interface requirements with other facilities. Direct feed low activity waste (DFLAW) scope and associated applicable design requirements have been incorporated in Sections 1-3 of this document only. The Facility Design Description (FDD) is prepared in accordance with 24590-WTP-3DP-G04B-00093, *System and Facility Design Descriptions*.

The intended use of these collected requirements is to:

- Identify the overall Lab facility requirements for the design effort,
- Provide a basis for the flow-down and incorporation of interfacing requirements into system and facility designs
- Provide a validated basis upon which to confirm implementation of requirements in design
- Provide the expected means of verification for requirements, including those that are post-construction (i.e., startup and commissioning test objectives and acceptance criteria)

It is intended that all requirements established in this document are verified to be implemented in design and/or physical configuration using a graded approach commensurate with importance and risk. Deviations from the identified expected means of verification are allowed, except where noted.

Where numeric values are provided within requirements in Section 3, these values are provided without additional margin. For example, if a value is established in the Basis of Design, no attempt is made to remove any margin that may or may not have gone into the establishment of that value, neither has any margin been added. Where values are stated as minimums or maximums, there is no expectation that any additional margin be applied in the verifications that the design requirements have been met. Testing that is required to be performed in accordance with external codes and standards must follow the rules established in those documents.

The scope of this document is limited to Lab facility features that support production and/or protects equipment, personnel, and the environment. This includes, but is not limited to the civil, structural and architectural features such as building roof, walls, floors, embeds/ anchors, portals, bulges/enclosures, sumps, penetrations, coatings and liners, as well as those requirements tied to the overall functioning of the facility. The contents are specifically intended to not include or be redundant to requirements more appropriately allocated to and defined in System Design Descriptions (SDDs) and System Descriptions (SDs). Where appropriate, some requirements that are overarching to the facility mission or function are included even though they may depend on contributions from multiple individual systems.

Some requirements for system-designated equipment items, for example glove boxes and manipulators (LIH system), are included in this FDD. Those items are listed in this FDD because they perform safety-designated functions, i.e., hotcell containment / confinement, and therefore are required to be at least Safety Significant (SS) and at least Seismic Category III (SC-III), and their existing system descriptions lacked methodology to verify that they meet those requirements. Their non-safety functions and requirements remain in their respective system descriptions.

This document is intended to be used in support of design verification, startup testing, and commissioning activities. It is intended to be maintained current relative to changes in source requirements documents. Updates shall be made concurrent with these changes to source requirements, or implementation is to be tracked for completion in accordance with 24590-WTP-GPG-ENG-0170, *Impact Evaluation*.

Engineers are expected to be able to use the requirements in Section 3 of this document as input for design development without recourse to the upper-tier source documents or searches of the Technical Requirements Management System supported by Technical Requirements Search Application. Design Engineers are still required to ensure that requirements contained with the discipline/functional standards incorporated by reference in Section 3 are followed. These documents contain additional criteria that are based on application of external codes/standards, corporate best practices, and engineering management expectations for a consistent design.

The contents of Section 4, *Facility Description*, are being developed in a phased approach in support of future operations and maintenance. At this revision, only the contents of Sections 4.1.1 through 4.1.6 and 4.2.1 through 4.2.5 have been updated and verified. Sections 4.2.6, 4.3 and 4.4 are preliminary during this phase and will be updated in a later phase after work to support completion of these sections has been completed.

1.3 Ownership and Maintenance

The Design Authority (DA) organization is responsible for the preparation and maintenance of this document through turnover of the included systems to Operations. Thereafter, maintenance of this document is the responsibility of the Plant Engineering organization; however, the Engineering DA organization retains responsibility for the establishment and definition of design requirements.

1.4 Definitions/Glossary

Confinement – For consistency, regardless of usage elsewhere, confinement is used in this document to denote the controls used to prevent or minimize the release or migration of airborne contaminants, including aerosols, and hazardous vapors or gases.

Containment – For consistency, regardless of usage elsewhere, containment is used in this document to denote the controls used to prevent or minimize the release or migration of liquid or liquid-entrained contaminants.

Primary confinement / containment – The structures, systems, and components (SSCs) and their associated boundaries that confine/contain airborne, solid and liquid contaminants under normal conditions.

Secondary confinement / containment – The backup structures or other design features that capture and prevent further spread or migration of airborne, solid and liquid contaminants once they have escaped primary confinement/containment.

Design Basis Event – Bounding accidents are termed design basis events if they result in credible hazards, including the most significant possible releases of radioactive and other hazardous materials, criticality scenarios, and other accidental releases expected during the lifetime of the facility. [Section 5.5.2, *The Preliminary Documented Safety Analysis to Support Construction Authorization; General Information*]

1.5 Acronyms and System Designators

1.5.1 Acronyms

ADR	ALARA design review

ALARA	as low as reasonably achievable
ATA	analytical time available
BOF	balance of facilities
CCTV	closed-circuit television
CCP	chiller/compressor plant
C&I	control and instrumentation
DFLAW	direct feed low-activity waste
DOE	U.S. Department of Energy
DQO	data quality objective
EMF	effluent management facility
EQP	environmental qualification package
ETF	effluent treatment facility
FCR	facility control room
HC	hot cell
HEPA	high efficiency particulate air
HLW	high-level waste
HVAC	heating, ventilation and air conditioning
ICP	inductively coupled plasma
IDLH	immediately dangerous to life and health
IHLW	immobilized high level waste
ILAW	immobilized low activity waste
Lab	analytical laboratory
LAW	low-activity waste
LAWPS	low-activity waste pretreatment system
LERF	liquid effluent retention facility
LIMS	laboratory information management system
MCC	motor control center
MCR	main control room
MS	mass spectrometer
MSM	master – slave manipulator
M&TE	measuring and test equipment
MTG	metric tons of glass (vitrified waste)
NFPA	National Fire Protection Association
NPH	natural phenomena hazard
OES	optical emission spectrometer
OSHA	Occupational Safety and Health Administration
PCM	personnel contamination monitor
OR	operations research
PAM	post-accident monitoring
PC-2	performance category – 2
PPE	personal protective equipment
PEL	Permissible Exposure Limit
PT	pretreatment

PTF	pretreatment facility
RAS	record air samplers
RCRA	Resource Conservation and Recovery Act
RL	radiological laboratory
SC-III	seismic category-III
SS	safety significant
SSC	structures, systems, and components
TAC	test acceptance criteria
TEDF	treated effluent disposal facility
TLAW	treated low-activity waste
TIC	total inorganic carbon
TOC	total organic carbon
TSR	technical safety requirements
UBC	Uniform Building Code
VoIP	voice-over internet protocol
WAC	Washington (State) Administrative Code
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1.5.2 System Designators

AHL	analytical hotcell laboratory equipment system
ARL	analytical radiological laboratory equipment system
ARV	atmospheric reference ventilation system
ASX	autosampling system
BAG	bottled argon gas system
BHG	bottled helium gas system
BNG	bottled nitrogen gas system
BSA	breathing service air system
C#V	C# ventilation system
CHW	chilled water system
CME	communications electrical system
CPE	cathodic protection electrical system
DEP	direct-feed low activity waste effluent management facility process system
DIW	demineralized water system
DOW	domestic (potable) water system
EMJ	environmental monitoring system
FDE	fire detection and alarm system
FPW	fire protection water system
FSW	fire service water storage & distribution system
GRE	grounding and lightning protection electrical system
HP	health physics
HPS	high pressure steam system
HTE	heat trace electrical system
LIH	laboratory in-cell handling system

LPS	low pressure steam system
LTE	lighting electrical system
LVE	low voltage electrical system
MVE	medium voltage electrical system
MXG	miscellaneous gas system
NLD	non-radioactive liquid waste disposal system
PSA	plant service air system
PVA	process vacuum air system
PWD	plant wash and disposal system
RLD	radioactive liquid waste disposal system
RWH	radioactive solid waste handling system
SCW	steam condensate water system
SDJ	stack discharge monitoring (rad and non-rad) system
SND	sanitary disposal system
SWD	storm water disposal system
UPE	uninterruptible power electrical system

2 General Overview

Figure 2-1 below provides the contextual depiction of the facility in terms of its primary interrelationships with other facilities, systems, utilities and contractors. This diagram does not include every internal system (e.g., breathing air (BSA) system) or differentiate among some utilities that have both normal and safety service provision (e.g., medium voltage electrical system (MVE) and chilled water system (CHW)). This diagram is used in support of functional and performance definition at the facility level. See section 1.5.2 for the list of relevant system designations.

As shown in Figure 2-1 below, two operating configurations exist for Hanford Tank Waste Treatment and Immobilization Plant (WTP) that will produce samples requiring analysis in the Lab. These operating configurations are referred to throughout this document as the pretreatment (PT) (baseline) configuration and the DFLAW configuration.

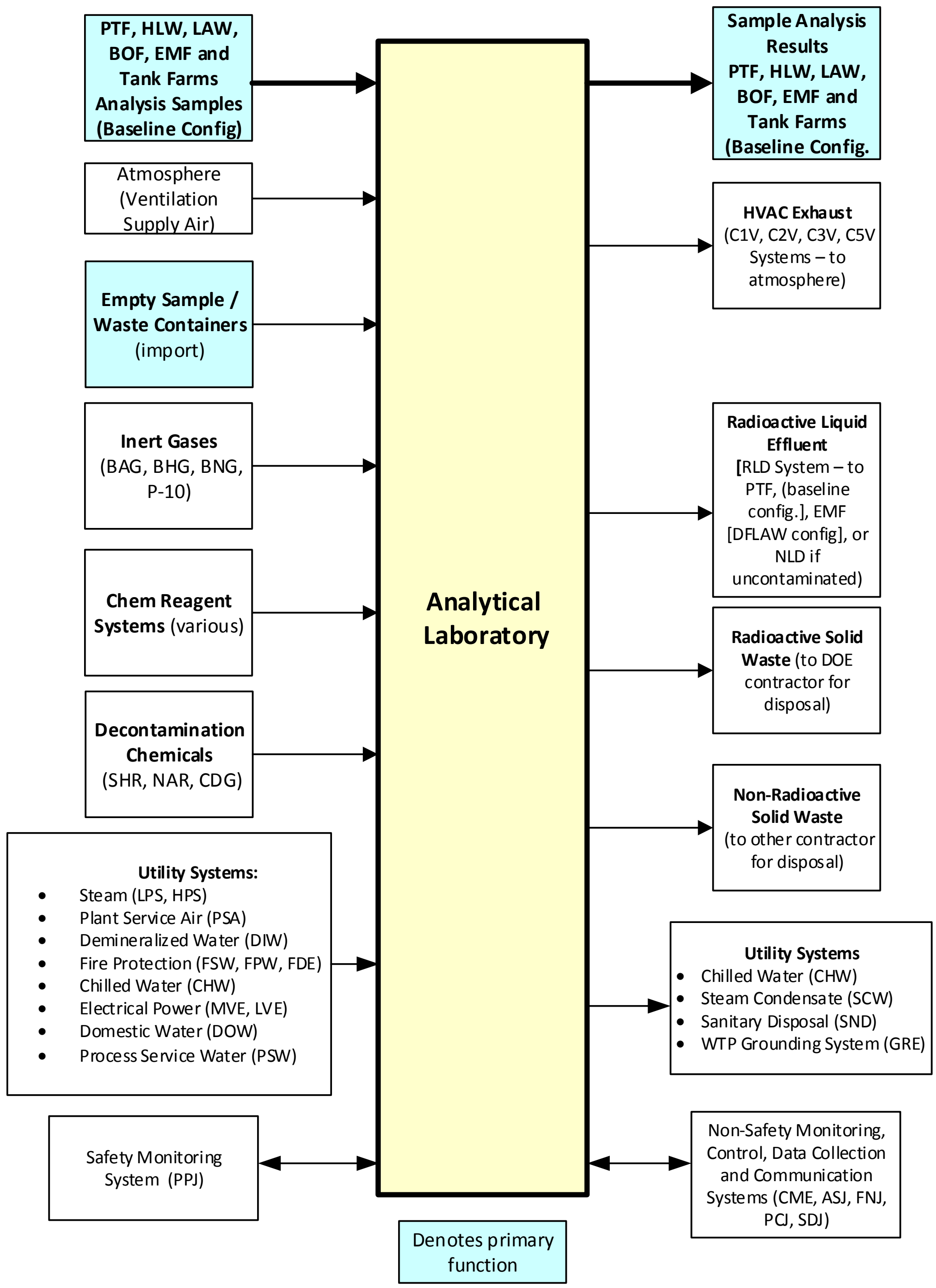
In the baseline configuration, waste feed is provided to the low activity waste (LAW) facility from PT's treated LAW concentrate storage process system. This configuration supports LAW facility glass production by providing the necessary treated low-activity waste (TLAW) feed to the LAW facility, but also by accepting secondary liquid effluents generated during the glass making process that are returned to PT from the LAW facility for additional treatment. In the baseline configuration, PT, high level waste (HLW), LAW and Tank Farms are the sources of the waste samples sent to the Lab for analysis.

In the DFLAW configuration, waste feed is provided directly to the LAW facility from the tank operations contractor low activity waste pretreatment system (LAWPS) facility. Samples of the waste feed from tank operations contractor LAWPS are provided to the Lab for verification in accordance with the requirements of the DFLAW data quality objective (DQO). The LAW facility uses the combination of treated waste feed from LAWPS and recycled evaporator concentrate effluent from effluent management facility's (EMF's) direct-feed low activity waste effluent management facility process system (DEP) system to produce glass, and samples of the liquid products and effluents generated as part of the process are sent to the Lab for analysis. Secondary liquid effluents generated by the LAW glass-making process (that would otherwise be returned to PT in the baseline configuration) are sent to the EMF for further processing. The EMF generates samples of the dilute and concentrated effluent products, which are sent to the liquid effluent retention facility (LERF)/Effluent Treatment

Facility (ETF) and back to the LAW facility/Tank Farms/tanker truck for further processing, respectively. Samples of both the dilute and concentrated effluent are manually transported to the Lab for analysis. In the DFLAW configuration, LAW, EMF and the tank operations contractor LAWPS are the sources of the waste samples sent to the Lab for analysis.

Figure 2-1 shows the inputs and outputs to the Lab facility for the two operating configurations.

Figure 2-1 LAB Facility Context Diagram

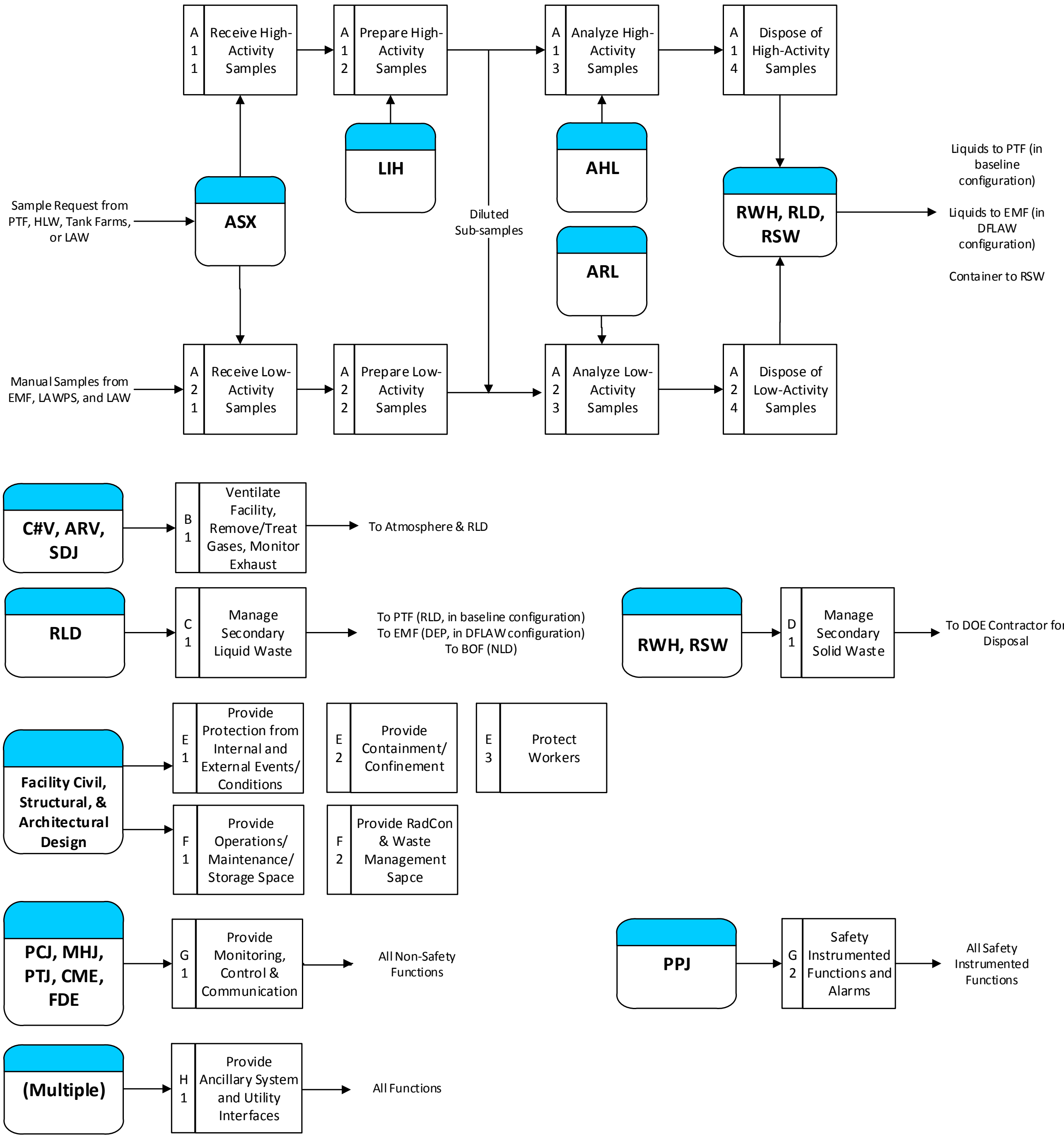


2.1 System Functions/Safety Functions

This section defines the facility functions and attributes that need to be addressed by the facility design. Section 3 provides the design requirements to meet both functional and other requirements. Figure 2-2 provides the functional block diagram for the Lab facility, indicating the internal and external systems and utilities that provide the primary support or interface for that function.

System interfaces are provided for reference only. Except where a level of interface with the facility needs to be defined, no attempt is made in this document to define system-level functions, performance or design requirements. (See section 1.5.2 for the list of relevant system designators.)

Figure 2-2 LAB Facility Functional Block Diagram



The functions included in Figure 2-2 are the primary and secondary level functions of the facility. These functions are further described below. Where appropriate to support definition of functional/design requirements, functions have been further decomposed and additional levels of supporting functions are also described.

Table 2–1 Functional Analysis & Crosswalk to Requirements

Reference	Functional Analysis Description	Requirement Section No.
A	**Support Sample Analysis**	**N/A**
A.1	**High-Activity Samples – Analytical Hotcell Laboratory Equipment System (AHL)**	**N/A**
A.1.1	Receive High-Activity Samples – The Lab receives high-activity samples from HLW, and pretreatment facility (PTF), via the autosampling system (ASX). Tank Farms transfers samples manually.	3.4.2, 3.8.5.22
A.1.2	Prepare High-Activity Samples – The LIH remotely retrieves high-activity samples from the ASX and repositions them to support sample analysis.	3.4.2, 3.8.5.22
A.1.3	Analyze High-Activity Samples – The AHL performs high-activity sample analysis.	3.4.2
A.1.4	Dispose of High-Activity Samples – Solid waste is either handled by the radioactive solid waste handling system (RWH) or exported as radioactive solid waste. Liquid waste is transferred to the radioactive liquid waste disposal system (RLD).	3.4.2,
A.2	**Low-Activity Samples - Analytical Radiological Laboratory Equipment System (ARL)**	**N/A**
A.2.1	Receive Low-Activity Samples – The Lab receives low-activity samples pneumatically from LAW via the ASX system, or manually from Tank Farms, EMF, LAWPS, or LAW. Additionally, perform sample analysis for the balance of facilities (BOF) on water and reagents.	3.4.2, 3.7.1.5
A.2.2	Prepare Low-Activity Samples – Low-activity samples are transferred from the sample receiving/shipping room to radiological laboratory workstations.	3.4.2
A.2.3	Analyze Low-Activity Samples – The ARL performs both low-activity sample analysis and diluted high-activity sub-sample analysis.	3.4.2
A.2.4	Dispose of Low-Activity Samples – Solid waste is either handled by the RWH or exported as radioactive solid waste. Liquid waste is transferred to the RLD.	3.4.2,
B.	**Ventilate Facility, Remove/Treat Gases, Monitor Exhaust**	**N/A**
B.1	• Ventilate the Facility – Control & minimize the spread of contamination • Remove/Treat Gases – Exhaust vaults, hotcells, radiological labs, gloveboxes, etc. • Monitor Exhaust – Monitor stack exhaust.	3.5.3.8
C.	**Manage Liquid Waste**	**N/A**
C.1	Manage Secondary Liquid Waste – Accumulate, store, sample and transfer radioactive and non-radioactive liquid waste. Drain and transfer sanitary liquid wastes.	3.6.2.2, 3.6.3.9.1, 3.6.3.9.8, 3.7.1.4, 3.8.5.6, 3.8.5.9, 3.8.5.14, 3.8.5.22, 3.8.5.23
D.	**Manage Solid Waste**	**N/A**
D.1	Manage Secondary Solid Waste – Accumulate, transfer, reduce, and process radioactive, mixed, dangerous secondary solid, and sanitary solid waste.	3.6.3.9.1, 3.6.3.10.1, 3.6.3.10.2, 3.6.3.10.3, 3.7.1.2, 3.8.5.7, 3.9.2.1

Table 2–1 Functional Analysis & Crosswalk to Requirements

Reference	Functional Analysis Description	Requirement Section No.
E.	**Support Safety and Environmental Permit Requirements**	**N/A**
E.1	Provide Protection from Internal and External Events/Conditions – Ensure the survivability of SSCs and structural integrity of the facility in external seismic category- III (SC-III)/performance category-2 (PC-2) events or abnormal internal events.	3.5.2.5, 3.5.3.2, 3.6.3.2, 3.8.2.1.1
E.2	Provide Containment/Confinement – Provide confinement and containment compliance with regulatory and permit requirements, and safety analyses.	3.6.2.9, 3.6.3.5.1, 3.6.3.5.2, 3.6.3.7
E.3	Protect Workers – Provide protection to employees, and minimize exposure, utilize as low as reasonably achievable (ALARA) principles of design.	3.5.3.9, 3.6.2.1, 3.6.2.2, 3.6.2.3, 3.6.2.4, 3.6.2.5, 3.6.2.7, 3.6.2.8 3.6.2.9, 3.6.2.10, 3.8.6.7
F.	**Support Operations and Maintenance**	**N/A**
F.1	Provide Operations/Maintenance/Storage Space – Provide space for all primary and support functions and maintenance activities.	3.6.2.10, 3.8.5.3, 3.8.5.4, 3.8.5.5, 3.8.5.6, 3.8.5.7, 3.8.5.8, 3.8.5.9, 3.8.5.10, 3.8.5.11, 3.8.5.12, 3.8.5.14, 3.8.6.1, 3.8.6.3
F.2	Provide Radiological Control & Waste Management Space – Provide space for radiological control and waste management activities.	3.6.2.10, 3.6.3.10.1, 3.6.3.10.2, 3.6.3.10.3, 3.8.5.6, 3.8.5.7,
G.	**Support Monitoring, Control and Communication**	**N/A**
G.1	Monitoring, Control, and Communications – Provide non-safety monitoring and control for facility systems, including communications.	3.8.3.1, 3.8.4.1, 3.8.4.2
G.2	Safety Instrumented Functions and Alarms – Provide safety monitoring and control for facility systems.	3.8.3.1
H.	**Support Ancillary and Utility System Interfaces**	**N/A**
H.1	Provide Ancillary System and Utility Interfaces – Provide connections to external utility and support systems, including internal distribution.	3.7.1.4, 3.8.4.2, 3.8.5.14,

2.2 System Classification

The Lab facility contains components with the following classifications/designations:

- ☐ Safety Class
- ☒ Safety Significant
- ☒ Dangerous Waste Permit affecting
- ☒ Air Permit affecting
- ☒ Waste Acceptance Impacting
- ☒ General

2.3 Basic Operational Overview

The Lab facility is located on the Hanford nuclear reservation, managed by the U.S. Department of Energy (DOE) in southeastern Washington State. It is part of the WTP, being designed and constructed to treat millions of gallons of nuclear and chemical waste currently stored in underground tanks.

The Lab will receive waste samples for analysis from the PT, HLW facility, LAW facility, EMF, and from the Tank Farms. The samples to be analyzed in the Lab facility are comprised of as-received tank farm wastes (at PT), the prepared HLW feed fraction, the prepared LAW feed fraction, and the dilute and concentrated effluents produced by the EMF. Reagent samples from BOF are also sent to Lab. Some Lab waste is a dangerous waste regulated under Resource Conservation and Recovery Act (RCRA) and Washington State Regulations, and must meet specific treatment and performance standards for storage and disposal in accordance with the specific requirements of the WTP Contract and WTP Dangerous Waste Permit.

The Lab will operate as part of both operating configurations that are used at WTP. While operating in the baseline configuration, the Lab will receive waste samples for analysis from the PT, HLW, and LAW facilities as well as samples from Tank Farms. While operating in the DFLAW configuration, the Lab receives waste samples for analysis from LAW, EMF, and the tank operations contractor LAWPS. The baseline and DFLAW operating configurations will not be operated concurrently. PT and HLW will be isolated from the EMF while operating in the DFLAW configuration. Conversely, the EMF has the capability to be isolated from PT when operating in the baseline configuration. Therefore, the sources of the waste samples to be analyzed within the Lab will vary based on the operating configuration in use. The necessary isolation required to operate WTP in both configurations has been incorporated in the design of the facilities and waste transfer systems. The isolation of the transfer of radioactive liquid waste effluents from the Lab to either the PT facility or EMF is within the scope of the process system (Lab RLD system), and is discussed in the Lab RLD system design description documents.

Lab secondary solid waste containers will be removed by transport vehicle to a permitted Hanford or offsite treatment and/or disposal facility. Liquid effluents collected by the Lab RLD system will be transferred to either PT (in the baseline configuration) or to EMF (in the DFLAW configuration) for further processing.

For a more detailed overview of the facility and its major systems the reader is directed to 24590-WTP-PSAR-ESH-01-002-06, *Preliminary Documented Safety Analysis to Support Construction Authorization; LAB Facility Specific Information*. The following table identifies the boundaries and interfaces with other systems. This information is based on existing design where possible, to provide a greater level of detail. See Section 1.5.2 for the list of relevant system designators.

Table 2–2 Lab Facility Interfacing Systems

System	Interface	Boundaries
AHL	Analyze process samples received from the HLW and PT facilities.	The AHL system is housed within Lab facility rooms A-0142 through A-0155. See 24590-LAB-3YD-AHL-00001, *System Description for the Analytical Hotcell Laboratory (AHL)*, for additional detail.
ARL	Analyze samples received from the LAW (baseline configuration) or the LAW/EMF/LAWPS (DFLAW configuration).	The ARL system is housed within Lab facility rooms A-0122 through A-0133. See 24590-LAB-3YD-ARL-00001, *System Description for the Analytical Radiological Laboratory (ARL)*, for additional detail.
ASX	Transfers process samples from PT, HLW, and LAW, to the Lab.	Fume hood receipt stations (ASX-SMPLR-00034 and ASX-SMPLR-00047), hot cell receipt station (ASX-SMPLR-00039), and the hot cell receipt and disposal station (ASX-SMPLR-00043). See 24590-WTP-3ZD-ASX-00001, *System Design Description of the Autosampling System (ASX)*, for additional detail.

System	Interface	Boundaries
BSA	Supplies breathing air to the Lab by a dedicated, stand-alone compressor.	The Lab BSA compressor, located in the R1/C1 Mechanical Room (A-0202) on the 17’-0” elevation. See 24590-WTP-3YD-BSA-00001, *System Description for the Waste Treatment Plant Breathing Service Air (BSA)*, for additional detail.
C1V, C2V, C3V, and C5V	Provides heating, cooling, humidification, and ventilation for the Lab facility.	Inlets/outlets of fans, filters, air handlers, and ductwork located throughout the Lab facility 0’-0” and 17’-0” elevations. See 24590-LAB-3ZD-60-00002, *Analytical Laboratory Ventilation System Design Description*, for additional detail.
CME	Provides VoIP: Telephone/PC, wireless access, public address and building evacuation, take-cover alarms, building electronic access and control system, ‘keep out’ warning lights, and ‘noisy area’ warning lights.	The interface point between communications electrical system (CME) cables/raceways and the end of line device. See 24590-WTP-3YD-CME-00001, *System Description for the Communications Electrical System (CME) and Facility Network Infrastructure (FNJ)*, for additional detail.
DOW	Provides a continuous supply of potable water to the Lab facility.	The manual isolation valves on the various supply and return headers to Lab facility equipment. See 24590-WTP-3YD-DOW-00001, *System Description for the Waste Treatment Plant Domestic Water System (DOW)*, for additional detail.
EMJ	Provides detection of airborne contamination or radiation and warns personnel in the immediate vicinity	Instruments used to detect airborne contamination or radiation, located throughout the Lab facility. See 24590-WTP-3YD-EMJ-00001, *System Description for Environmental Monitoring System (EMJ)*, for additional detail.
FDE	Monitors the fire protection water system (note: internal system fed from fire service water storage & distribution system (FSW)) (FPW) as well as other initiating devices	Instruments and panels used to detect fire in the Lab, located throughout the Lab facility. See 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*, for additional information.
FPW	Distributes fire protection water throughout the Lab facility	Piping and sprinklers located throughout the Lab facility. See 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*, for additional information.
GRE	Provides grounding and lightning protection	Alternate paths directly to the ground for electrical currents. See 24590-WTP-3YD-GRE-00001, *System*

System	Interface	Boundaries
		Description for Grounding and Lighting Protection System, for additional detail.
LIH	Provides the handling equipment and items required to perform the operational and maintenance tasks within the hotcells	LIH equipment located in hotcells including shield windows, master – slave manipulators (MSMs), service penetration embeds, transfer ports, fume hoods, and the sample export glovebox. See 24590-LAB-3YD-LIH-00001, *System Description for the Analytical Laboratory In-Cell Handling System*, for additional detail.
LTE	Provides artificial illumination for the Lab	Lighting fixtures located throughout the Lab facility. See 24590-WTP-3YD-LTE-00001, *System Description for Lighting Systems (LTE)*, for additional detail.
NLD	Collects non-dangerous, non-radioactive effluent from the Lab	Floor drains located throughout the Lab facility. See 24590-WTP-3YD-NLD-00001, *System Description for the Waste Treatment Plant Non-Radioactive Liquid Waste Disposal (NLD) System*, for additional detail.
RLD	Collects radioactive liquid effluents for interim storage.	Floor, sink, and hotcell drains located throughout the Lab facility. See 24590-LAB-3ZD-RLD-00001, *Lab Radioactive Liquid Waste Disposal (RLD) System Design Description*, for additional detail.
RWH	Provides the equipment, controls, and instrumentation to contain and transport radioactive solid waste from the hotcells and fume hoods.	Waste handling equipment located throughout the Lab. See 24590-WTP-3YD-RWH-00002, *System Description for the WTP System RWH Radioactive Solid Waste Handling*, for additional detail.
SDJ	Monitors and samples Lab air stack emissions	Instruments, sampling equipment and associated panels used to monitor and sample stack air emissions, located throughout the Lab facility. See 24590-WTP-3YD-SDJ-00001, *System Description for Stack Discharge Monitoring (Rad and Non-Rad)*, for additional detail.
SND	Collects, treats, and disposes sanitary sewage effluent generated by the analytical laboratory	Gravity collection system located throughout the Lab facility. See 24590-BOF-3YD-SND-00001, *System Description for Balance of Facility Sanitary Disposal (SND) System*, for additional detail.
SWD	Provides drainage away from structures and paved areas	Engineered collection structures located around the Lab facility structure. See 24590-BOF-3YD-SWD-00001, *System Description for Balance of Facility Storm Water Disposal (SWD) System*, for additional detail.

3 Design Requirements

3.1 Requirements

Requirements are documented in Sections 3.1 through 3.10. Each requirement statement is accompanied by a basis discussion (as needed) and the expected means of verification. Requirements must be met in design. If a requirement stated in this document cannot be met in design, then a revision to the requirement needs to be pursued, if appropriate, or the design must be changed to meet the requirement.

Requirements preceded by "**[HOLD]**" may only be used in support of preliminary or committed design, which shall also be issued with appropriate holds per 24590-WTP-3DP-G04B-00046, *Engineering Drawings* procedure. They may not be used in support of fabrication or construction.

The following abbreviations are used to designate the selected method for verification (see 24590-WTP-3DP-G04B-00092, *System Verification*, for additional guidance concerning methods of verification):

(A)	Analysis
(R)	Review
(T)	Test

The following abbreviations are used to designate the organization responsible for performing the verification:

(COM)	Commissioning
(ENG)	Engineering
(IQRPE)	Independent Qualified Professional Engineer
(SU)	Startup
(SUP)	Supplier

3.2 Bases

Basis discussions are provided as needed to explain the decomposition or interpretation from the originating source requirement(s) or to provide additional clarifications. Where a **[HOLD]** has been applied to a requirement, this section will include the basis for the **[HOLD]**. Basis discussions contain no requirements.

With minor exceptions, this document is dedicated to the requirements associated with the facility structure and its interfaces with systems and not the functional or design requirements for individual systems, which are left for other documents to define.

No attempt is made to identify all component level requirements that are more appropriately left to design agency efforts (e.g., the dimensions of individual structural members, the application of codes and standards to individual sections of gypsum board wall design, the routings of internal systems and the design or performance requirements of individual penetrations, supports, hangers, embeds, etc.).

3.3 References

The requirements include a source document reference. Each unique source document reference is bracketed separately. Requirements may include a reference to Section 2.1, *System Functions/Safety Functions*, listed in parentheses following the source document. A complete listing of all source references is provided in Section 5.1.

3.4 Facility General Requirements

3.4.1 Facility Site Design Parameters

3.4.1.1 Deleted

3.4.1.2 Deleted

3.4.1.3 Deleted

3.4.1.4 Deleted

3.4.1.5 Structural Design Parameters

Requirement: The Lab facility structural design parameters are as follows:

- The design parameters for soil shall be as recommended in the WTSC99-1036-42-17, *RPP-WTP Geotechnical Investigation* report.
- Depth of frost penetration below grade shall be as stated in the WTSC99-1036-42-17, *RPP-WTP Geotechnical Investigation* report.
- Earthquake design parameters shall be in accordance with the 24590-WTP-DC-ST-04-001, *Seismic Analysis and Design Criteria*.
- Internal temperatures at various locations inside the WTP structures during normal operating conditions and accident conditions shall comply with BOD, Section 12, Ventilation Basis of Design.

[Section 10.2.6, BOD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify the structural design parameters.	

3.4.2 WTP Production Support

Requirement: The Lab facility design shall accommodate a minimum integrated facility availability, and the individual facility availabilities shall be equal to or greater than 70 percent. [Section C.7 (b)(1), WTP Contract] (A.1.1)(A.1.2)(A.1.3)(A.1.4)(A.2.1)(A.2.2) (A.2.3)(A.2.4)

Basis Discussion: This is based on the contract PT capacity to produce 3740 MT waste sodium (LAW) and 1225 MT as-delivered solids (HLW) per year design capacity, and 2620 MT waste sodium (LAW) and 860 MT as-delivered solids (HLW) per year treatment capacity. The treatment capacity represents 70% of the design capacity. Per 24590-WTP-PL-PR-01-004, *Analytical Laboratory Design Requirements: WTP Sampling and Analysis Plan* the Lab processes in-house an estimated 4853 PT samples, 3855 HLW samples, 952 LAW samples, and 81 BOF samples per year. This does not include an estimated 1147 annual internal calibration tests, etc. These numbers represent an average (~75% of maximum output) for the Lab per the S&AP.

The Contractor is to estimate the integrated facility availability factor from the Operations Research Assessment as defined in Contract Standard 2 (b)(1) *Operations Research Assessment of the Waste Treatment and Immobilization Plant.* The determination of integrated facility availability for WTP facility design compliance shall be based on estimates of the total time to treat all tank wastes, with no reliability/availability/maintainability/Inspectability (RAMI) failures applied, divided by the total time to treat all tank wastes, with all RAMI failures applied.

The Contract requires 20-day commissioning runs for HLW and LAW facilities and four ultrafiltration cycles (two in each train) for PT. The Lab would be required to demonstrate adequate capability during each of the LAW, HLW, and PT commissioning runs. 20-day concurrent commissioning runs for Lab would require approximately 266 PT samples, 211 HLW samples, 52 LAW samples, and 4 BOF samples to be processed within required time and meet or exceed the Contract required minimum 70% availability.

Internal systems are designed to accommodate the analysis of specific waste types, using AHL and ARL analysis capabilities, to meet the design throughput requirements.

The Lab facility is designed to support WTP production of HLW glass and LAW glass, and sampling for PT, HLW, and LAW Facilities. The Lab is also designed to support process control, waste form qualification testing, environmental analyses, and limited technology testing.

The Lab is also designed to support sampling and analysis activities for the LAW and EMF facilities, as well as samples of waste feed received from LAWPS, while WTP is operating in the DFLAW configuration. Lab supports sampling activities as necessary to ensure LAW design and treatment capacities are met per contract requirements.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
A	**ENG**	Perform an analysis to verify the integrated Lab facility availability and the individual facility availabilities are equal to or greater than 70 percent.	
R	**ENG**	Review the facility design to verify conformance with Operations Research Model assumptions.	

3.4.3 Deleted

3.4.4 General Building Configuration and Architecture

3.4.4.1 Air Intakes

Requirement: The Lab facility air intake design location will be as follows:

- Air intakes shall be located so that they are protected from inclement weather (for instance, prevailing wind direction will be considered, to minimize wind pressure effects.
- Air intakes shall also be located so that emergency power equipment exhaust fumes cannot enter.
- Air intake design shall provide for appropriate stack height and location to prevent re-entry of exhaust air to the building supply.

[Section 16.1, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify acceptance and conformance to general facility requirements.	

3.4.4.2 Exhaust Filtration Equipment Location

Requirement: The Lab facility exhaust filtration equipment shall be located at or near individual enclosures to minimize long runs of ventilation ducting. [Section 20, ORD]

Basis Discussion: Placing filtration equipment near the final common point for exhaust streams, gloveboxes, fume hoods, etc. minimizes long runs of ducting where contamination could accumulate. Minimizing long runs of ductwork supports the efficient deactivation, closure, decontamination and decommissioning of the facility and system components upon mission completion.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the ventilation ductwork design to verify exhaust filtration equipment is located at or near individual enclosures.	

3.4.4.3 Exterior Building Materials and Color

Requirement: The Lab facility selection and placement of exterior building material types, treatments, colors, and roof slopes shall reflect a coordinated WTP site aesthetic that shall facilitate a visually unified project campus. The facility shall be a neutral color that will minimize the visual/aesthetic impact on the surrounding environment. [Section 10.3.4, BOD][Section 1.6, ICD-9]

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the exterior building material types, treatments, colors and roof slopes reflect the WTP site aesthetics.	

3.4.4.4 Building Materials

Requirement: The Lab facility building material products, salient features, sizes, and manufacturers (when necessary) shall be consistent throughout the WTP for ease of procurement and maintenance, and to reduce storage and handling requirements. [Section 10.3.4, BOD]

Basis Discussion: Of importance are building envelope materials, roofing systems, interior finish materials, doors and door hardware/keying, signage, conveying systems, and plumbing fixtures.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the building material products, salient features, sizes and manufacturers are consistent with the rest of the WTP.	

3.4.4.5 Material Durability

Requirement: The Lab facility shall be designed with durable materials for those interior and exterior areas subject to equipment movement and operations of potential impact. [Section 10.1, ORD][Section 10.3.4, BOD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that durable materials are used for those interior and exterior areas subject to equipment movement and operations of potential impact.	

3.4.4.6 Energy Conservation Measures

Requirement: The Lab facility shall be designed to meet the energy conservation requirements. Additional energy conservation measures shall include the following:

- Exterior windows in conditioned buildings shall meet shading coefficient requirements by means of tinted insulated glass.
- Exterior openings shall be weather-stripped to minimize air leakage.
- Personnel, equipment, and vehicular exterior access doors in conditioned buildings shall be insulated.
- Vestibules shall be provided at all building entrances, where possible, to maintain positive or negative air pressure.

[Section 10.3.4.8, BOD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the listed energy conservation requirements are met.	

3.5 Facility Requirements Related to Off-Normal / Emergency (Design Basis) Conditions and Configurations

3.5.1 Deleted

3.5.2 External Events

3.5.2.1 Deleted

3.5.2.2 Deleted

3.5.2.3 Deleted

3.5.2.4 Deleted

3.5.2.5 Ash Fall / Snowfall / Precipitation Events

Requirement: The Lab facility building envelope must be designed to withstand applicable design basis (PC-2) snow, ash, and rain natural phenomena hazard (NPH) forces for those portions of the Lab walls that must be designed to meet PC-2 winds. [Section 4.4.1.3, PDSA – Lab Facility][Sections 4.6, 4.10, BOD] (E.1)

Basis Discussion: For the WTP facilities, the design loads for PC-2 safety designated SSCs with NPH safety functions are 5.0 lbs./ft^2 for volcanic ash and 15.0 lbs./ft^2 for snow load (per ASCE 7-98). Rain load is considered when a roof has “ponding”, which occurs on a flat roof. The facility roof design is not considered a flat roof, because it is compliant with Building Code Criteria and exceeds the criteria for a flat roof (less than ¼” per foot of slope). Additionally, the roof system is designed to have a positive drainage system, as required by code. The Lab building envelope is considered SS solely to protect designated SS SSCs internal to the Lab facility from environmental conditions and events such that they are available to perform their designated safety functions when called upon. Design of the facility structure and roofing system is considered a passive design safety feature. The structure and roof system are designed for both static and live loads in accordance with ASCE 7-98, *Minimum Design Loads for Buildings and Other Structures*.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify analyses of the facility structure demonstrates conformance to PC-2 design loads for rain, snow and/or ash loading.	

3.5.2.6 Deleted

3.5.2.7 Deleted

3.5.2.8 Deleted

3.5.3 Internal Events

3.5.3.1 Deleted

3.5.3.2

3.5.3.2 Lab Facility Fire Barriers and Other Materials

Requirement: Facility fire protection design requirements include the following:

- Each designated fire control area shall be separated from other areas by 2-hour rated fire barriers in accordance with Fire Hazard Analysis requirements to prevent the propagation of fires between areas and limit the impact of fires.
- Other fire barriers shall be designed to provide a fire resistance rated enclosure based on the fire exposure and acceptance criteria specified in relevant codes.
- Door openings into 2-hour rated filter plenum housings shall be 1 1/2-hour minimum fire-rated.
- Door openings into 1-hour rated filter plenum housings shall be ¾-hour minimum rated.
- Design of mechanical and electrical penetrations of fire barriers shall be fire stopped by materials listed in accordance with relevant codes and standards or approved engineering evaluation and be of a fire rating not less than the barrier or enclosure.
- Fire dampers and doors shall be rated as required per relevant codes.
- Design of interior finish materials shall be Class A.
- Design of interior floor coverings shall be Class I.
- Design of Lab roofing system shall be Class II.
- Fireproofing of structural steel shall be provided in accordance with relevant codes and standards, where applicable.
- In areas containing equipment designated to perform safety functions following a design basis event, the piping for standpipe and hose valve stations located within the stairwells shall be analyzed for earthquake loads.
- Portable fire extinguishers shall be provided in accordance with relevant codes, selected for the appropriate class of hazards to be protected, and located in the following places:
- Laboratory rooms, operating galleries, and other C2/R2 areas
- Maintenance shops and other C3/R3 areas
- Accessible locations along routes of travel near door exits and corridors
- The hotcell structure shall mitigate the consequences of an airborne release to the public and/or co-located workers by providing a high-integrity confinement boundary evaluated for accident (seismic and fire) conditions.

[Sections 10.3.4.7, 13.3.5.1, 13.3.2, BOD][Sections 10.6.4, ORD][Sections 14.4, 14.4.1, 14.4.2, 14.4.3, SRD] (E.1)

Basis Discussion: The use of non-combustible materials is a passive safety design feature that mitigates the risk of fire and reduces fire loading in the event of a fire. The fire barriers are constructed to give a minimum 2-hr fire resistance mandated as part of the implementation of DOE O 420.1B. To complete the fire rated barriers, the openings (e.g., doors, dampers, etc.) are designed in accordance with their associated National Fire Protection Association (NFPA) code/standard, nationally recognized testing laboratory listing, and manufacturers' requirements. Fire doors are installed in accordance with NFPA 80, *Fire Doors and Fire Windows*. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify conformance with listed facility fire protection design requirements.	

3.5.3.3 Deleted

3.5.3.4 Deleted

3.5.3.5 Deleted

3.5.3.6 Deleted

3.5.3.7 Hazardous Gas Monitoring

Requirement: Atmospheric monitoring for gaseous hazards shall be provided for rooms or areas where there is a potential for the gas concentration to exceed the Permissible Exposure Limit (PEL), due to a single failure or miss-operation. [Sections 8.1.1, 8.1.4.3, ORD] (B.1)

Basis Discussion: Potential gaseous hazards within the Lab Facility include asphyxiates (oxygen displacing) gases such as refrigerants, nitrogen, helium, P-10, argon, etc. The lower value of the PEL, Threshold Limit Value (TLV), or Occupational Exposure Limit (OEL) may be required for code compliance.

Verification: Verification is expected to be achieved by the following:

Verif. Method	Verif. By	Plan	Notes/Comments
A	ENG	Perform analysis to identify rooms or areas with potential for gas concentrations to exceed the PEL.	
R	ENG	Review design to verify inclusion of appropriate monitoring equipment.	

3.5.3.8 Personnel Protection from Hazardous Gases

Requirement: The following hierarchy of requirement shall be applied to the Lab facility design:

- Facility design shall maintain the room breathing zone below the immediately dangerous to life and health (IDLH) concentration during expected component failures and abnormal maintenance and operation activities, such as instrument tubing break or miss-operation of vent valves.
- If the facility design cannot prevent reaching IDLH concentrations, the time from the event to reaching IDLH concentration in the room shall be greater than 30 minutes.
- Where the system design cannot provide 30 minutes for identification and evacuation, the affected room shall be considered inaccessible to personnel while the hazard is present in the system piping.
- Maintenance requirements and plant availability shall be evaluated to ensure contract requirements are met by the design with this limitation on access.
- Systems with gaseous hazards shall be designed to eliminate the hazard by isolation, vent, purge, or decay prior to entry.

- Rooms containing these systems shall include design access controls (e.g., locks).

[Section 8.1.4.4, ORD] (B.1)

Basis Discussion: Short Term Exposure Limit (STEL), or ceiling value, is preferred in lieu of IDLH thresholds. With regards to 30-minute identification criteria, the design and operating philosophy should be such that personnel evacuation is achievable before dangerous threshold limits are breeched.

Verification: Verification is expected to be achieved by the following:

Verif. Method	Verif. By	Plan	Notes/Comments
A	**ENG**	Perform analysis to determine if requirements can be met with any imposed access restrictions and that personnel will have time to evacuate in IDLH events.	
R	**ENG**	Review design to verify conformance to the requirement.	

3.5.3.9 Radiation Shielding in Hotcell and R5 Areas

Requirement: The R5 areas and Lab facility hotcell structure and related shielding components (such as shield doors and windows) must reduce radiation exposure of facility workers within acceptable limits. [Sections 4.4.1.3, PDSA – Lab Facility] (E.3)

Basis Discussion: 30 inches of concrete shielding is more than adequate to provide shielding. Joggled paths are another technique (for through-wall penetrations) to aid in shielding. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify that hotcell structure and related components and other R5 areas provide adequate shielding.	

3.5.3.10 Gaseous Hazard Separation

Requirement: The Lab facility systems with gaseous hazards shall be designed to separate the hazard from facility personnel via the following:

- Systems with gaseous hazards shall be located outside to the extent practicable.
- Piping and tubing systems containing gaseous hazards within facility buildings shall use welded joints to the extent practicable to eliminate leak points.
- Potential leak points shall be contained within ventilated enclosures where feasible and appropriate to prevent worker exposure to leaks.
- If potential leak points are not enclosed, evaluation of design leakage from system components and piping against designed ventilation flow through the affected room must demonstrate atmospheric concentrations remain below applicable limits during normal system operation.

[Section 8.1.4.2, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved by the following:

Verif. Method	Verif. By	Plan	Notes/Comments
A	ENG	Perform analysis to identify rooms or areas with potential for gas concentrations that would pose a hazard to personnel.	Active ORD Exceptions: 24590-WTP-ORDX-MS-14-0001
R	ENG	Review design to verify inclusion of appropriate monitoring equipment.	

3.5.4 Deleted

3.6 Facility Nuclear Safety, ALARA, Environmental, WAI, and Other Regulatory Requirements

3.6.1 Nuclear Safety

3.6.1.1 Deleted

3.6.1.2 Lab Seismic Design

Requirement: The Lab facility equipment, including post-accident monitoring (PAM), shall be designed and qualified for seismic conditions in accordance with Table 3-1 below. [Section 4.4.1.3, 4.4.2.3, 4.4.3.3, 4.4.4.3, PDSA-Lab Facility][Sections 4.1-3, SRD][Sections 10.2.8.1, 10.2.8.2, 10.2.8.3, BOD]

Table 3–1 Lab Seismic Design Categories

Description	Seismic Category	Reference
Lab Facility Structure • The Lab building envelope (including metal roof decking, siding panels, associated siding support system, and specific external doors). • Lab structural steel and concrete. • The Lab exterior walls that protect the safety SSCs.	SC-III	Section 4.4.1 PDSA - Lab Facility
Lab hotcell confinement • Concrete walls, floors, and ceiling • Through wall devices (including shield windows, shield doors, service embeds, gloveboxes, hotcell monorail airlocks, and trolley containment troughs) • Waste drum transport port system	SC-III	Section 4.4.1.3 and 4.4.2.3, PDSA - Lab Facility
C5 effluent vessel cell confinement and the hotcell drain collection tanks pump and valve pits	SC-III	Section 4.4.2.3 PDSA - Lab Facility

Basis Discussion: Section 2.4.12, 24590-WTP-PSAR-ESH-01-002-01, *Preliminary Documented Safety Analysis to Support Construction Authorization; General Information* states: "All components and parts of the equipment that provide or contribute to the safety functions and accident monitoring functions, including equipment supports and anchorage, shall be qualified accordingly." This qualification ensures SSCs meet the designated seismic design requirements. The SRD (24590-WTP-SRD-ESH-01-001-02) Safety Criterion 4.1-3 details the equivalence of the WTP seismic category (SC) to the seismic performance category of DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*. The SRD also states that SSCs designated as safety SSCs be designed to withstand the effects of NPH events (e.g., earthquakes, wind, and floods) without loss of capability to perform specified safety functions.

The seismic category portion of the through wall equipment is for the body to not fail and the component to remain inside the penetration. These attributes ensure the penetration allows minimal leakage through the C5V boundary.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
A	**ENG/ SUP**	Perform an analysis on equipment listed in the requirement to verify capability to withstand seismic event.	This is expected to be documented in the equipment qualification packages.
R	**ENG**	Review of design to verify conformance to the results of the analysis.	May be accomplished by environmental qualification package (EQP) or separate assessment.

3.6.1.3 Lab Safety Classifications

Requirement: Lab facility SSCs shall be designated as SS as shown in Table 3–2. [Safety Criteria 4.1-2, 4.1-3, 4.4-1, SRD]

Table 3–2 Lab Safety Classifications

Equipment / Component Description	Credited Safety Function	Classifi-cation	References
Lab Structure and Building Envelope Section 4.4.1	The facility structure including basemat must provide structural support to Safety SSCs during normal, abnormal, or accident conditions, including all NPH events. The Lab building (exterior walls) envelope must be designed to withstand applicable design basis (PC-2) snow, ash, and rain NPH forces; those portions of the Lab walls that must be designed to meet PC-2 winds The hotcell structure, in conjunction with related shielding components (such as shield doors and windows), must reduce radiation exposures of facility workers within acceptable limits.	SS	Sections 4.4.1.3, PDSA – LAB Facility[Section 10.3.4.10, BOD]

Equipment / Component Description	Credited Safety Function	Classifi-cation	References
Hotcell Confinement Section 4.4.2	During abnormal conditions, including NPH seismic events, the concrete walls, floors, and ceiling of the hotcells, the hotcell through-wall devices (including shield windows, shield doors, service embeds, gloveboxes, hotcell monorail airlocks, and trolley containment troughs), and the waste drum transfer port system must provide confinement of radioactive materials. The sample analysis gloveboxes must provide confinement of radioactive material.	SS	Sections 4.4.2.3, PDSA – LAB Facility
C5 Effluent Cell Confinement Section 4.4.2	The C5 effluent vessel cell and the hotcell drain collection tank pump and valve pits must ensure materials remain confined to the C5 effluent vessel cell confinement boundary and the hotcell confinement boundary.	SS	Sections 4.4.2.3, Table 4A-1, PDSA – LAB Facility

Basis Discussion: All SSCs for the Lab facility are credited SS for confinement, as noted in the table. For more information on instruments, controls, and safety interlocks, see section 3.8.3. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify correct safety designations and safety functions have been incorporated into the design.	Document in EQPs.

3.6.2 ALARA

3.6.2.1 Off-Site Dose

Requirement: The Lab facility design shall support the overall WTP design requirement to ensure that exposure to the maximally exposed off-site individual (non-acute) is ALARA but not more than 1.5 mRem per year and hazardous organic emissions are as low as reasonably achievable but not more than 0.375 tons per year from components regulated under 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart AA, "Air Emission Standards for Process Vents. [Section C.7 (a)(13), WTP Contract][Section 8.1.3.1.1, ORD] (E.3)

Basis Discussion: The limits are for the WTP taken in conjunction with the other facilities. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
A	ENG	Perform an analysis, based on process model and facility design, to verify it is ALARA is met for both radiological and hazardous organic emissions requirements.	

3.6.2.2 In-Cell Decontamination Capabilities

Requirement: Lab facility design shall include provisions for decontamination of hotcells, vessels, gloveboxes, and pits to reduce contamination levels and personnel exposure. The following provisions support this requirement**:**

- In-cell/pit/glove box wash down capabilities, including spray rings and water jets in inaccessible areas, shall be provided in the areas listed above to aid decontamination and deactivation of the stainless steel lined areas and floors with special protective coatings.
- In-cave/cell equipment and components shall be designed to minimize the potential for radioactive contamination and include features to facilitate appropriate decontamination techniques.
- Sumps shall be installed at a low point in the cave/cell areas noted above (i.e., those areas that have a decontamination/wash-down capability) with an accessible emptying system in place.
- The sumps shall have a means of emptying.
- Special protective coatings/sealants (to allow wet decontamination of surfaces with water, dilute nitric, and/or dilute caustic solutions without damaging the coated surface) shall be applied in C3 and C3/C5 areas to the selected surfaces listed below and where required by environmental permits:
  - Vertical Surfaces:
    - Structural steel and walls within 7.5 feet measured in vertical height above floors or platforms
    - Surfaces within 40 inches from a work area
    - Decontamination process splash zones
    - Aggressive chemical fume zones
  - Horizontal Surfaces:
    - Floors
    - Stairs
    - Work platforms
    - Platform support steel
  - Except for:
    - Stairs and work platforms made of steel grating
    - Stainless steel floors

[Section 11.4.1, BOD][Sections 13.4, 20.0, ORD] (C.1)(E.3)

Basis Discussion: This design requirement is based on ALARA design principles. Decontamination capabilities are appropriate for areas anticipated to have significant contamination, especially areas requiring worker access. Decontamination of inaccessible areas may be appropriate to lower radiological dose levels and to support decommissioning.

The designated cell/pit/glove box decontamination areas shall include:

- A-0142 to A-0155 C5 Hotcells (HC1 to HC14)
- A-B002 C3 Pump Pit (RLD-PMP-0182A/B)
- A-B003 C3 Effluent Vessel Cell (RLD-VSL-00164, RLD-LDB-00005/00006/00007/00008/00011)
- A-B004 C5 Effluent Vessel Cell (RLD-VSL-00165, RLD-LDB-00002/00004/00009)
- A-B005 C5 Hotcell Drain Collection Pump pit (RLD-PMP-00183B)
- A-B006 C5 Piping pit
- A-B007 C5 Hotcell Drain Collection Pump pit (RLD-PMP-00183A)
- A-0141B C3 Lab Maintenance Glove box (LAB-60-MHAN-00003)

[ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review of design to verify designated areas have installed wash down capability and sumps or drains with emptying capability	

3.6.2.3 Minimize Potential for Contamination Accumulation

Requirement: The design shall minimize "dead" spaces in the plant layout where contamination could build up and be difficult to remove (i.e., spaces that could become contaminated, but that have no flush or decontamination capability). [Section 20.0, ORD] (E.3)

Basis Discussion: A substantial and important element of the design process is the incorporation of features to minimize the cost and complexity of deactivation, closure, and decommissioning. Consideration of design features in support of this requirement is accomplished through the ALARA Design Review (ADR) process, which establishes requirements specific to individual SSCs. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify facility conforms to requirement to minimize areas in which radiological contamination could accumulate, including verification that any specific ADR requirements have been met.	

3.6.2.4 Stainless Steel Liners

Requirement: Contact – maintained cell building layouts shall include stainless steel liners and washdown/decontamination capabilities (stainless steel versus epoxy for maintenance cell shall be evaluated case by case). The design shall ensure stainless steel liners are used where appropriate. It is acceptable for stainless liners to extend up the walls only to the regulatory required height. The walls above the steel shall be sealed with suitable finishes depending upon the conditions. [Sections 14.9, 20.0 ORD] (E.3)

Basis Discussion: It is acceptable for stainless liners to extend up the walls only to the required height. The walls above the steel may be sealed with suitable finishes depending upon the conditions and as established by ALARA Design Review for the special protective coatings. Stainless steel wall and floor liner installations are detailed on 24590-LAB-A5-A19T-05200001/05200002, *Analytical Laboratory Architectural Room Finish Schedule*. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify facility conforms to requirement to provide stainless steel liners in locations identified in the requirement.	

3.6.2.5 Building Layout for Removal & Replacement Capabilities

Requirement: The Lab facility remotely maintained cell building layouts shall include the following

- Disposal routes and shielding methods for packaging and shipping of failed contaminated equipment.
- Remote recovery of failed equipment to enable repair to be undertaken in the worst-case credible failure mode. Consideration shall be given to designing equipment to fail safe to allow recovery operations to be taken.
- Laydown space for temporary storage of failed equipment.
- Where there is potential for equipment failure within a high radiation area (not black cells), means shall be provided for recovery of that equipment. Recovery shall be accomplished by using either routine remote maintenance or, where permissible, manned intervention. Manned intervention will not be an acceptable means for routine maintenance, but the capability shall be designed into the facility for off-normal recovery operations, such as strategically located plugs in cave or cell walls, roofs with special lifting and handling equipment, specially designed systems, a means of isolation in the cell or cave, and equipment connections.
- Packaging and shipping areas adjacent to contact handled maintenance cells.
- Temporary shields, when used during change-out of shielding windows, shall limit dose rates to ALARA. There shall be space for transfer of failed shielding windows for disposal as well as space for storage of shields.

[Sections 8.1.3, 9.1, 14.8, ORD][Sections 11.3.2, 11.4.1, BOD] (E.3)

Basis Discussion: This requirement is for remote maintenance, so as not to expose workers to radiation or contamination. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify that the Lab facility remotely maintained cell building design encompasses the requirements for removal and replacement capabilities.	

3.6.2.6 Deleted, Combined with 3.6.2.5

3.6.2.7 Equipment and Instrumentation Location

Requirement: The Lab facility instrumentation shall be designed to include the following:

- Equipment and instruments requiring personnel access for periodic calibration or maintenance shall be located in areas where personnel exposures are ALARA.
- In general, instrumentation is located outside of R5/C5 areas. However, for instrumentation required on contaminated process, it is preferable to locate that instrumentation on remotely maintainable jumpers.
- For instrumentation required to be located in-cell, instrumentation shall be located on remotely removable and maintainable jumpers, or in areas where the dose rate can be readily reduced to acceptable radiation levels, unless exempted by OPS.
- Whenever possible, instruments and detectors that require maintenance are located outside the C3 contamination areas. However, transducer panels housing liquid level systems and associated remote I/O, and pressure transducers, will be located in C3 classified areas as a precaution against back-contamination.
- In-plant controls shall be easily accessible (radiological zone) and shall not require double staffing (for example, locate control equipment close to readouts that monitor change of state).
- Warning and alarm systems designed to ensure that they can be heard at the local noise levels of the area they are intended to cover. Flashing lights should be used in high noise areas.
- Instrumentation designed so that it can be tested and calibrated from outside of remotely installed locations such as the hot cells and bulges.
- Indicators positioned to give a clear line-of-sight and safe accessibility.
- Temperature elements installed in thermowells to allow removal without interrupting the process.
- Where flow interruption is not acceptable, flowmeters shall be provided with bypass piping.
- Instruments and any of their sensing line valving shall be positioned to allow access from the floor or permanent platform. All instrument valves shall be uniquely identified.
- Adequate headroom provided above valves and in-line instrumentation to facilitate removal.
- When thermal insulation is required around valves and in-line instruments it shall be sectionalized to allow easy removal and replacement.
- Valves and instruments protected from adverse environmental conditions such as excessive heat, corrosion, vibration, and mechanical damage.
- Where termination is made to a measuring element that has to be withdrawn, sufficient cable length will be provided so that the element can be withdrawn without disconnecting.

[Sections 9.1, 11.16, ORD] (E.3)

Basis Discussion: Instrumentation located within high radiation hotcell (typically limited to analytical equipment), C5/R5 pits, and vaults is run to failure. Means are provided for removal and replacement of that instrumentation. Recovery is accomplished by using remote maintenance capability, when applicable. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify that all Lab facility equipment and instrumentation meet the locations requirements.	

3.6.2.8 Provide for Rapid Evacuation Under Emergency Conditions

Requirement: No physical control(s) shall be installed at any radiological area exit that would prevent rapid evacuation of personnel under emergency conditions. [Section 8.1.3, ORD] (E.3)

Basis Discussion: Immediate threats to life or health due to an emergency outweigh concerns of potential inadvertent spread of contamination from evacuating personnel. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify no physical control(s) are installed at any security, radiological, or other area exit that would prevent rapid evacuation of personnel under emergency conditions.	

3.6.2.9 Wall Penetrations

Requirement: Penetrations and associated electrical/instrument cabling passing through walls from non-contaminated (out-cell) areas into contaminated (in-cell) areas shall meet the following design criteria:

- Cables shall be designed to drain moisture away from the out-cell penetration.
- Conduits connected to the in-cell side of offset tubes, or passing through other approved penetrations, shall be designed to drain moisture away from the penetration.
- Penetrations shall be sealed only at the out-cell opening to provide containment while facilitating cable removal / replacement.
- Shall include offset or other approved penetration designs.

[Section 14.8, ORD] (E.2)(E.3)

Basis Discussion: Designing cables to drain moisture away from out-cell penetrations is accomplished by ensuring that a permanent drip loop, with its low point below the height of the out-cell penetration, is provided on the in-cell side of the penetration and ensuring that in-cell cable termination points are lower than the out-cell height of the penetration. Designing conduits to drain moisture away from penetrations is accomplished by installing an approved drain fitting at a low point below the height of the out-cell penetration, just prior to exiting the in-cell area. These operational requirements implement ALARA design principles. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify out-cell to in-cell electrical cabling transitions stated requirements are met.	

3.6.2.10 Space for Radiological Monitoring Equipment at Zone Boundaries

Requirement: The Lab facility design shall accommodate the following requirements that apply to radiological monitoring equipment at zone boundaries:

- Personnel contamination monitors (PCM)s shall be installed at C2/C3 subchange areas and at the main C2/C1 access control point within the WTP, as identified on the plant layout drawings. These monitors are powered from the normal electrical supply. The monitors may require a carrier gas supply, depending on device and type selection.
- Frisk monitors shall be provided as required at C2/C3 subchange areas and at the main C2/C1 access control point as a backup to PCMs. The equipment is powered from the normal electrical supply.
- C3 and C3/C5 rooms shall have dedicated receptacles for CAMs. The circuits shall be sufficiently sized to operate one CAM in each C3 and C3/C5 room simultaneously.
- Adequate space shall be provided so that personnel access and egress are not hindered when temporary CAMs are in use.
- Adequate space shall be provided to allow positioning and accessing of monitors and associated equipment without obstructing passageways, doorways, and work areas.
- Space shall be provided at each personnel survey station for step-off pads, survey instrument storage, and four laundry bags.

[Sections 9.4.13.1, 9.4.13.2, BOD][Sections 12.6.1.2, 12.7, 12.7.1, ORD] (E.3)(F.1)(F.2)

Basis Discussion: PCMs and hand friskers are installed at personnel access airlock areas and at the main C1/C2 access control point within the Lab, as identified on the plant layout drawings. The monitors may require carrier gas supply, depending on device and type selection. Carrier gas, if required, may be supplied locally (bottle) or remotely via supply line. The equipment is powered from the normal electrical supply (wall outlets) or by internal batteries. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify radiological monitoring equipment requirements are met.	

3.6.2.11 Decontamination

Requirement: Lab facility equipment subject to decontamination shall be designed to withstand this process without any reduction of functionality through degradation of the electrical, mechanical, or any other components involved. [Section 9.1, ORD][Section 11.4.1, BOD]

Basis Discussion: Equipment operating in a contaminated environment is monitored and, if necessary, decontaminated before maintenance. The specifications must convey that the equipment design accounts for these processes. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify equipment that is subject to decontamination is designed to withstand the process without degradation or reduction in equipment functionality.	.

3.6.2.12 Remotely Maintained Cells (Hotcells)

Requirement: Remotely maintained cell building layouts (not including black cells) shall include the following:

- The optimization of equipment location to avoid dismantling for access (minimize stacking of jumpers and equipment).
- The design shall determine the number and placement of spare electrical and process connections installed in-cell.
- Viewing capabilities, either camera or window, from out-cell for surveillance of activities. Window and/or cameras shall be used for cell maintenance areas.
- Selection of materials of construction compatible with the in-cell chemical, radiological, and thermal environment to minimize maintenance requirements and dangerous waste generation.
- In-cave/cell decontamination techniques shall be incorporated to minimized the spread or buildup of radioactive contamination.

[Section 14.8, ORD]

Basis Discussion: None. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify inclusion of remotely maintained cells (Hotcell) design provisions are included in the design.	

3.6.2.13 Glove Boxes

Requirement: Glove boxes shall be designed as follows:

- Access to plant equipment shall be maximized.
- Assessment of normal, abnormal, and maintenance conditions shall be required in the design of the glove box.
- The accessibility of all maintainable items shall be demonstrated through mock up, simulation, or start-up.
- Glove port positioning shall consider typical operator size and strength within the limiting environment of a glove box.
- There shall be no sharp edges or the potential to generate sharp edges within a glove box or wash cabinet.
- The use of braided metal hosing, glass, or plastic (that is likely to degrade) shall be avoided unless suitable justification is provided.

- Equipment within glove boxes shall be minimized and the use of common supplies maximized.
- Gloveboxes shall be held at negative pressure relative to their room location. A differential pressure indicator should be mounted to the gloveboxes.
- To prevent the potential for siphoning of hot liquid into the secondary containment, the glove box shall be located at least one barometric head above the primary vessel.
- Wherever practical, glove boxes shall be designed to contain the minimum volume of active liquid bearing piping.
- The impact of temperature, shielding, and environment (acid vapor and corrosion) shall be considered in the design, in terms of corrosion of mild steel, degradation of gloves, and accessibility to equipment.
- Dismantling of plant and equipment contained within glove boxes shall be simple and easy. Direct handling shall be minimized through modularization or lifting equipment.
- All valves and instruments within a glove box shall be labeled clearly.
- Suitable design precautions shall be taken to prevent the migration of contaminates into the secondary containment via the process line (for example, seal pots/loops, vacuum breakers, or air purges).

[Section 14.15, ORD]

Basis Discussion: None. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review Lab glove box design to verify the stated requirements are adequately satisfied.	

3.6.3 Environmental Protection

3.6.3.1 Deleted

3.6.3.2 General Requirement for Foundation and Structural Integrity

Requirement: For design and installation of new tank systems or components, design considerations shall ensure that:

- Tank foundations maintain the load of a full tank.
- Tank systems withstand the effects of frost heave. (WAC 173-303-640(3)(a)(v)(A))

[Section III.10.E.9.b.i, DWP][Section 14.10.1, BOD] (E.1)

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review of design to verify the facility supports the load of filled DWP tanks/vessels along with ancillary equipment and withstands frost heave.	

3.6.3.3 Deleted

3.6.3.4 Facility Design Requirements for Dangerous Waste Tanks

3.6.3.4.1 Deleted

3.6.3.4.2 Deleted

3.6.3.4.3 Support and Protect Ancillary Equipment

Requirement: The Lab facility shall be designed such that ancillary equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction. (WAC 173-303-640(3)(f)) [Section III.10.E.9.b.i, DWP][Section 14.10.1, BOD]

Basis Discussion: This requirement applies to the Lab dangerous waste tanks in vessel cells or vaults that provide structural support for dangerous waste tanks or vessels (RLD).

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	IQRPE	Review the design to verify that ancillary equipment has been designed so it is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.	

3.6.3.4.4 Deleted

3.6.3.4.5 Deleted

3.6.3.4.6 Tank System Inspection Requirements

Requirement: The Lab facility tank systems containing dangerous (hazardous) wastes shall be inspected on a regular basis to identify leaks and faulty equipment. In terms of the inspection requirements, the design shall provide means to perform these inspections. Non-accessible cells and caves shall be provided with CCTV inspection ports to allow for remote inspection of mechanical and process facilities and piping. [Section 14.10.1.5, BOD][Section 14.13, ORD]

Basis Discussion: This requirement is implemented through design to facilitate access for required inspections.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify leak detection system data collection capabilities and the ability to inspect for corrosion.	

3.6.3.5 Secondary Containment System Design Requirements

3.6.3.5.1 Secondary Containment Liner Design

Requirement: Liners, vaults, double-walled tanks or equivalent devices, as approved by Ecology, shall be used as secondary containment for tank systems. (WAC 173-303-640(4)(d)(i), (ii), (iii), and (iv)) [Sections 14.10, 14.10.1.2, BOD] (E.2)

Basis Discussion: This requirement applies to the secondary containment provided by the Lab facility. Tank systems, including sumps that serve as part of a secondary containment system, are exempted from the requirements for secondary containment. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review the design to verify that liners, vaults, double-walled tanks or equivalent devices, approved by Ecology, are used as secondary containment for tank systems.	

3.6.3.5.1.1 Migration of Liquids

Requirement: Facility secondary containment shall prevent any migration of wastes or accumulated liquid out of the facility to the soil, ground water, or surface water at any time during the use of the facility. (WAC 173-303-640(4)(b)(i)) [Sections 14.10, 14.10.1.2, 14.10.1.3, BOD]

Basis Discussion: This requirement applies to the secondary containment provided by the Lab facility.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review the design to verify that all leaks or accumulated liquids are prevented from migrating to the soil, ground water, or surface water.	

3.6.3.5.1.2 Detect Releases

Requirement: The containment system liners shall detect and collect releases and accumulated liquids until the collected material is removed. (WAC 173-303-640(4)(b)(ii)) [Sections 14.10.1.2, 14.10.1.3, BOD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review secondary containment design to verify conformance with WAC 173-303-640(4)(b)(ii)	

3.6.3.5.1.3 Construction Materials

Requirement: The containment system shall be constructed of material that is compatible with the waste to be placed in the containment system. (WAC 173-303-640(4)(c)(i)) [Sections 14.10, 14.10.1.2, 14.10.1.3, BOD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review secondary containment design to verify conformance with WAC 173-303-640(4)(c)(i)	

3.6.3.5.1.4 Strength of Containment

Requirement: The containment system shall be designed to prevent failure owing to: (WAC 173-303-640(4)(c)(i))

- Pressure gradients, including static head and external hydrological forces
- Physical contact with the waste
- Climatic conditions
- The stress of daily operation, including stresses from nearby vehicle traffic

[Section 14.10.1.2, BOD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review secondary containment design to verify conformance with WAC 173-303-640(4)(c)(i).	

3.6.3.5.1.5 Foundation or Base

Requirement: The containment system shall be placed on a foundation or base capable of: (WAC 173-303-640(4)(c)(ii))

- Supporting the secondary containment system
- Resisting the pressure gradients above and below the system
- Preventing failure due to settlement, compression, or uplift

[Sections 14.10.1.2, 14.10.1.3, BOD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. By supporting the structural integrity secondary containment system, this helps minimize exposure to radiation. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review secondary containment design to verify conformance with WAC 173-303-640(4)(c)(ii).	

3.6.3.5.1.6 Drainage

Requirement: The containment system shall be sloped to drain and remove liquids resulting from leaks, spills, or precipitation within 24 hours of a leak detection (WAC 173-303-640(4)(c)(iv)). The design shall provide a minimum of 1% floor slope. [Sections 14.10.1.2, 14.10.1.3, BOD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review secondary containment design to verify conformance with WAC 173-303-640(4)(c)(iv).	

3.6.3.5.1.7 Liquids Removal

Requirement: The containment system design shall facilitate the removal of spills, leaks, or accumulated liquid from the secondary containment system within 24 hours or in as timely a manner as possible. (WAC 173-303-640(4)(c)(iv)) [Sections 14.10.1.2, 14.10.1.3, BOD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. Liquid detection and removal equipment is part of the RLD System. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**IQRPE**	Review secondary containment design to verify conformance with WAC 173-303-640(4)(c)(iv).	

3.6.3.5.1.8 Means of Inspection

Requirement: The containment system shall provide means to inspect the visible portion of the secondary containment system daily. (WAC 173-303-640(6)(b)(iii)) [Sections 14.10.1.2, 14.10.1.3, BOD][Section 14.13, ORD]

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review secondary containment design to verify conformance with WAC 173-303-640(6)(b)(iii).	

3.6.3.5.1.9 Liner Capacity

Requirement: The secondary containment system shall have a liner designed to handle 100% capacity of the largest tank plus the volume of fire protection water applied over the minimum sprinkler design area for a period of 20 minutes. (WAC 173-303-640(4)(e)(ii)(A)) [Section 14.10.1.2.1, BOD]

Basis Discussion: This requirement applies to the secondary containment systems. Fire protection volume includes run-in from adjacent rooms.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
A	ENG	Perform an analysis to determine the liner size and design to handle capacities of the requirement.	
R	ENG	Review the design to verify the liner design can accommodate 100% capacity of the largest vessel plus 20 minutes of fire suppression water (if applicable).	

3.6.3.5.2 Leak Detection Capability

Requirement: The containment system shall provide a leak-detection system that detects the failure of primary tank system and ancillary equipment or the secondary containment system, the presence of any release of mixed or dangerous waste, or accumulated liquid in the secondary containment system within 24 hours of a leak. (WAC 173-303-640(4)(c)(iii)) [Sections 14.10.1.2, 14.10.1.3, BOD] (E.2)

Basis Discussion: This requirement is implemented through design in accordance with structural codes and standards as defined as incorporated in the BOD. *Note: Ecology has interpreted this requirement to mean the detection of 0.1 gallons per hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours based on dangerous waste permit condition III.10.E.9.e.ii.* Any exceptions to this criteria must be approved by Ecology in accordance with WAC 173-303-680, WAC 173-303-640(4)(c)(iii), and WAC 173-303-806(4)(it)(i)(b). Dangerous waste pipe penetrations that require a penetration seal per applicable codes, or meet ventilation sealing requirements identified in Table III.10.H.G of the DWP, are not required to meet the twenty-four (24) hours leak detection criteria for those sections of piping that are in contact with approved silicone or equivalent low-permeability seal material. Piping on either side of the penetration seal is designed to meet the requirements of Section III.10.H.5.e.ii of the DWP. Revisions (including additions or deletions) to Table III.10.H.G of the DWP will be submitted to Ecology for review and approval pursuant to Conditions III.10.C.2.e and III.10.C.2.f. Addition of penetration seal locations to Table III.10.H.G, DWP, will be approved by Ecology prior to installation of the penetration seal.

The DWP acknowledges use of a graded approach to ensure the integrity of secondary liquid containment in inaccessible (e.g., high radiation) areas in lieu of daily visual inspections. An evaluation/assessment of required minimum leakage rates to ensure detection within 24 hours has been performed in 24590-LAB-PER-M-04-0001, *Lab Minimum Leak Rate Detection Capabilities for Leak Detection Boxes, Cell Sumps, and Pit Sumps.* [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify the ability to detect leaks in secondary containment areas within 24 hrs. This may be by direct visual observation or through leak detection devices as approved in design and accepted into the DWP in conformance with WAC 173-303-640(4)(c)(iii).	

3.6.3.6 Design and Performance Standards for Vaults

3.6.3.6.1 Vault Capacity

Requirement: Vaults shall contain 100% of the capacity of the largest tank. (WAC 173-303-640(4)(e)(ii)(A)) [Section 14.10.1.2.2, BOD]

Basis Discussion: This requirement applies to secondary containment systems. Fire protection volume includes run-in from adjoining rooms. One hundred percent capacity means the total volume of the tank. It is not the expected process volume of the tank or the volume at the level where overflow prevention measures are implemented.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that each vault (cell) can contain 100% of the largest vessel's total volume plus the volume of fire protection water applied over the minimum sprinkler design area for a period of 20 minutes, if applicable.	

3.6.3.6.2 Run-on or Infiltration

Requirement: Vaults shall prevent run-on or infiltration into the containment system, unless the containment system has the capacity to contain precipitation from a 25-year, 24-hour rainfall event. (WAC 173-303-640(4)(e)(ii)(B)) [Section 14.10.1.2.2, BOD]

Basis Discussion: This requirement applies to the secondary containment systems.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that run-on or infiltration into the containment is prevented	

3.6.3.6.3 Water Stops

Requirement: Vaults shall be constructed with chemical-resistant water stops in place at all construction joints (if any). (WAC 173-303-640(4)(e)(ii)(C)) [Section 14.10.1.2.2, BOD]

Basis Discussion: This requirement applies to the secondary containment systems. However, water stops are not required in secondary containment areas provided with stainless steel liners. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify chemical-resistant water stops are in place at all secondary containment vault construction joints.	

3.6.3.6.4 Liners and Coatings

Requirement: Vaults shall be designed with an impermeable interior coating or lining that is compatible with the stored waste. Special protective coatings/sealants shall be applied to surfaces where required by environmental permits or regulations. (WAC 173-303-640(4)(e)(ii)(D)) [Section 14.10.1.2.2, BOD][Section 13.4, ORD]

Basis Discussion: This requirement applies to the secondary containment systems. Vault coatings and linings prevent the migration of waste into the concrete.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that impermeable interior coating or lining is provided in all secondary containment vaults.	

3.6.3.6.5 Ignition of Vapors

Requirement: Vaults shall be designed with a means to protect against the formation of ignitable vapors within the vault if the waste is being stored or treated. (WAC 173-303-640(4)(e)(ii)(E)) [Section 14.10.1.2.2, BOD]

Basis Discussion: This requirement applies to the secondary containment systems. Ignitable waste is defined under WAC 173-303-090(5). Reactive waste defined under WAC 173-303-090(7) may form an ignitable or explosive vapor.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that design protects against the formation of ignitable vapors within the secondary containment vault.	

3.6.3.6.6 Moisture Barrier

Requirement: Vaults shall be designed with an exterior moisture barrier or be otherwise designed to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure. (WAC 173-303-640(4)(e)(ii)(F)) [Section 14.10.1.2.2, BOD]

Basis Discussion: This requirement applies to the secondary containment systems.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that an exterior moisture barrier is provided if the vault is subject to hydraulic pressure.	

3.6.3.7 Secondary Containment for Ancillary Equipment

Requirement: Tank system ancillary equipment that manages dangerous waste shall have secondary containment (e.g. trench jacketing, double-walled piping). (WAC 173-303-640(4)(f)) [Section 14.10.1.3, BOD] (E.2)

Basis Discussion: Ancillary equipment means any device, such as but not limited to, piping, fittings, flanges, valves, and pumps used to distribute, meter, or control the flow of dangerous waste from its point of generation to a tank system, between dangerous waste storage tanks, or to a point of disposal or shipment offsite. All Lab facility RLD drain lines that are encased in concrete are coaxial pipe. Vessel vaults will also perform secondary containment function for non-encased pumps, valves, etc. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify that all tank system ancillary equipment that manages dangerous waste has secondary containment.	

3.6.3.7.1 Deleted, Combined with 3.6.3.5.1.1

3.6.3.7.2 Deleted, Combined with 3.6.3.5.1.2

3.6.3.7.3 Deleted, Combined with 3.6.3.5.1.3

3.6.3.7.4 Deleted, Combined with 3.6.3.5.1.4

3.6.3.7.5 Deleted, Combined with 3.6.5.1.5

3.6.3.7.6 Deleted, Combined with 3.6.3.5.2

3.6.3.7.7 Deleted, Combined with 3.6.3.5.1.6

3.6.3.7.8 Deleted, Combined with 3.6.3.5.1.7

3.6.3.7.9 Deleted, Combined with 3.6.3.5.1.8

3.6.3.8 Deleted

3.6.3.9 Moved to 3.6.3.9.8

3.6.3.9.1 Separation of Dangerous Waste Containers

Requirement: The Lab facility regulatory dangerous waste container storage areas shall be designed to allow a minimum 30 inches of separation between of dangerous waste containers. (WAC 173-303-630(5)(c)) [Section 14.11.1, BOD] (C.1)(D.1)

Basis Discussion: This requirement provides space to allow inspection. Immobilized glass storage areas are exempt from this separation requirement.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify that rows of dangerous waste containers are separated by at least 30 inches.	

3.6.3.9.2 Deleted

3.6.3.9.3 Inspectability of Dangerous Waste Storage Areas

Requirement: Storage areas shall be designed to allow inspections for: (WAC 173-303-630(6))

- Leaking containers
- Deterioration of containers caused by corrosion or other factors
- Deterioration of the containment system caused by corrosion or other factors

[Section 14.11.1, BOD] (C.1) (D.1)

Basis Discussion: This requirement supports the maintenance/replacement of equipment and components.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify that dangerous waste storage areas allow adequate access for container inspections.	May be documented in an evaluation/assessment.

3.6.3.9.4 Deleted

3.6.3.9.5 Deleted

3.6.3.9.6 Deleted

3.6.3.9.7 Deleted

3.6.3.9.8 Dangerous Waste Storage Areas

Requirement: Dangerous waste storage areas shall be provided in the waste accumulation areas for both satellite accumulation areas and less-than-90-day storage areas, and permitted container storage areas. [Section 18.0, ORD] (C.1)(D.1)

Basis Discussion: This requirement applies to dangerous waste container storage areas. The location and space for waste segregation, packaging and storage is specified on plant layout drawings. Allowable dangerous waste storage areas are designated in DWP Permit Table III.10.D.A.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify that dangerous waste container storage areas are in the design in accordance with the requirement.	

3.6.3.10 Design Requirements for Secondary Solid Waste

3.6.3.10.1 Segregate Solid Waste

Requirement: The Lab facility shall be designed with means for waste segregation as near the sources of the waste generation as practical. [Section 18.0, ORD] (D.1)(F.2)

Basis Discussion: This requirement is part of the waste management design strategy.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify that adequate space is provided for placement of multiple waste receptacles to accommodate waste segregation as near the source of the waste generation as practical.	

3.6.3.10.2 Solid Waste Control

Requirement: The Lab facility shall be designed with means for solid waste materials to be controlled and located so that an accidental release of the materials does not jeopardize the safe conditions in the WTP. [Section 18.0, ORD] (D.1)(F.2)

Basis Discussion: Storing chemicals separately that have the potential to react and limiting the quantities of chemicals during use are ways to apply this requirement. The use and storage of hazardous materials shall be minimized by limiting their quantities through design restrictions.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify that solid waste materials are controlled and located such that an accidental release does not jeopardize the safe conditions in the Lab.	

3.6.3.10.3 Facility Waste Management Design Strategy

Requirement: The Lab facility waste management design strategy shall incorporate the following requirements:

- Most radioactive waste shall be considered as mixed waste, and the methods, equipment, and facilities for packaging and shipment of that type of waste shall be provided in the design.
- The generation of secondary wastes shall be minimized, including radioactive solid wastes, dangerous wastes, and non-radioactive and non-dangerous liquid effluents.
- The design shall include appropriate disposal provisions for hydraulics fluids, oils, and refrigerants.
- Design shall provide a means for handling or disposal of laboratory glass samples waste.

[Section 18.0, ORD] (D.1)(F.2)

Basis Discussion: Storing separately chemicals that have the potential to react and limiting the quantities of chemicals during use are ways to apply this requirement. The use and storage of hazardous materials shall be minimized by limiting their quantities through design restrictions.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify that all requirements are met to support the management and disposal of all anticipated secondary wastes.	

3.6.4 Regulatory

See Section 3.6.3, *Environmental Protection*.

3.7 Facility Interface Requirements

3.7.1 Hanford Contractor Interfaces

3.7.1.1 Deleted

3.7.1.2 Deleted

3.7.1.3 Deleted

3.7.1.4 Interface with Effluent Management Facility

Requirement: While operating in the DFLAW configuration, the Lab shall have the capability to transfer radioactive liquid effluents to the EMF. [Sections 6, 6.1.4, BOD] (C.1)

Basis Discussion: While operating in the DFLAW configuration, secondary liquid wastes from the Lab RLD system (RLD-VSL-00164) are transferred to the evaporator feed vessel (DEP-VSL-00002) within the EMF for further processing. Isolating the transfer of radioactive liquid waste effluents from the Lab to the EMF-DEP system is within the scope of the Lab RLD system.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify that the Lab facility has the capability to transfer radioactive liquid effluents to EMF for further processing.	

3.7.1.5 LAWPS Samples

Requirement: While operating in the DFLAW configuration, the Lab shall have the capability to receive manual samples from tank operations contractor LAWPS in accordance with the requirements of the DFLAW DQO. [Section 6, BOD] (A.2.1)

Basis Discussion: Samples of the TLAW feed are provided from each LAWPS lag storage tank for analysis waste acceptance and process control.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify capability to receive and process manual samples from tank operations contractor LAWPS.	

3.7.2 WTP Facility Interfaces

3.7.2.1 Interfaces with Other Waste Treatment Plant Facilities

Interfaces with BOF, EMF, and WTP systems are shown on Figure 2-1.

3.8 Other Facility Technical, Specialty, Operations and Maintenance Requirements

3.8.1 Required Service Life

3.8.1.1 Facility 40-Year Design Life

Requirement: The Lab facility shall have a 40-year minimum design (operating) life. Selection of materials of construction for design life of the Lab shall consider the effects of chemical, radiological and thermal exposure. [Section C.7 (a)(1), WTP Contract][Sections 7.4.1.3, 10.3.4.3, 16.4.1.4, BOD]

Basis Discussion: This requirement covers the facility structure. Design life requirements for internal systems are not included. Note: Contract uses the term “operating life” and BOD uses the term “design life”. Both are defined as being 40 years in duration. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Perform design review to verify construction materials for the facility structure, and internal structure associated with confinement area boundaries, are specified or demonstrated for 40-year design life.	

3.8.1.2 Equipment Design (Operating) Life

Requirement: Non-replaceable, permanent Lab facility plant equipment shall be designed for a minimum design life of 40 years, inclusive of maintenance. All non-maintainable items of the Lab facility equipment shall be designed to last the life of the facility (40 years). Design life of equipment shall consider the effects of chemical, radiological, and thermal exposure. [Sections 11.1.1, 12.6.1, 16.4.1.4, BOD][Section 14.1, ORD]

Basis Discussion: Equipment and material selection is based on proven performance, value engineering principles, and fit-for-function principles. The selection of equipment and materials is further addressed in detail as the design progresses. Equipment design needs to consider the routine environmental exposures under normal operations for non-safety equipment; safety equipment also considers abnormal and emergency exposures. This minimizes the need for equipment maintenance. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify design life of non-replaceable, permanent equipment meets the 40 year design life.	

3.8.2 Specialty Requirements

3.8.2.1 Environmental Qualification

3.8.2.1.1 Environmental Design for Safety SSCs

Requirement: Lab facility civil, structural, and architectural design features with either credited safety functions or post-accident monitoring functions shall be designed to perform their safety function(s) as intended in the environmental conditions associated with the events for which they are intended to respond.

Safety structures, systems, and components designated as Safety Significant, and credited for preventing significant radiological release to the environment, shall be qualified to function as intended in the environments associated with the events for which they are intended to respond, inclusive of aging effects, throughout their qualified life.

[Safety Criteria 4.1-3, 4.4-1, SRD][Section 11.7.3, BOD] (E.1)

Basis Discussion: SSCs designated as SS are designed and qualified to perform their safety function(s). The effects of aging on normal and abnormal functioning are considered in design and qualification. The *Analytical Laboratory (LAB) Room Environment Data Sheet* (24590-LAB-U0D-W16T-00001) identifies environmental conditions for rooms that house safety SSCs. Per 24590-LAB-RPT-ENS-12-001, *Lab Post Accident Monitoring Report*, there is no PAM in the Lab facility. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
A/T	**ENG**	Perform analysis or testing to verify the ability of the SSCs credited with a safety function to withstand specified environmental conditions.	
R	**ENG**	Review the design to verify conformance to the as-tested or as-analyzed configuration.	

3.8.2.1.2 Environmental Qualification for Non-Safety SSCs

Requirement: The Lab facility equipment and components tagged non-safety shall be designed to operate and withstand the internal environment conditions of the Lab facility. [Table 12-1, BOD][Sections 11.16, 16.1, ORD]

Basis Discussion: Non-safety SSCs are designed to function as intended in the room environment conditions associated with their location. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design of non-safety SSCs to verify compliance with BOD Table 12-1 conditions.	

3.8.2.1.3 Environmental Design

Requirement: The Lab facility shall be designed to perform its required functions to meet the external temperature and humidity conditions established in Table 4-4, *Hanford Site Climatological Data*, of the BOD, and shall support internal temperature and humidity conditions specified in Table 12-1, *Internal Design Conditions*, of the BOD. [Table 12-1, BOD][Section 16.3, ORD]

Basis Discussion: While the Lab facility design should integrate with the ventilation system design (see 24590-LAB-3ZD-60-00002, *Analytical Laboratory Ventilation System Design Description*), the requirements stated in BOD Table 12-1 are applicable to design of the HVAC system. As needed, the facility structure and layout (e.g., penetrations for ductwork, balancing dampers, cooling water lines, etc.) need to accommodate the HVAC system design, i.e., structural and architectural detail design requirements should be utilized in the development of the HVAC system design. These are derived interface requirements that are beyond the scope of this document.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Verify facility construction materials selected are appropriate for design internal and external environmental conditions.	

3.8.2.2 Deleted

3.8.3 Monitoring, Controls & Communication

3.8.3.1 Standby Control Room

Requirement: The Lab facilities will be centrally controlled from the LAW facility control room (FCR), but also feature control stations at key locations for more localized control when needed for specific operations. For the DFLAW configuration, the standby control room (SCR) for the operating facilities shall be provided at the Lab facility. The SCR shall have the capability to shut down and/or monitor the LAW should the LAW FCR require evacuation. It shall have the following capabilities:

- Emergency shutdown initiation and indication
- Monitoring of safety instrumented systems
- Capacity for control and monitoring for plant processes and closed-circuit television (CCTV) monitoring
- Environmental surveillance, including radiological (functions to be determined)
- Public address communications
- Telephone communications, including Hanford Site Emergency Alerting Systems
- Radios communications (base station required)
- Computerized access to operations and maintenance documentation
- Access to plant information network

[Sections 11.1, 11.2 ORD] (G.1)(G.2)

Basis Discussion: None. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the requirements for Lab control and the standby control room meet the requirement.	

3.8.3.2 Deleted

3.8.3.3 Standardized Operator Controls

Requirement: Control units for the Lab facility cranes shall be standardized with similar mechanical handling control units facility-wide. [Section 14.16, ORD]

Basis Discussion: Standardized operator controls are provided as much as possible to avoid errors that might occur when moving from one crane to another. Differences to accommodate specialized crane operations are acceptable. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design and/or physical configuration to verify similar control units, including push-buttons on local control panels, pendants, and radio control units, are provided for similar cranes and hoists.	

3.8.3.4 Off-Board Logics

Requirement: Cranes and hoists that enter C5/R5 areas shall have no on-board logic, and all power and signal cables shall be marshalled off-board. [Section 14.16, ORD]

Basis Discussion: On-board logic is permissible in normally accessible areas (C1/R1 to C3/R3). [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design of cranes and hoist in C5/R5 areas to verify power and signals cables are marshalled off-board, and devices that execute control logic are located off-board.	

3.8.3.5 Deleted

3.8.4 Safeguards & Security

3.8.4.1 Access Control

Requirement: The Lab access control shall be by computer-based data verification. An employee identification badge, capable of interfacing with the access control system, shall be used to uniquely identify each employee and gain authorized admittance. Access control shall be provided at each facility entrance. Lab design shall facilitate emergency access and intervention by Hanford and/or local emergency services. [Section 8.11.2, BOD][Sections 13.2, ORD] (G.1)

Basis Discussion: Access control information may also be used to support personnel accountability in emergency scenarios. Emergency exits are expected to be available for post emergency re-entrance (i.e. after “All Clear” announcement). Rollup doors are not operable from outside the facility.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify access control system complies with security requirements.	May be documented in an evaluation/assessment.

3.8.4.2 Security System Integration with Voice Over Internet Protocol

Requirement: The Lab facility security systems shall be integrated into the voice over internet protocol (VOIP) system. [Section 8.11, BOD] (G.1)(H.1)

Basis Discussion: This is a necessary security system requirement.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify Lab security systems integration into VOIP system.	

3.8.5 Operations Requirements

3.8.5.1 Facility Handicap Access Exemption

The Lab facility is exempted from providing access for the physically handicapped, per section 10.3.4.9 of the BOD. Therefore, there is no verification required.

3.8.5.2 General Facility Requirements

Requirement: The Lab facility shall comply with the following general requirements if not specifically covered elsewhere in this document:

- Loading bays/docks shall be weather protected for safe receipt and shipment of supplies, waste, and equipment except as exempted by Plant Operations. Exemptions shall be approved by the respective Facility Operations Lead or Commissioning Operations Manager.
- Awning-type structures shall be provided at personnel exterior doors located below eaves for icicle protection, except as exempted by Plant Operations. Architectural features used in lieu of awnings shall be approved by the respective Facility Operations Lead or Commissioning Operations Manager.
- A floor drain system shall be provided in areas such as labs, galleries, and shops, to dispose of leakage, fire water, or wash-down liquids.
- Personnel movement between clean and regulated areas of the building shall be controlled to eliminate potential contamination of clean areas. Air locks shall be provided for personnel movement from C3 to C2 areas. This applies to normal access doors (not emergency exits).
- Conveniently located dumpster pads for waste dumpsters shall be provided.
- Doors shall be designed to meet Life Safety codes for the force required to open them during normal and adverse ventilation conditions. This ensures large, heavy doors or doors with differential pressure between zones can be opened and do not injure personnel.

- Vertical and horizontal surfaces in C3 and C3/C5 areas shall be decontaminated as required for ALARA operational or maintenance exposure.
- Storage pads shall be provided for low level waste drums awaiting pickup.
- Facility floors shall be designed to accommodate movement of loads to support operations (e.g., pallets with drums) and maintenance (e.g., motors, shield windows, MSMs).
- Areas for receiving truck shipments of chemicals shall be equipped with suitable drain systems (in accordance with *RCRA*) to collect spills, safety showers, and eye wash stations.
- Bollard posts at doorways with expected vehicle travel and in BOF yard near roadways to protect service piping and components (such as fire hydrants, pipe bridges).
- Personnel traffic flow patterns shall be developed, including maintenance activities, and movement of failed and new equipment, to determine the layout of interior corridors.
- Room and door numbering systems that are consistent across all facilities throughout the WTP site.
- Equipment to be positioned to avoid unnecessary dismantling to gain maintenance access.
- Human factors for operations and processes shall be considered.

[Sections 10.1,13.1, ORD]

Basis Discussion: This requirement assists with contamination control, and general operation and storage of the facility [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review and acceptance of the detailed designs to verify conformance to general facility requirements.	

3.8.5.3 Change Rooms

Requirement: Facilities shall be provided for changing between personal clothing and contractor-provided clothing. Additional specific requirements shall include:

- Change rooms with showers, lockers, and benches at the Lab facility for plant personnel to change between personal clothing and contractor-provided clothing.
- Lockers sized for storage of worker personal clothing, including coats and shoes.
- Change rooms designed to assume 50/50% male/female worker ratio, with an additional 20% contingency (for varying ratios) for estimating numbers of lockers and other change facilities. In addition, there shall be 10% more locker facilities to accommodate non-routine and visitor personnel in the same ratio.
- Storage for clean and used contractor-provided clothing.

[Section 10.3.1, ORD] (F.1)

Basis Discussion: Contractor provided clothing (non-personal protective equipment) is donned or removed in the clean change rooms.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design of change room areas to verify conformance with the requirement.	

3.8.5.4 Subchange Areas

Requirement: Personnel movement between clean and regulated areas of the building shall be controlled to eliminate potential contamination of clean areas. Subchange areas shall be provided for personnel movement between C3 and C2 areas, and when applicable, between C5 and C3 areas. This applies to normal access points (not emergency exits). Additional specific requirements for subchange areas shall include:

- Storage for regulated (clean and used) personal protective equipment
- Step-off pads
- Laundry bags for reusables or drums for disposables
- PCMs shall be provided to monitor personnel moving from areas of contamination potential. Personnel survey device (frisker) outlets or automatic whole-body frisking booths installed near the C2 exits of subchange airlocks. There shall also be installed personnel survey devices at each C2/C3 subchange area.
- Provisions for the prevention of co-mingling (workers in the same areas with and without the required protective clothing or respiratory protection)

[Sections 10.3.1, 12.7, 12.7.1, 13.1, ORD][Sections 9.4.13.1, 9.4.13.2, 12.3.4, 12.5.2, BOD] (C.1)(F.1)

Basis Discussion: Subchange areas should be incorporated where needed to control the spread of contamination. personal protective equipment (PPE) are donned in and removed prior to entering the subchange areas (C3 to C2, or when applicable, C5 to C3). Airlocks that will incorporate subchange areas are A-0139B and A-0141A. Containment tents and other temporary controls are used to control the spread of contamination during non-routine work in areas not supported by designated subchange areas. Subchange areas are an ALARA feature to prevent the spread of radioactive contamination to occupied areas. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design and layout of subchange areas to verify conformance with the requirement.	

3.8.5.5 Offices and Administrative Support Areas

Requirement: Personnel offices and miscellaneous rooms (such as conference rooms, restrooms, and janitor closets) shall be provided for in the Lab facility design. Provisions shall include:

- Except for field personnel such as operations and maintenance personnel, other personnel (management and supervisory) shall be provided individual or shared offices.
- Areas provided for rotating shift turnover briefings and pre-job meetings.

[Section 10.3.3, ORD] (F.1)

Basis Discussion: A lunchroom is not required for the Lab facility.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design of administrative areas conformance with the requirement.	

3.8.5.6 Health Physics Support Areas

Requirement: A radiological health physics (HP) operating area shall be provided in the laboratory. The HP operations area shall include rooms from which HP staff stage their activities and carry out their facility support tasks and shall include:

- A personnel ready room and office for non-management HP technician staff. The HP ready room shall be the primary staging area for the HP technician staff. This room shall be equipped with work tables and chairs. Adequate space shall be provided for bookcases and file cabinets for the storage of HP-related plant manuals, safety documents, and other reference material.
- An office for a radiological area access control system at the laboratory.
- A storage room for portable survey instruments and other radiological monitoring equipment. Workbenches and shelves shall be provided with adequate space for the storage of all required equipment with capability to segregate contaminated equipment. A lockable shielded locker shall be provided for the storage of radiation check sources.
- A counting room for counting samples such as smears, wipes, and filters. The room shall be equipped with appropriate alpha and beta/gamma counting equipment and instrumentation, with backup, for the analysis of all required samples. Space and support utilities (for example, power) shall be provided for a computer work station (dedicated to support the counting equipment), sample counting instruments, shelves, counters, and support equipment.
- A HP supervisor’s office.
- Decontamination room(s) provided with the following features:
- Sufficient space for decontamination of two or more individuals at one time.
- Adequate privacy features both men and women's clothing change during and after decontamination steps have been taken.
- Rooms equipped with cabinets, counter space, shower, and portable monitor(s).
- Adequate storage space for decontamination supplies and radiation monitoring and survey equipment used in this area.
- The shower and sink drains shall be routed to either the facility's contaminated liquid waste handling system, or the non-radioactive liquid waste system (NLD). If the liquid is routed to the NLD, provisions to isolate and sample the vessel and transfer routing for contaminated liquid shall be provided.
- Sinks that allow decontamination of facial areas and hair in a reclined position.
- A radiological HP operations area shall be provided close to the main facility change rooms and the main entrance to the process areas for each of the processing facilities.

[Sections 10.3.4, ORD] (F.1)(F.2)(H.1)

Basis Discussion: Requirements are generic. More definitive space requirements based on expected HP worker numbers are needed on which to base verification. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design of the HP operations areas for conformance to the requirements.	

3.8.5.7 Storage Areas

Requirement: General storage areas shall be provided at the Lab facility for supplies and equipment needed to operate the plant and for process by-products awaiting permanent disposal. Specific provisions shall include:

- Clean and used regulated and non-regulated clothing storage (four types).
- Storage facilities for miscellaneous operations support equipment and supplies in each major area of the Lab facility depending on the level of support required.
- Weather protected storage for Dry Active Waste in cardboard cartons.

[Section 10.3.5, ORD] (D.1)(F.1)(F.2)

Basis Discussion: Requirements are generic. Only waste destined for thermal treatment is likely to be put in cardboard cartons.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design of the designated storage areas for conformance to the requirements.	

3.8.5.8 C2 Equipment Maintenance Areas

Requirement: The Lab facility design shall include a maintenance shop in a C2 area, with sizing and access to accommodate the largest individual equipment piece anticipated to be repaired within the shop. The shop design shall accommodate the following as appropriate:

- Space for hand/powered tools, toolboxes, storage cabinets, and utilities (e.g., compressed air, water, and electrical power).
- Welding shop with layout burn tables, welding rod ovens, and both gas and electric welding.
- Measuring and testing equipment (M&TE) storage area separate from the instrument shop. The M&TE storage area shall be temperature and humidity controlled.
- Individual work stations with the instrumentation to allow for the calibration of instrument and specialty items.
- Electrical shop with motor run test station, work benches, toolboxes, and storage cabinets for test equipment.
- Mechanical shop with drill press, hydraulic bearing press, grinders, work benches, pipe threading machine, band saw, cut off saw, tool boxes, test bench for valves and pressure relief valves, and storage cabinets.
- Computers for technicians to access maintenance systems and records.

- Supervisor office near the maintenance shop and in a C1 area.
- Space for a limited supply of spare parts and consumables.
- Maintenance shops shall incorporate human factors practices, including workstation layout and design, tool ergonomics, and equipment and material handling.

[Section 9.2, ORD] (F.1)

Basis Discussion: Deviations from the above requirements may be granted by the Lab facility Operations Lead. This includes determination of expected maintenance needs. Maintenance shop design is expected to incorporate, to the extent practical, human factors practices, including workstation layout and design, tool ergonomics, and equipment and material handling. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify conformance of the maintenance areas to the requirements.	

3.8.5.9 C3/R3 Maintenance Area

Requirement: The Lab facility design shall include a regulated (C3/R3) shop, located consistent with the need for repair and replacement of contaminated equipment, including sizing and access to accommodate the largest individual equipment anticipated to be repaired within the shop. Each regulated shop shall be designed to accommodate the following:

- Appropriately sized maintenance facilities are provided for equipment maintenance and repair. Decontamination facilities are included where necessary to support maintenance and repair. Routes are provided for shielded removal of major equipment requiring maintenance or repair, as appropriate. Centralization of common maintenance activities is provided to the extent practical.
- Space for hand/power tools, and utilities (e.g., compressed air, water, breathing air, electrical power, welding machine outlets), and toolboxes, consistent with the needs in the facilities.
- Welding, using both gas and electric welding.
- Space for contaminated tool storage.
- Facilities to support regulated instrument and control process equipment repair.
- Floor wash-down equipment and sumps or drains for removal of liquid.
- Communication systems consistent with CME (Communications Electrical System) requirements.
- Test equipment used to troubleshoot and repair component failures.
- Fixtures to accommodate both rebuilding and, as practicable, run-in and/or pre-installation testing.
- Provisions for local storage, including proper ventilation, of both hazardous and flammable materials such as paints, solvents, hydraulic oil in quantities required for immediate work.
- Layout of the facilities minimizes the potential for personnel hazards, such as the following: spread of contamination radiation exposure and hazardous chemicals exposure.
- Hazardous chemicals exposure

- Maintenance shops shall incorporate human factors practices, including workstation layout and design, tool ergonomics, and equipment and material handling.
- Facilities shall be provided to test equipment after repair, especially for equipment that has been repaired coming from R3 or R5 areas.

[Sections 9.1, 9.2, ORD][Sections 11.3.1, 11.3.2.2, 11.5.1, BOD] (C.1)(F.1)

Basis Discussion: None. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the requirements for C3/R3 maintenance area is met.	

3.8.5.10 Manipulator Decontamination, Maintenance and Storage Areas

Requirement: The Lab facility design shall include a shop and/or facility for decontamination, maintenance, and storage of manipulators in a C3/R3 area. Each repair shop shall be designed to accommodate the following:

- Sufficient size to work on multiple manipulators (number to be determined during design)
- Storage space for all spare parts that may be required to completely rebuild a manipulator, as well as space to test repaired equipment
- Adequate (10% of the installed manipulators) lag storage for repaired manipulators
- An adequate number of hydraulic or electric manipulator repair carts to handle anticipated repair requirements
- A monorail system to service all repair stations
- Tool storage
- Decontamination capabilities
- Facilities shall be provided to test equipment after repair, especially for equipment that has been repaired coming from R3 or R5 areas.

[Section 9.2, ORD][Sections 11.3.2.2, 11.5.1, BOD] (F.1)

Basis Discussion: Deviations from the above requirements may be granted by the L facility Operations Lead/Manager. Maintenance shop design is expected to incorporate, to the extent practical, human factors practices, including workstation layout and design, tool ergonomics, and equipment and material handling. Operations input to, and review of design, needs to consider number of manipulators requiring maintenance or storage. [ALARA]

Note**:** It is preferred that the manipulator maintenance area be separate from the general regulated shop, or partitioned off from the rest of the regulated shop. The general regulated shop and manipulator shop area(s) may share decontamination facilities. “Regulated shop” refers to the maintenance area for contaminated equipment.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify conformance of the manipulator decontamination and maintenance areas to the requirements.	

3.8.5.11 Manipulator Removal and Transport Accommodation

Requirement: The Lab facility design shall accommodate the removal and transport of MSM from their installed locations to the regulated (C3/R3) maintenance shop. Space shall be provided for removal through the in-cell wall to the operating gallery using a special removal cart or monorail. In addition, the use of an in-cell crane will be required for 3 piece MSM removal/installation. Storage shall be provided for future repair/replacement. [Sections 9.1, 9.2, ORD][Sections 11.3.2.2, 11.5.1, BOD] (F.1)

Basis Discussion: Evaluation/assessment to be prepared prior to demonstration. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify accommodation of MSM removal and transport needs.	

3.8.5.12 Shield Window Removal and Transport Accommodation

Requirement: The Lab facility design shall accommodate the removal and transport of loads to support operations and maintenance, including shield window assemblies, from their installed hot-cell location, through operating galleries, via transfer carts to maintenance shop(s) or waste packaging and export area. [Sections 9.1, 13.1, ORD] (F.1)

Basis Discussion: Motors, shield windows, MSMs, pallets with drums, etc. are different ways to help achieve this. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify accommodation of shield window assembly removal and transport needs.	

3.8.5.13 Temporary Cell Access and other Commissioning Support

Requirement: The Lab facility shall include access provisions for cells that do not normally require personnel access during routine operations, but require access during commissioning, with provisions for personnel access, habitability, and life safety, including temporary ventilation. [Sections 19.12, 19.13, ORD]

Basis Discussion: Access provisions typically include inserting temporary flow, pressure, and temperature measuring equipment (to support commissioning). The requirement is established in support of commissioning to maintain cell accessibility, including temporary ventilation, to permit commissioning or other personnel to access cell areas before shield window installation or radioactive material is introduced. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify inclusion of access provisions for cells that do not normally provide access.	

3.8.5.14 Decontamination Areas in Support of Maintenance

Requirement: The facility design shall include space for the decontamination and maintenance of laboratory equipment. Decontamination areas shall meet the following provisions:

- Decontamination areas shall include appropriate utilities, including one or more of the following: carbon dioxide, pressurized warm water, detergent solution, steam.
- Facility design shall include provision for the disposal of the waste liquid generated by decontamination activities.

[Sections 14.8, 14.16, ORD] (C.1)(F.1)(H.1)

Basis Discussion: Provision of capabilities to support decontamination of equipment, including cranes and manipulators, is established in support of ALARA design principles. Operations input to the detailed design development effort is essential and to be based on best available understanding of the equipment to be maintained and the anticipated maintenance activities. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify accommodation of decontamination area requirements.	

3.8.5.15 Deleted

3.8.5.16 Deleted

3.8.5.17 Breathing Service Air Access

Requirement: Lab facility design shall provide an installed breathing air system for locations where fresh air entries will be required. The systems shall include:

- Wall/door penetrations should be available to alleviate doors needing to be propped open and hoses potentially being pinched and damaged.
- Protective access door remains open and a second non-shielded door with access ports will allow hoses to be routed into area without being pinched.

[Section 14.6, ORD]

Basis Discussion: Deviations from the above requirements may be granted by the Lab facility Operations Lead/Manager. Design is expected to incorporate, to the extent practical, accessibility for maintenance or recovery operations in normally unmanned C5 areas. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Engineering/Operations review and acceptance of the conceptual and detailed facility layout design wall/door penetration and protections.	

3.8.5.18 Mobile Mechanical Lifting Equipment

Requirement: The facility design shall provide installed equipment or space for mobile equipment with mechanical lifting capability for any routine or anticipated lifts of equipment or supplies that exceed 40 lbs. [Section 8.1.1, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify that anticipated/routine lifts of equipment and materials of more than 40 lbs. are provided with the capability to use installed or mobile mechanical lifting equipment.	

3.8.5.19 Standardization of Plant Equipment

Requirement: Standardized equipment shall be used between WTP facilities and within the Lab facility for similar equipment performing similar duties to help improve operator familiarity, reduce maintenance training, minimize spare parts inventory, reduce maintenance procedures, reduce design effort and types of testing and test equipment required. [Section 11.4.5, BOD][Section 19.7, ORD]

Basis Discussion: Equipment standardization is employed throughout the facility design where safety requirements and cost requirements can be satisfied. The WTP Project uses these standardized equipment designs whenever possible. Where identified as cost-efficient, the WTP Project develops new standardized equipment designs. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify facility conforms to requirement to provide for standardized equipment.	

3.8.5.20 Shield Doors

Requirement: Where necessary or applicable, the design of shield door assemblies or adjacent walls shall permit control of contamination. Shield doors shall also be designed with airtight seals or an engineered gap to maintain sufficient air velocities to control contamination. [Section 7.1, ORD] (G.4)

Basis Discussion: Design of shield doors to accommodate control of contamination. Design of shield doors is consistent with ALARA principles. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify the shield door meets the requirement.	

3.8.5.21 Plugs and Connectors

Requirement: Plugs shall be used for power and instrumentation instead of hard wiring where practical. The design shall utilize other techniques for minimizing maintenance labor to reduce the time, number and type of crafts required to perform work. In higher risk areas, design shall be provided for wire connectors that cannot be reconnected incorrectly after maintenance is completed. This applies to locations where there are multiple wires and the possibility exists to mix the wires. [Section 9.1, 16.1 ORD]

Basis Discussion: This is required to minimizing maintenance labor, reduce the time, number and type of crafts required to perform work. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify that higher risk areas are equipped with wire connectors that cannot be reconnected incorrectly after maintenance is completed.	

3.8.5.22 Radiochemical Laboratory Layout

Requirement: The radiochemical laboratory complex shall provide for the following:

- Receipt of LAW samples via the autosampling system
- Receipt of dilute samples from the hot cells complex
- Space for preparation of reagents and standards
- Space for radionuclide sample and analysis
- Space for liquid waste export
- Provisions for liquid waste export
- Space for solid waste collection

[Section 10.6.2, 19.6, ORD] (A.1.1)(A.1.2)(C.1)

Basis Discussion: None

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify laboratory facility can accommodate the radiochemical laboratory chemicals.	

3.8.5.23 General Laboratory Requirements

Requirement: Laboratory areas, in addition to the hot cell complex and radiochemistry laboratory area described above, shall provide for the following:

- Liquid waste collection and transfer
- Cascading ventilation system
- Solid waste collection and storage
- Utility gas bottle storage and gas distribution
- Operator control of laboratory support systems such as power distribution, HVAC, breathing air, and liquid waste transfer
- Provisions for decontamination and maintenance of laboratory equipment
- Space for locating and operating the laboratory information management system (LIMS)
- Space for shift turnover
- Provisions for the decontamination of personnel
- Minimize transportation and handling of radioactive material
- Allow for support of WTP commissioning activities
- Support WTP decommissioning activities
- Account for routine maintenance of laboratory systems including sample conveyance systems
- Implement current WTP design philosophies for overflows, secondary containment, flushings/washdowns, and shielding
- Provide central control and monitoring of process systems and components that affect laboratory operations and interfaces for normal operations. Components and control circuits shall be designated to fail in a safe process configuration on loss of motive power or control signal. Provide for local monitoring and control of components that might need to be repositioned to place the facility in a safe configuration in the event of process failures
- Provide retention of spent samples to accommodate controlled transfers to the PT facility for treatment as required
- Provide for chemical and radioactive waste handling
- Paved parking for at least four vehicles at each building near main maintenance shop area access.

[Sections 10.6.3, 13.3, ORD][Section 6.3.4, BOD] (C.1)

Basis Discussion: None. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify laboratory facility can accommodate the provisions identified in the requirements.	

3.8.5.24 Hotcell Face Control

Requirement: Lab hotcell control stations where an operation within the hotcell requires constant operator intervention or direct viewing shall have the following designed into the operator control stations:

- Initiation, control and monitoring of mechanical handling operations
- Direct actuation or manual mode control for mechanical handling equipment as required
- The use of a single station to control several machines
- Control of a single machine from several different stations
- Hands-free telephone communications
- CCTV viewing of facility equipment where adequate viewing is not possible from the cell/cave face
- Local operator interfaces in the plant, usually adjacent to the cell/cave-face windows. These panels shall provide control in automatic and manual modes and display plant mimics. New indicators, buttons, and displays can be added via software configuration options, rather than installing new equipment. Hardwired interfaces may be provided for systems that are independent of the normal control systems (such as public address, building evacuation, fire surveillance).
- Devices on the process graphic that dynamically indicate status, but do not have feedback relating their field status will be differentiated from devices with feedback. For example, solenoid valves that do not have position indication shall appear differently than those that have open/close feedback.

[Section 11.5, 11.12.4.1, ORD]

Basis Discussion: Hotcell control at a hotcell face may require constant operator intervention or direct viewing.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify hotcell stations where operations performed with constant operator intervention or the operator maintaining direct viewing of all operations have the required controls.	

3.8.5.25 Local Control Stations

Requirement: The Lab design shall have local control points for the following purposes:

- Control of services.
- Startup and shutdown of services and utilities equipment (where appropriate)
- Where direct viewing of hotcell equipment is required for maintenance operations
- The following shall be available at the local control points:
- Manual mode control of mechanical handling operations (where appropriate)
- Direct actuation for mechanical handling equipment (where appropriate)
- Telephone communications

[Section 11.6, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the local control stations meet the requirements.	

3.8.5.26 Electrical and Instrument Rooms

Requirement: The Lab electrical and instrument equipment rooms shall have the following capabilities:

- Telephone communications.
- Connection points for engineer workstations for software and equipment maintenance in the instrument rooms.
- Connection points for computerized access to WTP information networks, and direct actuation for drives through motor control centers.

[Section 11.7, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify the electrical and instrument rooms have the required capabilities.	

3.8.5.27 Manual/Local Control

Requirement: Maintenance control (also called direct control) shall be available as a means of operating devices independent of the control systems from a local panel, pendant, or motor control center, where appropriate. Systems used to control and monitor plant processes and equipment shall include direct actuation for drives via a maintenance control switch. [Sections 11.10 and 11.12.3.6, ORD]

Basis Discussion: Control systems used for direct actuation of drives include systems controlling drive motors for fans, pumps, etc. Maintenance control is used in the event of control system failure or to perform operational tests because of equipment repair or maintenance.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify maintenance control meet the requirement.	

3.8.5.28 Utility Outages

Requirement: The Lab facility shall have utilities designed to allow partial outages and preclude total facility utility outages during maintenance. [Section 14.1, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify utilities are designed to allow partial outages and preclude total facility utility outages during maintenance.	

3.8.5.29 Equipment Seals

Requirement: Pump seals or other design features, upon failure, shall not provide a pathway for liquids or gases to personnel or to the environment. [Section 14.1, ORD]

Basis Discussion: The spread of contaminants (liquids or gases) to personnel or to the environment is minimized by using pump seals or other design features. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify the Lab pumps are designed to preclude leakage of liquids/gases that could lead to exposure to the workers or the environment.	

3.8.5.30 Pressure Relief Valves

Requirement: Pressure safety relief valves (PSVs) shall be configured with a full port three-way valve, dual PSVs, and drain valve on each (unless a redundant train is provided) to preclude a service outage when servicing any relief valve. The three-way valve shall have the following design provisions:

- Designed such that there is no position where the internal plug, disc, or ball would isolate or block both PSV's simultaneously.
- Capable of being locked (with use of either an integral or commercially available after market locking device) in a position that only allows one port to be fully open and the other port fully closed.

[Section 14.4, ORD]

Basis Discussion: The configuration allows maintenance on one valve during plant operation while still providing protection for the system components. The PSVs allow continuous operations of the steam system during off-normal events while protecting necessary components and instruments. This configuration is required on vessels and systems that cannot be easily isolated, or when system draining and isolation would have a negative impact on safety or availability.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the PSVs have capability that allows the steam systems to operate while one of the relief valves is taken out of service (verify that the type of valve is a full port three-way valve).	May be documented in an evaluation/assessment report.

3.8.5.31 Permanently Lubricated Components

Requirement: Permanently lubricated, sealed for life components shall be used wherever possible to reduce maintenance requirements. [Section 9.1, ORD]

Basis Discussion: Use of permanently lubricated, sealed for life components wherever possible ensures that the need for maintenance is minimized, which supports maintaining facility worker exposure levels ALARA. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify permanently lubricated, sealed for life components are used in facility system designs wherever practical.	

3.8.5.32 Hoist Locations

Requirement: The LAB shall be designed with hoisting equipment located to remove equipment designed to be replaced during the operating life of the Lab. [Section 20.0, ORD]

Basis Discussion: None. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review Lab design to verify there are hoists located to remove equipment designed to be replaced during the life of the Lab.	

3.8.5.33 Cranes and Hoists

Requirement: Under-the-hook lifting shall be designed for multiple uses for equipment. Engineered anchor points shall be provided to accommodate the use of rigging and portable hoists. Fall protection or tie-off points shall be provided in appropriate locations. [Section 14.16, ORD][Section 11.3.2.2, BOD]

Basis Discussion: Ensuring the hoist is designed to lift different types of equipment limits the amount of lifting equipment that must be purchased. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify all aspects of hoist design have been met.	

3.8.5.34 Anti-condensation Heaters

Requirement: Where required by ambient conditions, anti-condensation heaters shall be provided. [Section 16.1, ORD]

Basis Discussion: Placement of anti-condensation heaters are helpful in reducing the corrosion in metal components and keeping the electrical components' insulation resistance within limits.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify that anti-condensation heaters are provided where required by ambient conditions.	

3.8.5.35 Electrical Utilities

Requirement: Utilities design shall consider the following measures:

- Use of premium efficiency motors for pumps, fans, and other uses
- Use of double- or triple-sized neutral conductors
- Use of high efficiency dry-type transformers

[Section 16.1, ORD]

Basis Discussion: None

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify the electrical utilities requirements are included in the design.	

3.8.5.36 Instrument Cable Routing

Requirement: Instrument cable design routing shall consider the following:

- Do not interfere with the maintenance or removal of unrelated equipment
- Avoid hot environments and fire risk areas
- Are not subject to mechanical abuse

[Sections 16.1, ORD]

Basis Discussion: None

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify the instrument cable routing requirements are included in the design.	

3.8.5.37 Isolation and Test Points

Requirement: Isolation and test points with drain and bleed valves shall be included in the Lab design to allow for testing of plant items during normal operations and removal or replacement, as applicable. For work on high-energy systems (fluid systems with operating parameters greater than 200 °F and/or 500 psig.), a double block and bleed method of isolation shall be provided for all paths where the fluid could cross the work boundary involving hands-on maintenance. If isolation of the high-energy system impacts unit operations, the double block and bleed arrangements shall be applied to individual components. Isolating devices shall be capable of being locked out and shall provide visible indication of the required device position. [Section 11.5.1, BOD][Sections 9.1 and 19.14, ORD]

Basis Discussion: Isolation and test points that are needed to support testing are identified by the design agency, startup, and commissioning during the design development and review process, with consideration given to the tests and demonstration activities required for requirement verifications specified in Appendix A. Isolations and test points are provided within the design as necessary to support the testing plan. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review system design to verify isolation and test points meet the requirement.	

3.8.5.38 Utility Piping

Requirement: Utility piping containing fluids without suspended solids shall be designed to be level with high point vents and low point drains such that the piping can be drained. [Section 14.3, ORD]

Basis Discussion: None.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review system design to verify utility piping is level or sloped with high point and low point drains.	

3.8.6 Maintenance Requirements

3.8.6.1 Equipment Accessibility

Requirement: The Lab facility design for maintenance and accessibility shall include:

- Where maintenance, repair, or replacement activities are deemed necessary, the design provides adequate access for lifting and handling devices, and provides adequate provisions for transfer of equipment.

- Adequate clearances around equipment to accommodate maintenance and operation personnel and any encumbrances such as protective garments, respirators, portable lifting devices, and alignment equipment for pumps, etc.
- Equipment and plant structural elements such as columns and beams shall be arranged to allow access to equipment by maintenance personnel.
- All fixed ladders or stairs, catwalks, platforms, docks, wall and floor openings shall meet code requirements.
- Equipment, instrumentation, and electrical components that are located more than 5 feet from ground level will have adequate space to allow for access with a ladder, portable manlift, or scaffolding for operation and maintenance.
- Equipment, instrumentation, and electrical components that are 6 feet and over from floor level shall be provided with permanent work platform with fixed ladder/stair access to perform operation and maintenance. Any exceptions shall be approved in accordance with ORD Section 2.1.
- Adequate space and support provided for installing permanent and temporary shielding in areas where it may be needed. Dual trains of radioactive systems, for example, shall have adequate space to be separated by shielding and still permit access by maintenance and operation personnel.
- Clearances around valves and in-line equipment to facilitate maintenance and removal.
- Space and pathways shall be provided to allow transport of equipment to repair shops or to disposal.
- Provision shall be made in the Lab design to perform instrument calibrations, preventive maintenance, and periodic functional testing of protective circuits while the plant is in normal operation. Consideration shall be given to performance of routine calibrations and preventive maintenance of equipment during normal operations.

[Section 11.3.1, BOD][Sections 9.1, 11.16, ORD] (F.1)

Basis Discussion: Deviations from the above requirements may be granted by the Lab facility Operations Lead/Manager. Design is expected to incorporate, to the extent practical, human factors practices, including tool use, ergonomics, and equipment and material handling.

If space does not permit for the installation of permanent fixtures on cranes, then on a case by case evaluation, temporary attached removable work platforms may be designed and installed. Where necessary manlifts may be used for maintenance, inspection, or access to any equipment installed on the crane. All fixed ladders or stairs, catwalks, and platform will meet code requirements as stated by Occupational Safety and Health Administration (OSHA), the American National Standards Institute (ANSI), and the American Society of Mechanical Engineers (ASME). All work platforms will meet code requirements as stated by OSHA 29 CFR 1910 Subpart D. All manlifts will meet code requirements. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG/ OPS**	Engineering/Operations Review the design to verify maintenance and accessibility of Lab facility equipment meet the requirements.	

3.8.6.2 Deleted

3.8.6.3 Operating Galleries

Requirement: Lab facility design shall include the following general requirements for operating galleries:

- Space for movement of large pieces of equipment, temporary containment enclosures for change areas, maintenance, and change out of large equipment
- The integration of hoisting equipment into the facility design to remove equipment designed to be replaced during the operating life of the facility.
- Space for removal and re-insertion of manipulators will start from the near edge of the wall through which the manipulator is installed. The space reserved will be dependent on the type of manipulator to be installed (1 piece, 2 piece or 3 piece) as well as the method for removal (cart, monorail, etc.) Space allocation shall consider whether the type and removal method requires the full extension of the inside portion of the arm during the removal process.
- The entire operating area for manipulators in the X-Y-Z dimensions designed with no obstructions adjacent to the shield window area.
- Storage areas for equipment and supplies needed for operation of equipment, decontamination, and entries to C3-C5 areas.
- Floors sealed or painted to facilitate decontamination.

[Sections 10.5, 20.0, ORD] (F.1)

Basis Discussion: Deviations from the above requirements may be granted by the Lab facility Operations Lead/Manager. Design is expected to incorporate, to the extent practical, human factors practices, including tool use, ergonomics, and equipment and material handling. Operating galleries include those spaces with remote handling, manipulation, and/or equipment transfer. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG/ OPS	Engineering/Operations review the design to verify the operating galleries meet the requirements.	

3.8.6.4 Deleted

3.8.6.5 Standardization of Hoist Component

Requirement: Components between cranes shall be standardized and interchangeable to the maximum extent possible. [Section 14.16, ORD]

Basis Discussion: Differences to accommodate specialized hoist operations are acceptable. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review the design to verify similar components are provided for similar hoists.	

3.8.6.6 Deleted

3.8.6.7 Facility Noise

Requirement: For acoustic hazard controls, plant spaces shall be designed to allow continuous occupancy under American Conference of Governmental Industrial Hygienists limits without PPE. Where this is not practical, the design shall minimize noise exposure levels to allow continuous occupancy with PPE. Up to the use of double hearing protection (i.e., less than 10 dBA). Equipment within rooms shall be designed to be below 109 dBA when equipment is in operation. Rooms with equipment that require PPE for entry shall be considered “high-noise areas” for compliance with the ORD, Section 12.5, Communications. [Section 8.1.5, ORD] (E.3)

Basis Discussion: Plant Operations objective for acoustic hazards is to minimize the need for PPE in occupied plant spaces. Where this is not practical, deviations from the above requirements may be granted in accordance with ORD Section 2.1. The design is expected to incorporate, to the extent practical, human factors practices, including tool use, ergonomics, and equipment and material handling. Noise levels are generally a function of equipment design or selection, not facility design requirements. Acceptable noise levels for individual equipment should be specified based on OSHA and/or American Conference of Governmental Industrial Hygienists standards for continuous occupancy areas. High noise level areas are posted for hearing protection.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review the design to verify Lab facility equipment is designed to be below 109 dB A when in operation.	
T	**SU/COM**	Perform noise level measurements to verify normal operating noise levels are minimized within Lab facility occupied plant spaces.	

3.8.6.8 Equipment Location Supporting Maintenance

Requirement: Maintainable equipment components, such as drive motors, shall be located outside of high radiation cave, cell, and bulge areas to the extent practical. [Section 7.1, ORD][Section 11.4.1, BOD]

Basis Discussion: Locating maintainable equipment out of high radiation areas to the extent practical supports maintaining facility worker exposure levels. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	**ENG**	Review design to verify maintainable equipment is located outside of high radiation areas to the extent practical.	

3.8.6.9 Lockout Valve Design

Requirement: Valves shall be designed and procured where possible to support lockout using commercially manufactured devices other than chains. [Section 7.1, ORD]

Basis Discussion: Design of Lab valves for compatibility with commercial off-the-shelf locking devices supports maintainability, operability, and testing of the valves throughout the life of the valve.

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify all valves are designed and procured where possible to support lockout using commercially manufactured devices other than chains.	

3.8.6.10 Remote Valve Operation

Requirement: Remote valve operation designs shall be as follows:

- Remote operation of valves shall be provided where accessibility is difficult, such as R5/C5 areas, and for valves used in routine operations.
- All valves used in remote locations shall be equipped with highly reliable position indicators.
- When utilizing chain operators for remote operation of valves, the chain shall be 41"+/-7" above the floor. If the chain operators are in walkways, a provision shall be installed to stow the chain out of the walkways when not in use. The chain shall be stowed < 72" above the floor.
- The chain operator must be stowed by attaching it to a wall or structural support.
- The chain operator will be routed so it does not contact SSC when used to operate the valve.
- Valve reach rods, if necessary, shall be designed to be removed easily and, when reinstalled, only engage the valve in the correct alignment, using no more than two universals.

[Section 14.4, ORD]

Basis Discussion: Remote operation is used to ensure the WTP facilities' design achieves occupational doses that are ALARA. The need for "remote" operation does not apply to a black cell or pit only, but instead applies to an automatic valve or other feature needed to operate from a distance. Valve position indication signals can be visual, mechanical, electric, or electronic based on the valve location and type of valve. [ALARA]

Verification: Verification is expected to be achieved through the following:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify remote operation of valves meet the requirements.	

3.9 Other Facility-Level Requirements

3.9.1 Waste Management

3.9.1.1 Deleted

3.9.1.2 Deleted

3.9.2 Decommissioning

3.9.2.1 Design for Future Volume Reduction

Requirement: The facility shall be designed, where possible, using materials amenable to decontamination, volume reduction, and eventual disposal. [Section 20, ORD] (D.1)

Basis Discussion: Where possible, the Lab facility is to be constructed of materials that can be readily demolished and crushed or compacted for disposal, or that can be salvaged and reprocessed pending free release. This is a design objective that is lower in precedence than the need for the facility to be designed to survive design basis conditions and still maintain safe containment and confinement of hazardous materials. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify the facility materials used are amenable to decontamination and volume reduction.	

3.9.2.2 Decontamination and Decommissioning (D&D) Requirements

Requirement: The Lab facility design shall include process and facility design features to safely and efficiently facilitate deactivation, decontamination, decommissioning, and the *Resource Conservation and Recovery Act of* 1976 (RCRA) closure of the facilities. The WTP design process will use decommissioning methodologies and mechanisms based on proven experience. Specific design features to be considered to support decommissioning include the following:

- In-cell sumps and periodic wash-downs of cells will help reduce the decommissioning period. Sumps shall be installed at a low level in the cells with an accessible emptying system in place.
- Features in place to facilitate in-cell/cave cleaning and periodic decontamination (for the stainless-steel-lined portion). Also, where possible, periodic line flushes and tank clean-out capability shall be provided for use during operations.

[Section C.7 (a)(12), WTP Contract][Sections 11.10, BOD][Section 20.0, ORD]

Basis Discussion: A substantial and important element of the design process will be the incorporation of features to minimize the cost and complexity of decommissioning. Design features that simplify and facilitate D&D, minimize contaminated equipment, and minimize the generation of radioactive waste during deactivation, decontamination, and decommissioning are identified during the planning and design phase based upon anticipated decommissioning methods. Consideration of design features in support of this requirement is through the ADR process, which establishes requirements specific to individual SSCs. This is a design objective that is lower in precedence that the need for the facility to be designed to survive design basis conditions and still maintain safe containment and confinement of hazardous materials. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Engineering to verify review and acceptance of the detailed designs of general facility requirements and any aspects of facility design supporting D&D, conform with the requirements.	

3.9.2.3 Deleted

3.9.2.4 Provide Capability to Seal Off In-Cell Penetrations

Requirement: The design shall have the capability to seal off in-cell penetrations provided when justified. [Section 20.0, ORD]

Basis Discussion: Design features that seal off penetrations simplify and facilitate closure of the cell penetrations to prevent the spread of contamination or prevent unintended intrusion of cells that cannot be satisfactorily decontaminated and demolished or that are demolished later. [ALARA]

Verification: Verification is expected to be achieved through:

Verif. Method	Verif. By	Plan	Notes/Comments
R	ENG	Review design to verify penetrations have pipe stubs or threaded connections to add pipe stubs.	

3.10 Relevant Codes and Standards

3.10.1 Codes of Record

The table below identifies relevant external codes and standards applicable to the Lab facility design. Use of the *Engineering, Procurement, and Construction (EPC) Code of Record,* 24590-WTP-COR-MGT-15-00001, is typically invoked in the design process through the documents identified in Section 3.10.2. Beyond inclusion here, no attempt is made in this document to extract individual design requirements from the Code of Record for allocation to SSCs.

In some cases, the expected means of verification may be established based on tests or other criteria required by the codes and standards. This does not necessarily include verification or testing more appropriately defined in the procurement of individual sub-systems or components, or verification or testing that is a routine activity defined by specifications and/or procedures used by Construction and Startup.

Table 3–3 Lab facility Applicable Codes & Standards

Implementing Codes and Standards: [24590-WTP-COR-MGT-15-00001, Rev 0, Engineering, Procurement, and Construction (EPC) Code of Record]
• 1997, *UBC Uniform Building Code*, as tailored in Appendix C. NOTE: The tailoring of UBC 97 is required for use by the WTP contractor as a daughter standard referenced by the implementing standard for the fire protection. For the Analytical Lab, replace Chapters 1 through 15 and 24 through 35 of the 1997 UBC with corresponding Chapters of the 2000 *International Building Code (IBC)*.[1,2]
• 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II,* Appendix A, "Implementing Standard for Safety Standards and Requirements Identification"
• 29 CFR 1910, Subpart D, *Walking-Working Surfaces*
• ACGIH 2090, *Industrial Ventilation, A Manual of Recommended Practice*
• ACGIH 04-008, *Noise Control*
• ACI 318-99, *Building Code Requirements for Structural Concrete*, as tailored in Appendix C of the SRD.
• ACI 318R-99, *Commentary on Building Code Requirements for Structural Concrete*
• ACI 349-01, *Code Requirements for Nuclear Safety-Related Concrete Structures*, as tailored in Appendix C of the SRD.
• ACI 349R-01, *Commentary on Code Requirements for Nuclear Safety-Related Concrete Structures*
• ACI 530.99, *Building Code Requirements for Structures and Commentary*.
• AISC M016-89, *Manual for Steel Construction - Allowable Stress Design, Ninth Edition*, as tailored in Appendix C of the SRD.
• ANSI/AISC N690-94, *Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities*, as tailored in Appendix C of the SRD.
• ANSI/HPS N13.1-1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances From the Stacks and Ducts of Nuclear Facilities*
• ANSI/ISEA Z358.1-2009, *American National Standard for Emergency Eyewash and Shower Equipment*
• ASHRAE 90.1-99, *Energy Efficient Design of Added Buildings Except Low-Rise Residential Buildings*
• ASCE 1992 Engineering Practice No. 78, *Structural Fire Protection*
• ASCE 4-98, *Seismic Analysis of Safety-Related Nuclear Structures and Commentary*
• ASCE 7-98, *Minimum Design Loads for Buildings and Other Structures* [1,2]
• ASME B30.2, *Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)*
• ASME B30.11, *Monorails and Underhung Cranes*
• ASME B30.16, *Overhead Hoists (Underhung)*
• ASME B31.3, *Process Piping – Chemical Plant and Petroleum Refinery Piping*
• ASTM D2922, *Standard Test Methods Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)*
• ASTM D3017, *Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods*
• ASTM D3740, *Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction*
• ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*
• ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems*
• ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*
• ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*
• CMAA 74-2000, *Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist* (supplemented with ASME NUM 1-2000 [with NUM 1a-2002], Sections NUM-G2000, NUM-II-7000, NUM-II-8200, NUM-II-8300, and NUM-II-8400 for SS cranes). NOTE: Seismic acceleration loads shall be included in the extraordinary loadings identified in CMAA 74-2000.
• DOE Newsletter (Interim Advisory on Straight Winds and Tornados) Dated 1/22/98
• DOE O 420.1B , *Facility Safety* (as tailored in the *Safety Requirements Document (SRD)*, 24590-WTP-SRD-ESH-01-001-02 Rev 5X, Appendix C of the SRD)
• DOE-RL-92-36, *Hanford Site Hoisting and Rigging Manual*

Table 3–3 Lab facility Applicable Codes & Standards

• DOE-STD-1020-94 (Change 1, 1996), *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, as tailored in Appendix C of the SRD. [1,2]
• DOE-STD-1066-97, *Fire Protection Design Criteria*, as tailored in Appendix C of the SRD
• *Factory Mutual (FM) Global Property Loss Prevention data Sheets 1-57, Plastics in Construction*
• *FM Global Approval Guide*
• *FM Global Property Loss Prevention data Sheets 1-28R, 1-29R, Roof Systems*
• *FM Global Property Loss Prevention data Sheets. 1-28, Wind Design*
• IBC 2000, *International Building Code* NOTE: The following tailoring of UBC 97 is required for use by the WTP contractor as a daughter standard referenced by the implementing standard for the fire protection, for the LAB Facility, replace Chapters 1 through 15 and 24 through 35 of the 1997 UBC with corresponding Chapters of the 2000 International Building Code (IBC). [Appendix C 10.0, *SRD*] [1,2]
• IEEE 338-2006, *Standard Criteria for Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems*
• Illuminating Engineering Society of North America (IES), IESNA RP-1, *Office Lighting*
• Illuminating Engineering Society of North America (IES), IESNA RP-7, *Industrial Lighting*
• ISA S7.0,01, *Quality Standard for Instrument Air*
• ISA-S84.01-1996, *Application of Safety Instrumented Systems for the Process Industries*
• ISO 10007:1995(E), *Quality Management - Guidelines for Configuration Management*, as tailored in Appendix C of the SRD.
• *NFPA Fire Protection Handbook*
• NFPA 14, *Standard for the Installation of Standpipes and Hose Systems*
• NFPA 70-1999, *National Electrical Code*
• NFPA 101-2000, *Life Safety Code*
• NFPA 221-2000, *Standard for Fire Walls and Fire Barrier Walls*
• NFPA 780-97, *Standard for the Installation of Lightning Protection Systems* [1]
• NFPA 801-2003, *Standard for Fire Protection for Facilities Handling Radioactive Materials*
• *Society of Fire Protection Engineers (SFPE) Fire Protection Engineering Handbook*
• *Underwriters Laboratory (UL) - Fire Resistance Directory*
• Steel Deck Institute, Fox River Grove, Illinois, *Steel Deck Institute Design Manual*
[1] The LAB-PDSA specifies that design of selected portions of the Lab facility per this code or standard is a credited design feature to help ensure the robustness of the design in support of the nuclear safety hazards analysis and selection of controls. [2] This code or standard from the SRD applies to components of the LAB facility that have a safety function.

3.10.2 WTP Design Criteria, Guides and General Specifications

The table below identifies relevant discipline design criteria, guides, and general specifications applicable to the Lab facility design. Use of these documents to develop the detailed design of SSCs is governed by engineering procedures. Many the requirements contained within these documents are derived from external codes and standards or are specified methods and approaches to achieve standardization and consistency of design. Beyond inclusion here, no attempt is made in this document to extract individual design requirements from these documents for tracing and verification, or to define how direction provided by these documents is applicable and allocated (or not) to individual SSCs.

Table 3–4 WTP Design Criteria, Guides and General Specifications Applicable to Lab

Document Number	Title
Design Criteria	
24590-WTP-DC-AR-01-001	*Architectural Design Criteria*

Table 3–4 WTP Design Criteria, Guides and General Specifications Applicable to Lab

Document Number	Title
24590-WTP-DC-C-01-001	*Civil Design Criteria*
24590-WTP-DC-E-01-001	*Electrical Design Criteria*
24590-WTP-DC-ENG-06-001	*Design Criteria for Environmental and Natural Phenomena Hazard Qualification of Structures Systems and Components*
24590-WTP-DC-ST-01-001	*Structural Design Criteria*
24590-WTP-DC-ST-04-001	*Seismic Analysis and Design Criteria*
Design Guides	
24590-WTP-GPG-ENG-004	*Design Guide Pipe Stress, Pipe Layout and Support Spacing*
24590-WTP-GPG-ENG-005	*Engineering Design Guide for Pipe Support*
24590-WTP-GPG-ENG-0099	*Design Verification of Plant Design Deliverables*
24590-WTP-GPG-ENG-0124	*Selection Process for the Use of WSGM for Design and Qualification of Equipment*
24590-WTP-GPG-ENG-0150	*Plant Design/Mechanical Systems Equipment Interfaces: Terminal End Equipment*
24590-WTP-GPG-ENG-033	*Evaluation for Seismic Interaction Effects*
24590-WTP-GPG-ENG-034	*Automation Work Process for Pipe Stress Analysis and Support Design*
24590-WTP-GPG-ENG-039	*Quality Designation & Grading*
24590-WTP-GPG-ENG-086	*Equipment Environmental Qualification*
24590-WTP-GPG-M-013	*Plant Wash System Design*
24590-WTP-GPG-M-052	*Specifying Design Cycles for Equipment and Piping*
24590-WTP-GPG-PL-002	*Plant Design Material Control Guide*
Specifications	
24590-WTP-3DI-P52W-00001	*Seismic Category III/IV Electrical Raceway Support Design*
24590-WTP-3DG-W12S-00001	*Design Guide for ALARA*
24590-WTP-3PS-ADDS-T0001	*Engineering Specification for Steel Doors and Frames 08110*
24590-WTP-3PS-ADDW-T0001	*Engineering Specification for Flush Wood Doors 08211*
24590-WTP-3PS-ADDX-T0001	*Engineering Specification for Severe Weather Door System*
24590-WTP-3PS-ADDZ-T0001	*Engineering Specification for Access Doors and Frames 08311*
24590-WTP-3PS-ADEL-T0001	*Engineering Specification for Aluminum Entrances and Window Systems 08410*
24590-WTP-3PS-ADGG-T0001	*Specification for Glazing 08800*
24590-WTP-3PS-ADHD-T0001	*Engineering Specification for Door Hardware 08711*
24590-WTP-3PS-ADRC-T0001	*Engineering Specification for Vertical and Horizontal Coiling Doors 08331*
24590-WTP-3PS-AEDL-T0001	*Engineering Specification for Loading Dock Equipment 11160*
24590-WTP-3PS-AESP-T0001	*Engineering Specification for Projection Screens 11132*
24590-WTP-3PS-AFBR-T0001	*Engineering Specification for Resilient Wall Base and Accessories 09653*
24590-WTP-3PS-AFFR-T0001	*Engineering Specification for Resilient Floor Tile 09651*
24590-WTP-3PS-AFFV-T0001	*Engineering Specification for Sheet Vinyl Floor Coverings 09652*
24590-WTP-3PS-AFGB-T0001	*Engineering Specification for Gypsum Board Assemblies 09260*

Table 3–4 WTP Design Criteria, Guides and General Specifications Applicable to Lab

Document Number	Title
24590-WTP-3PS-AFGB-T0005	*Engineering Specification for Quality Requirements for Procurement of Fire and Pressure Rated Safety Equipment, Assemblies and Components*
24590-WTP-3PS-AFGW-T0001	*Engineering Specification for Gypsum Board Shaft-Wall Assemblies 09265*
24590-WTP-3PS-AFPS-T0001	*Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*
24590-WTP-3PS-AFPS-T0002	*Engineering Specification for Special Protective Coating Limited-Combustible Testing Protocol*
24590-WTP-3PS-AFPS-T0003	*Engineering Specification for Field Applied Special Protective Coatings for Steel Items and Equipment*
24590-WTP-3PS-AFPS-T0004	*Engineering Specification for Field Applied Special Protective Coatings for Concrete Surfaces*
24590-WTP-3PS-AFPS-T0006	*Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Area*
24590-WTP-3PS-AFPS-T0007	*Engineering Specification for Cold Galvanizing Field Touch-Up/Repair of Steel or Galvanized Steel Items and Equipment*
24590-WTP-3PS-AFTC-T0001	*Engineering Specification for Ceramic Tile 09310*
24590-WTP-3PS-AFWA-T0001	*Engineering Specification for Acoustical Wall Panels 09840*
24590-WTP-3PS-AFWA-T0001	*Engineering Specification for Acoustical Wall Panels 09840*
24590-WTP-3PS-AICK-T0001	*Engineering Specification for Interior Architectural Casework 06402*
24590-WTP-3PS-AIWH-T0001	*Engineering Specification for Horizontal Louver Blinds 12491*
24590-WTP-3PS-ATPW-T0004	*Engineering Specification for Inspection of Factory Foam Insulated Metal Wall Panel System Installation*
24590-WTP-3PS-ATRC-T0001	*Engineering Specification for Thermoplastic Membrane Roofing 07540*
24590-WTP-3PS-ATRY-T0001	*Engineering Specification for Protective Canopies 10530*
24590-WTP-3PS-ATRZ-T0001	*Engineering Specification for Roof Accessories 07720*
24590-WTP-3PS-ATTF-T0001	*Engineering Specification for Sheet Metal Flashing and Trim 07620*
24590-WTP-3PS-ATWF-T0001	*Specification for Bituminous Dampproofing 07115*
24590-WTP-3PS-AWCR-T0001	*Specification for Rough Carpentry 06100*
24590-WTP-3PS-AYAF-T0001	*Engineering Specification for Access Flooring 10270*
24590-WTP-3PS-AYBD-T0001	*Engineering Specification for Visual Display Boards 10100*
24590-WTP-3PS-AYFP-T0001	*Engineering Specification for Fire Protection Specialties 10520*
24590-WTP-3PS-AYML-T0001	*Engineering Specification for Metal Lockers 10505*
24590-WTP-3PS-AYPW-T0001	*Engineering Specification for Wire Mesh Partitions 10605*
24590-WTP-3PS-AYSS-T0001	*Engineering Specification for Architectural Signage 10431*
24590-WTP-3PS-AYTA-T0001	*Engineering Specification for Toilet and Bath Accessories 10801*
24590-WTP-3PS-AYVL-T0001	*Engineering Specification for Louvers and Vents 10200*
24590-WTP-3PS-AYWP-T0001	*Engineering Specification for Impact Resistant Wall Protection 10265*
24590-WTP-3PS-D000-T0001	*Engineering Specification for Concrete Work*
24590-WTP-3PS-DB01-T0001	*Engineering Specification for Furnishing and Delivering Ready-Mix Concrete*
24590-WTP-3PS-DB01-T0002	*Engineering Specification for Furnishing and Delivering Ready Mix Lightweight Concrete*

Table 3–4 WTP Design Criteria, Guides and General Specifications Applicable to Lab

Document Number	Title
24590-WTP-3PS-DD00-T0001	*Engineering Specification for Purchase of Standard and Non-Standard Embedded Steel Items*
24590-WTP-3PS-DG00-T0001	*Engineering Specification for Furnishing of Reinforcing Steel*
24590-WTP-3PS-F000-T0001	*Engineering Specification for Q Bulk Fasteners*
24590-WTP-3PS-F000-T0002	*Engineering Specification for Fastener Torque and Tensioning*
24590-WTP-3PS-FA01-T0001	*Engineering Specification for Furnishing of Anchor Bolts (Rods)*
24590-WTP-3PS-FA02-T0001	*Engineering Specification for Purchase of Post Installed Concrete Anchors for Non-Important to Safety (Non-ITS) Applications*
24590-WTP-3PS-FA02-T0002	*Engineering Specification for Purchase of Post Installed Concrete Anchors for Important to Safety (ITS) Application*
24590-WTP-3PS-FA02-T0003	*Engineering Specification for Design of Posted Installed Concrete Anchors for CM Applications*
24590-WTP-3PS-FA02-T0004	*Engineering Specification for Installation and Testing of Post Installed Concrete Anchors and Drilling/Coring of Concrete*
24590-WTP-3PS-FA02-T0005	*Engineering Specification for Design of Post Installed Concrete Anchors for Q Applications*
24590-WTP-3PS-FB01-T0001	*Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks*
24590-WTP-3PS-G000-T0014	*Engineering Specification for Supplier Design Analysis*
24590-WTP-3PS-G000-T0045	*Engineering Specification for Supplier Design Analysis With Developed Software*
24590-WTP-3PS-MJKH-T0001	*Engineering Specification for Commercial Quality Monorail Hoists, Jib Cranes and Under-Running Single Girder Cranes*
24590-WTP-3PS-MX00-T0002	*Engineering Specification for Shielded Glass Windows*
24590-WTP-3PS-NLLR-T0002	*Engineering Specification for Furnishing, Detailing, Fabrication, Delivery and Installation of Stainless Steel Liner Plates*
24590-WTP-3PS-SS00-T0001	*Engineering Specification for Welding of Structural Carbon Steel*
24590-WTP-3PS-SS00-T0002	*Engineering Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*
24590-WTP-3PS-SS00-T0005	*Engineering Specification for Thermite Welding of Rails*
24590-WTP-3PS-SS01-T0001	*Engineering Specification for Purchase of Miscellaneous Steel*
24590-WTP-3PS-SS01-T0002	*Engineering Specification for Purchase of Structural Steel*
24590-WTP-3PS-SS02-T0001	*Engineering Specification for Erection of Structural Steel*
24590-WTP-3PS-SS25-T0001	*Engineering Specification for Purchase of Steel Deck*
24590-WTP-3PS-SS25-T0002	*Engineering Specification for Purchase of Steel Roof Deck*
24590-WTP-3PS-SY00-T0001	*Engineering Specification for Purchase of Standard Struts, Fittings and Accessories*

4 System Description

This section summarizes design output information, describing the current design and the operational and maintenance aspects of the system. The information provided below does not contain design requirements and should not be used as design input. The description of the current design contained in this section may not fully align with design requirements. This is acceptable within the context of this document. Areas of misalignment are to be resolved through appropriate mechanisms and the FDD updated to reflect changes made to the design. Changes to the descriptive text will be made following the changes to the lower tiered Engineering documents.

4.1 Configuration Information

Note: The process conditions that are described in here are nominal operating parameters (unless otherwise noted) to provide the necessary context for description of system, subsystems and major components. The nominal operating parameters are not to be used directly for input to the design or design analysis of safety functions related to structures, systems, or components.

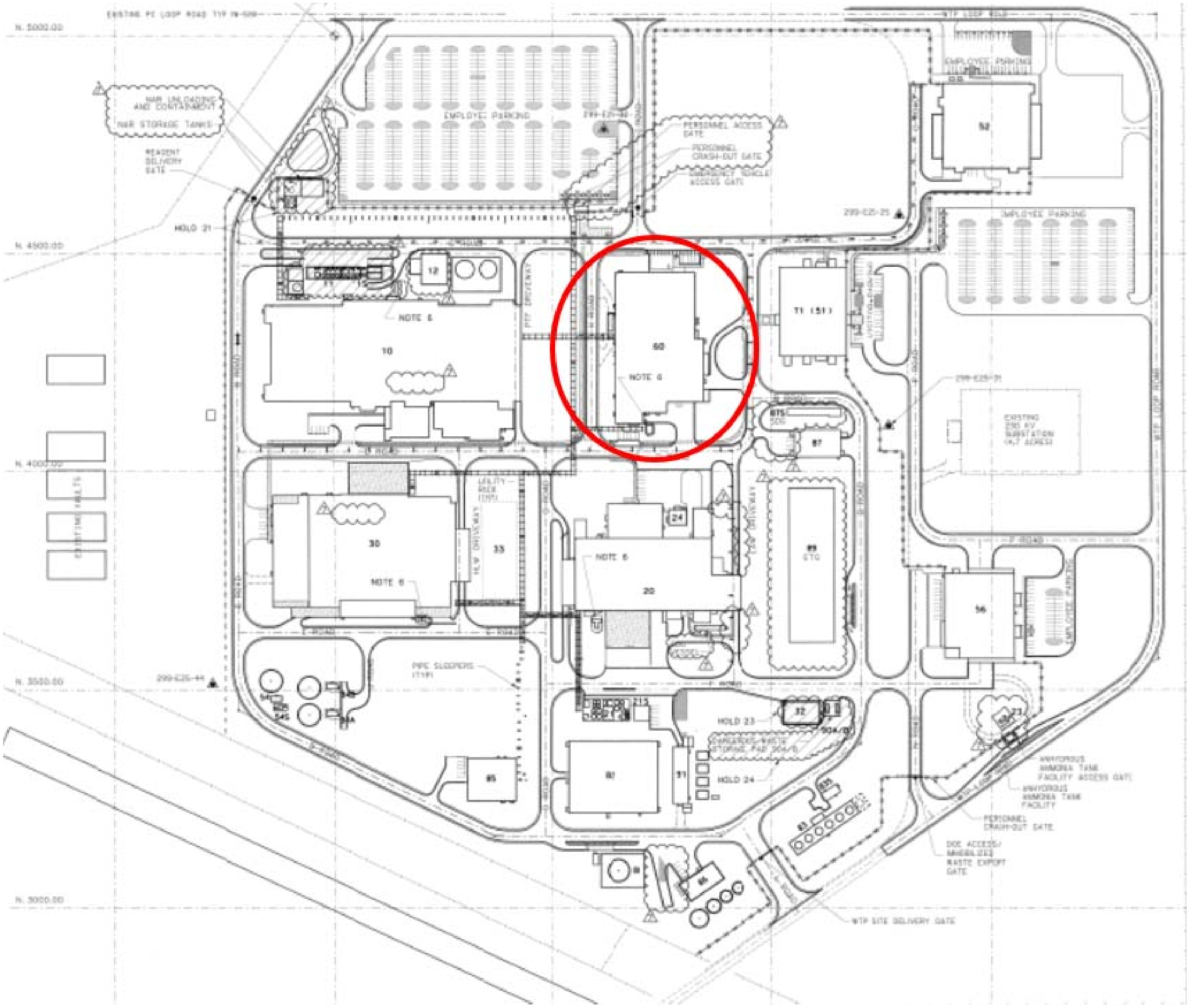
This section summarizes the description of the Analytical Laboratory Facility (Lab) including summary level description of the structures, systems, and components along with a description of the facility layout and location, boundaries, and interfaces with other SSCs.

The Lab (Building 60) is in the WTP complex as shown in Figure 4-1. The function of the Lab is to support WTP production by performing analytical functions including support process control, perform waste form qualification testing, conduct environmental analysis, and provide limited technology testing. While providing support, the Lab facility must prevent and/or mitigate the release of hazardous material, limit personnel exposure to hazards, and manage secondary solid and liquid waste. The Lab design incorporates features and capabilities necessary to ensure efficient WTP operations and support permitting, process control, authorization bases, and waste form qualification requirements. [3.4.2]

The Lab houses the AHL for high-level radioactive sample handling and analysis and the ARL for low-level radioactive sample handling and analysis in support of WTP production. Samples having low levels of radioactivity may be out-sourced to a supporting laboratory. Non-process samples, such as secondary waste samples, will also be out-sourced to a supporting laboratory. The AHL and the ARL areas are supported by various systems including an automated and manual transport of samples, mechanical handling equipment, LIMS, maintenance shops, waste management areas, and administrative areas.

The Lab is designed for nominal plant life of 40 years. The process systems, piping vessels, and equipment provide the primary confinement of hazardous radioactive and chemical materials. The facility structure, including the ventilation systems, provides secondary confinement of airborne releases and containment of liquid releases. Equipment within the Lab is designed to minimize the potential for contamination, which aids in maintenance and facility decommissioning.

Figure 4–1 WTP Plot Plan - Analytical Laboratory Building 60



4.1.1 Description of System, Subsystems, and Major Components

This section describes the Lab but does not cover details related to specific systems within the Lab facility which are covered under their own system descriptions or system design descriptions. As illustrated in Figure 2-2, the scope of this document is limited to describing the Lab facility features that support production and/or protect equipment, personnel, and the environment not otherwise addressed in system descriptions or system design descriptions.

The Lab has six main functional areas: administrative areas, support areas (utilities), AHL/LIH, ARL, maintenance areas, and waste management areas (Radioactive Liquid Waste Disposal [RLD] and Radioactive Solid Waste Handling [RWH]).

4.1.1.1 Analytical Laboratory Structures Description

The Lab facility incorporates features and the capability necessary to support production, prevent and/or mitigate the release of hazardous materials, limit personnel exposure to hazardous areas and equipment, manage secondary solids waste, and meet regulatory requirements and standards. The facility provides protection for the on-site worker and off-site person from radiological and chemical hazards; protection from industrial hazards; and protection for the environment.

The Lab building is a two-story steel frame and concrete structure above-grade building with below-grade floors that house effluent vessels and vessel cells, including a fire water vault. The building dimensions are approximately 345 feet on the longest side, approximately 199 feet on the widest side, and the peak is about 42 feet high. At grade level, the building houses operating and equipment rooms, including hotcells, analytical radiological laboratories, maintenance shops, administrative offices, and support areas. The building grade level dimensional details are illustrated in Figure 4-2. A partial second floor houses additional ventilation, utility, and other equipment. The Lab exhaust stack and structure is located at the north end of this building. The top of the stack is at about +118 feet elevation. The Lab is designed for nominal plant life of 40 years.

The Lab facility is designed to limit the spread of contamination, facilitate decontamination, and minimize the dose to the facility worker, and minimize generation of wastes. The Lab building roof, walls, floors, anchors, and liners help prevent or mitigate the release of hazardous materials including radioactive air emissions, dangerous waste spills and emissions, dangerous waste effluents, and wastewater discharges. The exterior Lab walls are steel frame construction with metal siding and roofing. Most interior walls are steel framed dry wall construction; where shielding is required, walls are poured-in-place concrete. The hotcells are constructed of cast-in-place concrete with various penetrations to allow for operations. The at-grade floor slab and RLD pits are constructed of cast-in-place concrete.

The building structure and envelope and the confinement system are designed to maintain radiation exposure in controlled areas ALARA through engineered and administrative controls. Confinement, ventilation, remote handling, and shielding are the primary control methods used in the Lab facility. Lab structure (including structural concrete and steel components of the base mat) and hotcell structures (including through-wall devices and glove boxes), in conjunction with their respective ventilation systems and penetration seals, provide confinement and shielding to maintain radiation exposure in controlled areas ALARA for facility workers. Continuous Air Monitors and area radiation monitor are placed in the Radiological Controlled Areas to monitor the potential for personnel exposures.

The Lab is divided into numbered radiation and contamination zones. Areas within the Lab are classified based on their potential for contamination, as well as the anticipated contamination levels. Each area is identified as Rx/Cy, with the zone number being x or y. Airlocks serve as sub-change rooms and control personnel movement between clean and regulated areas to reduce potential contamination of clean areas.

In areas where the need for decontamination is anticipated, exposed surfaces are coated or lined as necessary to provide durability and ease of decontamination. Hotcells, vessel cells, and pump and pipe pits are partially stainless steel lined. The floor slab has embedded coaxial piping to support facility operations. Concrete floor surfaces are coated as necessary for durability and ease of decontamination. Special protective coatings (SPCs) are used in work areas where personnel exposure to radiation and radioactive materials is managed and controlled at levels ALARA by employing SPCs. Typically, this includes C2 area floors, C3, and potentially occupied C5 areas (floors, walls, ceilings and various commodities) up to 7.5 feet above the floor finish or platform and reachable surfaces within 40 inches of the "Work Area". Work area is defined as the physical area of the facility that operations personnel can encounter contaminated surfaces of the building structure or commodities therein.

4.1.1.2 Administrative Areas

The administrative area houses the personnel and administrative support functions. This area encompasses the programmed areas of management offices, general offices area, telephone and controls rooms, LIMS Room, and conference room. These offices/rooms are classified as C1/R1 because dose rates are low, and there's low potential for contamination. [3.8.5.5]

This area also includes change rooms, rad control offices, and a Personnel Protective Equipment (PPE) Room. These offices/rooms are classified as C1/R1 because dose rates are low, and there's low potential for contamination. [3.8.5.3, 3.8.5.6] A decontamination room is also part of the administrative area and provides space and equipment where contaminated personnel are decontaminated. The floor is concrete with special epoxy protective coating. Shower and sink drains are routed to the Lab RLD systems. This room is classified as C2/R2 because dose rates are low, and there's low potential for contamination. [3.8.5.6]

4.1.1.3 Support Areas (Utilities)

The support areas are located throughout the facility. Support areas house HVAC, ASX vacuum pumps, electrical and control cabinets, and other utilities.

4.1.1.3.1 HVAC

The Lab HVAC system is designed as a low-airflow confinement ventilation system. All fans and filters of the HVAC systems are housed throughout the Lab facility. The HVAC systems provide conditioned air to each area of the building, with different contamination areas and subsystems. The HVAC ventilation systems are segmented into four subsystems. The subsystems are classified by nuclear confinement zones C1, C2, C3, and C5 to establish a hierarchy for pressure control and decrease in potential spread of contamination. The facility control philosophy uses a cascading ventilation system wherein air cascades from areas of less potential for contamination to areas of greater potential for contamination, to provide confinement of contamination at or near the source. See 24590-LAB-3ZD-60-00002, *Analytical Laboratory Ventilation System Design Description*, for more details.

4.1.1.3.2 Auto Sampling System Vacuum Pump Room (A-0172A)

The ASX vacuum pump room houses the ASX vacuum pumps (ASX-PMP-0001A/B and 00005A/B) and filters, and the ASX Carrier Receipt and Dispatch fume hood (ASX-SMPLR-00047). The hood provides a controlled area to open, survey and decon carriers prior to reusing them. The room is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.1.3.3 Liquid Gas Storage

Two bulk liquid argon storage tanks (BAG-VSL-00001 and 00002) and one bulk liquid nitrogen storage tank (BNG-VSL-00001) are located outdoors on the east side of the Lab building. These tanks receive liquid argon and nitrogen from delivery trucks from the cryogenic supplier and provide a 14-day supply of argon and nitrogen to the rad labs.

4.1.1.3.4 Gas Bottle Area (A-0177)

The gas bottle area is located outdoors on the south end of the facility in a fenced and roofed area to protect from vehicular damage and prevent accumulation of gases in the event of a leak. The bottled helium gas (BHG) system gas cylinders are stored in two separate banks (BHG-RK-00001) to provide a 14-day supply of helium gas. The miscellaneous gas system (MXG) is (90% argon and 10% methane), is received in pressurized cylinders, and arranged with two banks (MXG-RK-00004). The BSA backup air supply rack (BSA-RK-00048) is also in this area. This storage area is classified as C1/R1 because dose rates are low, and there's low potential for contamination.

4.1.1.4 Description of the AHL and LIH Systems and Major Components (A-0141 through A-0156)

This section describes the major features and components of the AHL and LIH systems that are required for the hotcell system to perform its functions. The function of the AHL is to analyze process samples from the WTP PT and HLW Melter facilities. These samples are taken by the auto-sampling system and delivered to the sample receiving hotcell by a pneumatic transfer system (ASX). High activity samples can also be delivered manually by introduction to the hotcell system via the hotcell import fume hood or transfer tray on the south end of the hotcell. After arrival in HC1, these samples are analyzed per approved analytical operating procedures with analytical equipment available in the hotcells. The analytical equipment used to perform the analytical functions is described in the System Description for the Analytical Hotcell Laboratory, 24590-LAB-3YD-AHL-00001. LIH provides the handling equipment and items required to remotely perform the operational and maintenance tasks within the Analytical Laboratory hotcells. The equipment used to perform material movement in the hotcell is described in 24590-LAB-3YD-LIH-00001, *System Description for Laboratory In-Cell Handling System*.

The analytical hotcell facility is a concrete structure designed to minimize the radiation dose of personnel at the workstations to within ALARA guidelines. The shielding is designed to meet the R2 target dose rate of 0.25 mRem/hr. for the normally occupied work areas outside the hotcells. Within the concrete structure, there are 14 individual hot cells divided by partial or full height ¼" partition walls. Analytical activities within the structure are performed remotely with master slave manipulators while viewing operations through windows sealed into the walls of the structure provided by the LIH system. Each analytical instrument may have components inside the hotcell shielding wall, with controller/readout device outside the wall. A signal and/or electrical connection passes through joggles in the hotcell wall for each instrument. Wherever possible, components are installed outside the hotcell. By installing equipment outside of the cell, the volume of highly contaminated solid waste will be reduced, reducing the cost and improving ease of replacement of the equipment located inside the hotcell. Electronic components, exterior to the hotcells, can be contact maintained. A LIMS is provided to track and maintain an inventory of samples in the Laboratory area. Barcode readers are provided in each hotcell and a computer workstation is provided to input and retrieve data from the LIMS. LIMS also processes analytical results.

The laboratory hot cell is split into two process lines by partition walls and a central hot cell transfer trolley (LIH). Each process line is serviced by an overhead monorail system. The individual hot cells are made up of the large sample receipt (HC1) and waste export cell (HC14) and 12 analytical hot cells (6 on each side of the transfer trolley), as shown in Figure 4-3. The LIH MSM equipment provides the capability to manipulate, operate, handle, repair, move, or remove the equipment for the AHL. In HC1, the MSMs are used to retrieve samples received from the ASX and from the LIH import transfer ports, and to transfer aliquot samples to the LIH export transfer port glovebox (LIH-GB-00001) for the ARL Sample Receipt Laboratory. The trolleys are used to transport material from one cell to another. A monorail hoist is dedicated to each hot cell row to accommodate removal or insertion of larger equipment items.

Hotcells are partially lined with stainless steel suitable to withstand corrosive environment of samples and reagents used in analyses and decontamination [3.6.2.4]. Each hotcell is protected from fire by an auto-suppression system. The floors of each hotcell slope to the liquid waste drain (RLD system) for containment of spills and disposal of liquid wastes. A water supply with an air gap at the RLD drain is provided in each hotcell for flushing liquid waste drain system after each disposal event. The hotcells have wash down capabilities to aid decontamination and deactivation of the stainless steel lined areas. [3.6.2.2]

Solid waste generated in the AHL is placed in one-gallon paint cans. The one-gallon paint cans are transported between hot cells to the export hot cell (HC14) for collection, segregation, packaging, and preparation for removal through the drum out port attached to the floor of the hotcell (HC14). [3.6.3.10.1] The bagless drum out port (RWH-HTCH-00026) is part of the RWH system. After waste is loaded into the drum, the drum is disconnected from the port and moved to the maintenance access room. This room is primarily used as a C3 buffer during transfer of waste and materials into, or out of, the waste cell. It is also the dedicated space for introducing replacement in-cell monorail hoists which are run to failure items. The waste drum is transported to the Lab RWH drum handling area through the adjoining airlock. The airlock is used to aid in contamination control between the C3 cell maintenance area and the surrounding C2 area (A-0156).

The hot-cells are classified as C5/R5 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information). The hotcell bay is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.1.5 Description of the ARL System and Major Components (A-0122 through A-0133)

This section describes the major features and components of the analytical radiological lab that are required to perform its functions. The function of the ARL is to analyze samples from the LAW facility. Process samples from, the LAW facility, are transported by the ASX system to the radiological laboratory receipt station located in radiological laboratory (RL 1). Sample aliquots are also received from the AHL after reduction of the radiological dose rate to a level consistent with ALARA.

The ARL consists of equipment in thirteen laboratory rooms as depicted in Figure 4-4. The scope of the ARL consists of the function and operation of fume hoods, sample storage cabinets, and description of equipment layout in the RL 1-13. The analytical equipment used to perform the analytical functions is described in 24590-LAB-3YD-ARL-00001, *System Description for the Analytical Radiological Laboratory*.

Analytical work involving samples containing radionuclides or hazardous materials is performed in fume hoods constructed of corrosion resistant materials. A LIMS is provided to track and maintain an inventory of samples in the Laboratory area. Airflow is maintained across the face of the fume hood via the C3 ventilation system (C3V), with a minimum volumetric flow rate of 100 feet per minute (minimum) through a single open door on the airflow required to maintain space temperature conditions. The capture velocity of emissions at the fume hood face should be in the range from 80 to 120 feet per minute (Section 12.2.4, American Society for Testing and Materials (ASTM) E 2014). Each fume hood has a fire auto-suppression system installed (fire detection and alarm system (FDE), FPW, FSW). Room air near workstations is sampled using record air samplers (RAS); these filters are periodically analyzed for radionuclide concentrations.

Each fume hood, except ASX sample receipt station (ASX-AMPLR-00034), contains a corrosion resistant cup sink and drain system for disposal of liquid wastes to the RLD. Drip pans are provided as secondary containment and leak detection for cup sink drain lines. For a complete description of the secondary containment and leak detection associated with the ARL, see 24590-LAB-3ZD-RLD-00001, *Lab Radioactive Liquid Waste Disposal (RLD) System Design Description*.

Secondary solid wastes (solid, organic liquids) generated in fume hoods are accumulated and managed in satellite accumulation drums in each of the ARL laboratories. [3.6.3.9] Wastes are segregated by waste type. When satellite accumulation containers are full, they are transferred to the Laboratory Waste Drum Management Area (RWH).

4.1.1.6 Maintenance Areas

In support of the Lab mission, two areas are provided dedicated to equipment maintenance. The C2 Maintenance shop provides space for the maintenance/repair of equipment that is not expected to be radioactively contaminated. The C3 maintenance shop provides space to decontaminate, maintain, and store radioactively contaminated equipment.

4.1.1.6.1 C2 Maintenance Shop (A-0172)

This section describes the major features and components of the laboratory C2 maintenance shop that are required for the laboratory to perform its functions. [3.8.5.8] The function of the C2 Maintenance shop is to provide space for the maintenance/repair of equipment that is not expected to be radioactively contaminated and is ventilated to the C2 ventilation system. The electrical maintenance shop provides space for motor run tests and storage of test equipment. A list of other equipment present in the C2 maintenance shop is listed in section 4.1.3.5.1.

The C2 maintenance shop is sized to allow maintenance/repair on the largest size equipment. Space is provided for storage, utilities, a welding shop, an electrical shop, a mechanical shop, and computer stations. The C2 maintenance shop floor is concrete with special protective coating. The C2 maintenance shop is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.1.6.2 C3 Maintenance Shop (A-0141A/B/C/D)

This section describes the major features and components of the laboratory C3 maintenance shop that are required for the laboratory to perform its functions. [3.8.5.9] The function of the C3 maintenance shop is to provide space to decontaminate, maintain, and store contaminated equipment that are designed to be changed out during their operating life, such as hotcell manipulators.

The C3 maintenance shop airlock (A-0141A) is used to control ventilation while bringing in large pieces of equipment, and can also serve as a subchange room during normal access. Large pieces of equipment removed from the hotcells, especially manipulators, require decontamination prior to repair. The equipment will be brought through the airlock into the C3 maintenance shop maintenance glovebox (60-MHAN-0003). This glovebox is equipped with pressurized water and CO_2 for decontamination and a backdraft damper to prevent the backflow of the contamination in the event of a loss of the C5 ventilation fans. The decontamination glovebox generated liquids will drain to the hotcell collection vessel (RLD-VSL-00165). The glovebox is also attached to the CO_2 decontamination blast unit (60-MAINT-00001) to supply CO_2 pellets used to decontaminate equipment. The decontamination glovebox vents to C5V. The C3 maintenance shop Monorail Hoist (60-HST-00002) and Decon Glovebox Monorail Hoist (60-HST-00003) are used to move equipment within the C3 maintenance shop. A list of other equipment present in the C3 maintenance shop is listed in section 4.1.3.5.2.

Concrete walls are used around the C3 maintenance shop to provide shielding. The C3 maintenance shop is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.1.7 Waste Management

This section describes the major features and components of the laboratory waste management areas that are required for the laboratory to perform its functions. The function of the waste management area is to manage solid and liquid waste in accordance with permits.

4.1.1.7.1 Liquid Waste

This section describes the major features and components of the Lab RLD that are required for the laboratory to perform its functions. The function of the liquid waste management area is to manage waste in accordance with permits. The equipment and process used to manage liquid waste is described in 24590-LAB-3ZD-RLD-00001, *Lab Radioactive Liquid Waste Disposal (RLD) System Design Description*.

The Lab RLD system encompasses vessels, instrumentation, pumps, valves, mixers, transfer pump pits, piping pits, cells, and other ancillary equipment associated with the collection and transfer of liquid found within the Analytical Laboratories. The functional purpose is to collect the liquid effluents for interim storage before transferring the effluents to the PT Facility plant wash vessel for further processing or the NLD system in the balance of facilities (BOF).

The Lab RLD system is divided into three distinct subsystems per the radiological classification of the areas within the Laboratory they serve. The subsystems include the floor drain collection subsystem (C2), the sink drain collection subsystem (C3), and the hotcell drain collection subsystem (C5). Various operations such as collecting, storing, mixing, and sampling of the effluents are performed in the subsystems, as required.

The vessels, instrumentation, pumps, valves, mixers, and other ancillary equipment associated are housed in below grade cells. All three vessel cells are sized to accommodate the volume of the associated vessel, the associated vessel piping, and the associated fire protection water overflow volume. Each cell contains a dry, stainless steel sump that is embedded in the floor of the cell. Each cell sump collects vessel overflow or leakage from the associated vessel and associated ancillary equipment piping as a part of the secondary containment system. The cell sumps also collect liquid from periodic wash down of the cells. Liquid level in each sump is monitored with a radar level instrument to detect a leak into the respective cell area.

The cells are lined with stainless steel to facilitate decontamination and have wash down capabilities to aid decontamination and deactivation of the stainless steel lined areas. [3.6.2.2, 3.6.2.4] The secondary containment liner is designed to prevent run-on or infiltration into the containment system. The liners are free of cracks or gaps in accordance with WAC 173-303-640[4] [e][i][C]. All joints have chemical-resistant water stops. (Reference: 24590-WTP-3PS-AFPS-T0006, *Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Area*). The secondary containment system is constructed of materials that are compatible with the wastes managed in the Lab facility and is of sufficient strength and thickness to prevent collapse under the pressure exerted by overlaying materials and by any equipment used in the facility. [3.6.3.5.1.4]

Liquid collected from the C2 or C3 vessel cells are transferred to the C5 vessel as the primary destination. It can also be sent to the C3 vessel, recycled back to the C2 vessel, or sent to NLD-TK-00001, if uncontaminated. Effluent from the C5 vessel cell is transferred to PTF-PWD-VSL-00044. The floors of the cells are sloped to direct potential leakage occurring within the cell to their respective sumps. A minimum of 1% floor slope toward the sump is provided. The design of these cells and sumps are illustrated in drawing 24590-LAB-DB-S13T-00019, *Analytical Laboratory C5 Cell Structural Concrete Forming Sections and Details* and drawing 24590-LAB-DB-S13T-00020, *Analytical Laboratory C2 Vault and C3 Cell Structural Concrete Forming Plans and Sections*. The cells and sumps are constructed of material that is compatible with the waste to be placed in the Lab RLD tank system.

4.1.1.7.1.1 C2 Fire Protection Water Vault (A-B001), C2 Vessel Pump Platform (AP-B001)

The C2 fire protection water vault houses the floor drain collection vessel (RLD-VSL-00163) and the floor drain collection vessel pumps (RLD-PMP-00190A/B).

Although this C2 vessel is identified as part of the RLD system, it is not designed and permitted to manage dangerous wastes.

The vessel pumps (RLD-PMP-00190A/B) are housed in the C2 vault on a maintenance platform and recirculate the contents of RLD-VSL-00163 and empty the liquid collected in this vessel. Two ladders are provided for access to the pumps, instrumentation, and electrical components on this platform. This maintenance platform is designed to meet both the requirements set forth in WAC 296-24 and AISC M016-1989, *Manual of Steel Construction, Allowable Stress Design, and Ninth Edition.*

Liquid in this cell drains into sump RLD-SUMP-00040. The nominal capacity of this sump is 30 gallons, as shown in document 24590-LAB-PER-M-02-002, *Sump Data for Lab Facility*. Since this sump serves a non-DWP regulated vessel, it is emptied to meet operational needs. A wash station is provided to support maintenance activities and facilitates in-cell cleaning and periodic decontamination.

This cell and vessel RLD-VSL-00163 are vented to the C2V system and this area is classified as R2/C2 because dose rates are low, and there's low potential for contamination.

4.1.1.7.1.2 C3 Effluent Vessel Cell (A-B003)

The C3 effluent vessel cell is a stainless steel lined, rectangular cell that houses the laboratory sink drain collection vessel (RLD-VSL-00164) and provides secondary containment for this dangerous waste vessel. The C3 effluent vessel collects, by gravity flow, effluents and other inflows from the radiological laboratory fume hood sinks, radiological laboratory sinks, maintenance area floor drains, pump maintenance room drains, hotcell maintenance access area floor drains, personnel decontamination showers and sinks, process vacuum system equipment drains, and a maintenance area sink. These sources of influent are located at grade level. In addition, the C3 effluent vessel receives liquid transfers from floor drain collection vessel (RLD-VSL-00163) and sump drain flows from the C3 pump pit (A-B002). This vessel system and the ancillary equipment designs are in accordance with WAC 173-303-640 and are in the Lab RLD system. The waste removal capacity of this cell is within the 24-hour period required by the regulations and stipulated by Dangerous Waste Permit Number WA 7890008967, Permit Condition III.IO.E.9.e.iii.

The floor and walls of this cell are part of the base mat structure and are 3-ft thick concrete. The floor and the perimeter walls (approximately 5 ft. above the floor) are covered by a 304L stainless steel liner compatible with the waste. This secondary containment liner is installed within the concrete vessel cell, and is used to contain a potential spill or leak of dangerous waste in the event of a pipe break or vessel leak. The liner height is designed to handle the volume of fire protection water from the fire protection system applied over the minimum sprinkler design area for a period of 20 minutes in addition to the 100% capacity of the largest tank, in accordance with Uniform Building Code, 307.2.4, 1997. (Reference: 24590-LAB-PER-M-02-001, *Dangerous Waste Permit (DWP) Liner Heights in the Lab Facility*.) The walls above the liner and ceiling are concrete with no applied finish.

Liquid in this cell drains into sump RLD-SUMP-00041. The nominal capacity of this sump is approximately 30 gallons as shown in document 24590-LAB-PER-M-02-002, *Sump Data for Lab Facility*. The sump is provided with a radar level instrument for leak detection. Wash rings are provided to facilitate waste removal, in-cell cleaning, and periodic decontamination for the stainless steel lined portion of the cell. [3.6.2.2, 3.6.2.4]

This C3 cell sump is scheduled for integrity assessment every 10 years (24590-WTP-PER-M-08-001, *Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Analytical Laboratory and LAW Facility*).

Supply air cascades to the cell area through an in-bleed and high efficiency particulate air (HEPA) filter from filter fan Room 3 (A-0160) (C2/R2) and is exhausted by the C5 ventilation system. The room is classified C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.1.7.1.3 C5 Effluent Vessel Cell (A-B004)

This cell is a stainless steel lined, rectangular cell that houses the hotcell drain collection vessel (RLD-VSL-00165) and provides secondary containment for this dangerous waste vessel. The C5 vessel collects, by gravity flow, effluents and other inflows from laboratory hotcell floor drains, hotcell cup sinks, hotcell transfer drawer drains, hotcell transfer glovebox drains, autosampling system drains, and a maintenance decontamination glovebox drain. In addition, the vessel receives effluent transfers from the previously described C3 vessel (RLD-VSL-00164), floor drain collection vessel (RLD-VSL-00163), and sump drain flows from the C5 pump pits (A-

B005 and A-B007) and C5 piping pit (A-B006). The waste removal capacity of this cell is within the 24-hour period required by the regulations and stipulated by Dangerous Waste Permit Number WA 7890008967, Permit Condition III.IO.E.9.e.iii. The calculated values are based on consideration of the maximum operating volume of a single vessel in its respective cell, plus the maximum anticipated volume of fire protection water that is postulated to accumulate in these cells. (Reference: 24590-LAB-PER-M-04-0002, *Lab Waste Removal Capability for the Effluent Vessel Cells*.)

The floor and the perimeter walls (approximately 4 ft. above the floor) are covered by a 304L stainless steel liner compatible with the waste. This secondary containment liner is installed within the concrete vessel cell, and is used to contain a potential spill or leak of dangerous waste in the event of a pipe break or vessel leak. The liner is designed to handle the volume of fire protection water from the fire protection system applied over the minimum sprinkler design area for a period of 20 minutes, in addition to the 100% capacity of the largest tank in accordance with Uniform Building Code, 307.2.4, 1997. (Reference: 24590-LAB-PER-M-02-001, *Dangerous Waste Permit (DWP) Liner Heights in the Lab Facility*.) The walls above the overflow volume and ceiling are concrete with no applied finish.

Liquid in this cell drains into sump RLD-SUMP-00042. The nominal capacity of this sump is 30 gallons, as shown in document 24590-LAB-PER-M-02-002, *Sump Data for Lab Facility*. The sump is provided with a radar level sensor for leak detection. This C5 cell sump is scheduled for integrity assessment every 10 years (24590-WTP-PER-M-08-001, *Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Analytical Laboratory and LAW Facility*).

Wash rings are provided to facilitate in-cell cleaning and periodic decontamination for the portion of the cell that is lined with stainless steel. Sloped floor, sump, and sump pump provide liquid collection and removal. These features are shown in C5 cells, pump pits, and valve pit drawings 24590-LAB-M6-RLD-00002001, 24590-LAB-M6-RLD-00002002, and 24590-LAB-M6-RLD-00002003.

The ceiling of the cell is the concrete structure that provides the shielding. The pump pits and valve pit are separated (shielded) from each other and vessel 165 to allow for maintenance. This cell and the ventilation system form the secondary confinement barrier against the release of radiological materials. Supply air cascades to the cell area through in-bleeds and high-efficiency particulate air HEPA filters from the C5 pump maintenance room and is exhausted by the C5 exhaust ventilation system. This cell is SS and is classified as C5/R5 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.1.7.1.4 RLD Pits and Pit Sumps (A-B002, A-B005, A-B006, and A-B007)

There are four pits below grade that confine leaks or releases from pumps, valves, or piping within the cells in the Lab. These pits are structural compartments that house maintainable equipment in segregated locations where the equipment is readily accessible for maintenance and remote manual operation. These pits provide secondary containment and access for anticipated maintenance activities. Each pit contains a sump embedded in the floors of the pit, for the collection of pump and valve leakage as a part of the secondary containment system. Sump capacities range from approximately 1.4 to 1.6 gallons as shown in Calculation 24590-LAB-M6C-RLD-00027, *Lab Minimum Leak Rate, Detection Capabilities for Cell Sumps, Pit Sumps, and Leak Detection Boxes*.

- C5 pump pit (north) (Room A-B005) is located above room A-B004. This pit houses the hotcell drain collection vessel pump RLD-PMP-00183B and sump RLD-SUMP-00043B. This pit is classified as R5/R3/C5/C3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).
- C5 pump pit (south) (Room A-B007) is located above room A-B004. This pit houses the hotcell drain collection vessel pump RLD-PMP-00183A and sump RLD-SUMP-00043A. This pit is classified as R5/R3/C5/C3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

- C5 piping pit (Room A-B006) is located above room A-B004. This pit contains RLD-SUMP-00044. This pit is classified as R5/R3/C5/C3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).
- C3 pump pit (Room A-B002) is located above room A-B003. This pit houses the laboratory sink drain collection vessel pumps (RLD-PMP-00182A/B) and sump RLD-SUMP-00045. This pit is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

Each pit is stainless steel lined. The floor is designed to withstand an impact from the bounding crane load drop. The floor of each pit is sloped to direct potential leakage occurring within the pit to their respective drain. A minimum of 1% slope toward the sump is provided. Each sump is formed by a local depression in the stainless-steel floor liner. Each sump is provided with a radar level sensor for leak detection. Each sump drain is equipped with a removable weir. The weir allows a detectable liquid level to accumulate in the sump so that the level detection instrumentation can sense potential leaks. The weir drains overflow to the vessel below.

Each pit has a pit cover to allow access by removing the pit covers. The concrete pit and covers provide confinement and shielding during normal operation to protect the facility worker. The pit covers for the C5 pits are carbon steel with special protective coatings. The pit covers have reach rods extending through them to raise the sump weirs and to operate the valves in the valve pits. The openings for the reach rods have shield covers that can be removed to access specific valves for maintenance. The pit cover for the C3 pump pit consists of a few removable panels designed to remain within the lifting weight of the available forklift capacity. Many actuator and hand wheels are mounted to the covers.

4.1.1.7.2 Waste Drum Management Areas (A-0139, A-0139A/B/C/D)

This section describes the major features and components of the laboratory solid waste management areas that are required for the laboratory to perform its functions. The function of the solid waste management area is to manage waste in accordance with permits. The solid waste management equipment and operation are described in detail in 24590-WTP-3YD-RWH-00001, *System Description for the WTP RWH Radioactive Solid Waste Handling*.

The waste drum management areas are used for the packaging, handling, volume reduction, and storage of secondary wastes generated in the Lab. Dangerous and non-radioactive dangerous wastes generated in the Lab are managed and stored in designated areas. [3.6.3.10.2] Dangerous waste storage areas are provided in the waste accumulation areas where wastes are segregated. [3.6.3.10.1] Storage areas are designed with a minimum 30 inches of separation between rows of dangerous waste containers with rows no more than two drums wide. The containers and storage areas are designed so drums can be visually inspected. [3.6.3.9.1, 3.6.3.9.2, 3.6.3.9.3] Space is also provided for weather-protected storage for low-level waste in cardboard cartons. The container storage areas and containment systems are constructed and operated to protect containers from contact with accumulated liquids (e.g., leaks, spills, precipitation and fire protection water, liquids from damaged or broken pipes). The bases of containment storage areas are sloped to drain and removed liquids resulting from leaks, spills, or precipitation unless the containers are elevated or protected from contact with accumulated liquids. [3.6.3.9.4] The waste drum area is classified as C2/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

In addition to storage, the waste management area has rooms for lab packing (A-0139A) and volume reduction (A-0139C). These areas are separated for the storage areas by an airlock (A-0139B). The Lab pack room houses equipment for packaging of organic or chemical wastes and Lab pack wastes generated in the ARL areas. The room houses a walk-in fume hood (RWH-HOOD-00085) that provides contamination control while packaging Lab packs and re-packing drummed secondary waste. This room is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

The volume reduction area houses equipment for waste minimization. Waste minimization is achieved using an in-drum compaction unit (RWH-CMP-00003) designed to reduce the volume of low activity wastes generated in the Lab by compacting the waste inside a 55-gallon drum. This room is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

The airlock separates the main waste drum storage area, the lab pack area, and volume reduction area. It is used primarily to control ventilation in these areas. It can also be used as a subchange area to support entries into these areas. Due to storage area background levels, a hand frisker is used to perform personnel surveys prior to their exit to the C2 waste handling areas. Personnel exiting the waste area will go through the PCM in the adjacent hallway.

The exterior walls of the waste drum management areas are constructed of reinforced concrete and the entire floor area of the waste drum area is coated with a special protective coating. This coating is not designed to provide secondary containment. Coatings are provided to support the clean-up and decontamination of a potential spill. The concrete walls provide shielding to the adjacent R2 areas.

4.1.2 Boundaries and Interfaces

For Analytical Laboratory boundary and interface information please see the following sections of this document:

Figure 2-1, LAB Facility Context Diagram

Figure 2-2, LAB Facility Functional Block Diagram, and

Table 2-2, Lab facility Interfacing Systems

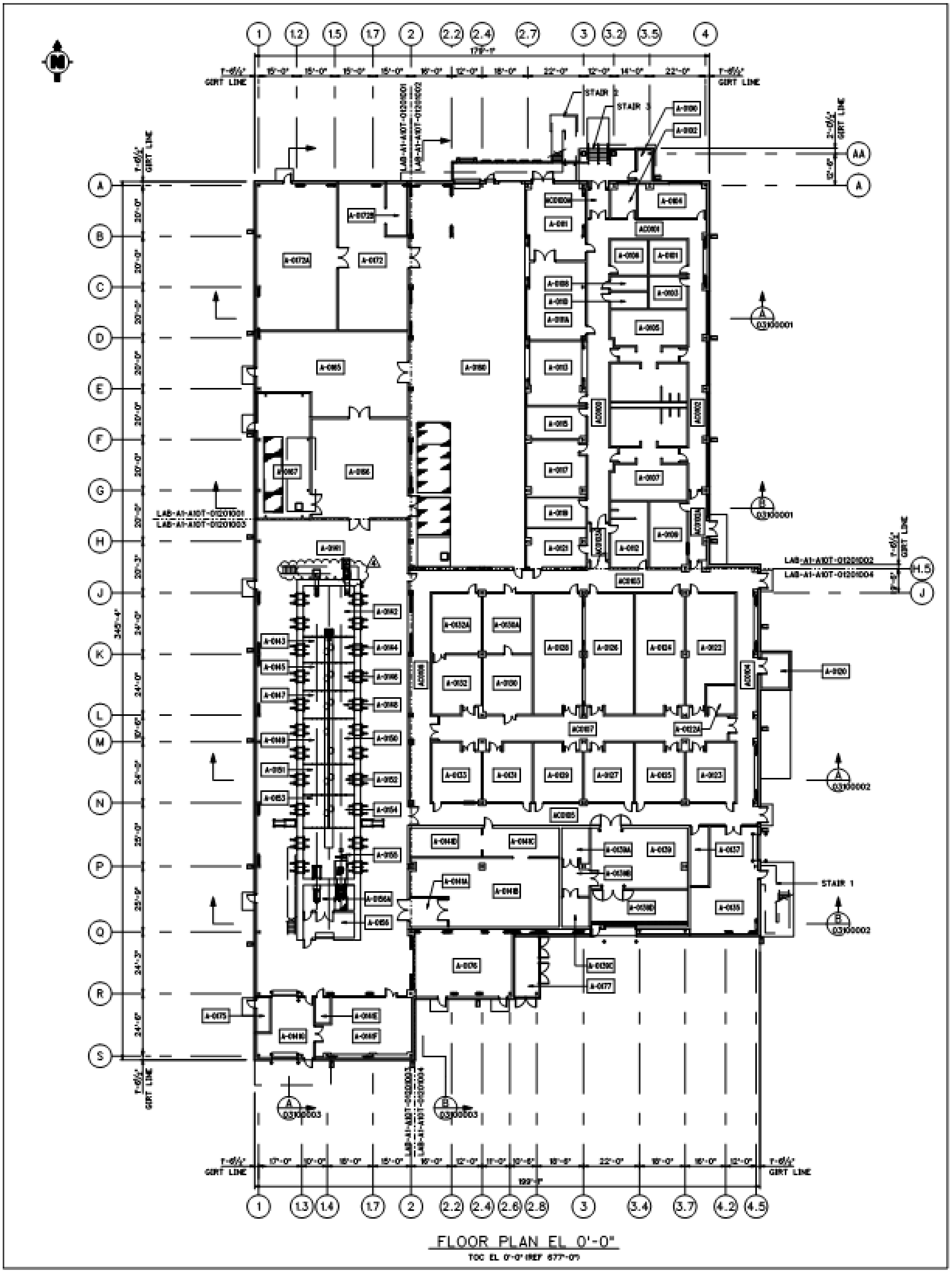
4.1.3 Physical Layout and Location

The Lab building is a two-story steel frame and concrete structure above-grade building with below-grade floors that house effluent vessels and vessel cells, including a fire water vault. The building dimensions are approximately 345 feet on the longest side, approximately 199 feet on the widest side, and the peak is about 42 feet high. At grade level, the building houses operating and equipment rooms, including hotcells, analytical radiological laboratories, maintenance shops, administrative offices, and support areas (Figure 4-2). A partial second floor houses additional ventilation, utility, and other equipment. The Lab exhaust stack and structure is located at the north end of this building.

The Lab building is completely enclosed by a floor, walls, and a roof to prevent exposure to the elements and to ensure containment of managed samples. The Lab is divided into numbered radiological and contamination zones. The facility has six main functional areas:

- Administrative/office area located in the northeast quadrant which houses the personnel and administrative support functions including: management offices, general offices area, change rooms, personnel decontamination room, and conference room.
- Support areas, mainly located in the northwest quadrant which houses the ventilation exhaust fans and HEPA filters, C5 pump maintenance room, and space for the autosampling vacuum pumps.
- Hotcell area, located in the southwest quadrant, which includes the hotcell laboratory and the LIH system.
- Radiological laboratory area, located south of the office area.
- Maintenance areas, C3 shop is in the southeastern quadrant and the C2 shop is in the northwest quadrant.
- Solid waste handling is mainly located in the southeastern quadrant of the building.
- Liquid waste management is mainly located in below grade.

Figure 4–2 Analytical Laboratory Architectural Floor Plan EL 0'-0"



4.1.3.1 Office/Administration Area

The administrative/office area is in the northeast quadrant, which houses the personnel, administrative, and health physics support functions including: management offices, general offices area, conference room, change rooms, and personnel decontamination room.

- The offices (A-0113, A-0102 and A-0106) and the shift supervisor office (A-0115) provide office space for administrative, supervisor, and support activities. These offices are at elevation +0 ft. 0 in. and are classified as C1/R1 because dose rates are low, and there's low potential for contamination.
- Telephone room (A-0108) provides workspace for telephone service.
- Lab Information Management Room (A-0101) room provides additional space for accessing LIMS, also known as the LIMS room, is at elevation +0 ft. 0 in. and is classified as C1/R1 because dose rates are low, and there's low potential for contamination.
- Control and Instrumentation (C&I) Room (A-0117) is at elevation +0 ft. 0 in. and is classified as C1/R1. This room houses a workstation for local operation of Lab systems and a cooling unit (C1V-ACU-00032).
- Facility Personnel Change Rooms (A-0105, A-0107) is at elevation +0 ft. 0 in. and is classified as C1/R1. The women's change room is A-0105. The men's change room is A-0107.
- The rad control supervisor office (A-0119) is at elevation +0 ft. 0 in. and is C1/R1 because dose rates are low, and there's low potential for contamination.
- Rad Control Ready Room (A-0109) provides office space for non-management HP technician staff, is at elevation +0 ft. 0 in., and is classified as C1/R1.
- Decontamination Room (A-0112) provides space and equipment where contaminated personnel are decontaminated. This room is at elevation +0 ft. 0 in. and is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.2 Support Areas

Support areas are located on grade level in the northwest quadrant and house the ventilation exhaust fans and HEPA filters, C5 pump maintenance room, and space for the autosampling vacuum pumps. Support areas are located on the second level housing HVAC and ASX. Additional support areas are located outside of the building, including gas storage.

4.1.3.2.1 HVAC/ Mechanical Support (Grade Level)

4.1.3.2.1.1 Autosampling System Vacuum Pump Room (A-0172A)

The ASX vacuum pump room is in the northwest quadrant of the Lab building and houses the ASX vacuum pumps (ASX-PMP-00001A/B and 00005A/B) and filters, and the ASX Carrier Receipt and Dispatch fume hood (ASX-SMPLR-00047). The room is at elevation +0 ft. 0 in. and is classified as C2/C3/R2 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.2.1.2 C5 Fan Room (A-0165)

The C5 fan room (A-0165) is north of the C5 filter room. This room houses C5V fans (C5V-FAN-00011A, C5V-FAN-00011B), is at elevation +0 ft. 0 in., and is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.2.1.3 C5 Filter Room (A-0166)

The C5 filter room contains C5V HEPA filters (C5V-HEPA-0034A through D, C5V-HEPA-0035A through D, and associated safe-change HEPA housings). This room is at elevation +0 ft. 0 in. and is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.2.1.4 RLD Access Area (A-0167)

This Room houses:

- C5 Tank Maintenance Bridge Crane (60-CRN-00004)
- Process vacuum system equipment skid (PVA-SKID-00001)

This room is at elevation +0 ft. 0 in. and is classified as C2/C3/R2/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.2.1.5 Filter/Fan Room 3 (A-0160)

The filter/fan room 3 houses the following equipment:

- C2V fans (C2V-FAN-00013, C2V-FAN-00014)
- C2V HEPA filters (C2V-HEPA-00006A through H, C2V-HEPA-00006J, C2V-HEPA-00006K)
- C3V fans (C3V-FAN-00007A, C3V-FAN-00007B, C3V-FAN-00007C)
- C3V HEPA filters (C3V-HEPA-00005A-G, C3V-HEPA-00005J-R, C3V-HEPA-00005P-R)
- Stack discharge monitoring system instrument panels (SDJ-PNL-00001, SDJ-PNL-00002, SDJ-PNL-00003, SDJ-PNL-00004)
- In-bleed HEPA filter (RLD-HEPA-00018)
- Base of the exhaust stack support structure

This room is at elevation +0 ft. 0 in. and is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.2.2 HVAC/ Mechanical Support (Second Level)

4.1.3.2.2.1 Mechanical Room (A-0202)

Mechanical Room A-0202 is north of mechanical room A-0201, above the two motor control center (MCC) rooms and a portion of the administrative areas.

This room houses the following equipment:

- C1V AHUs (C1V-AHU-00033, C1V-AHU-00034, C1V-AHU-00037)
- C1V humidifier units (C1V-HU-00016)
- C1V fan (C1V-FAN00055, C1V-FAN00056)
- BSA compressor (BSA-CMP-00004)
- BSA purification package (BSA-ABS-00004)
- BSA receiver (BSA-VSL-00007)

This room is at elevation +17 ft. 0 in. and is classified as C1/R1 because dose rates are low, and there's low potential for contamination.

4.1.3.2.2.2 Mechanical Room (A-0201)

Mechanical Room houses the following equipment:

- C2V air handling units (C2V-AHU-00064A-C)
- C2V humidifier units (C2V-HU-00040, C2V-HU-00041, C2V-HU-00048)
- C3V ducting from the rad lab fume hoods
- Mezzanine Jib Crane (24590-WTP-MJ-60-CRN-00001)

This room is at elevation +17 ft. 0 in. and is classified as C1/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.2.2.3 Hotcell Roof Platform (AP-0141)

The hotcell roof platform houses the following equipment:

- ASX Sample Hotcell Receipt station (ASX-SMPLR-00039)
- ASX Sample Hotcell Receipt and Disposal Station (ASX-SMPLR-00043)
- ASX Diverters (ASX-DISP-00007/00008/00009/00010)
- C5V Cooling Coils (C5V-CCl-00050/00051)
- C5V HEPA filters (C5V-HEPA-00045/00046)

This area is at elevation +17 ft. 0 in. and is classified as C2/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.2.3 Gas Storage

4.1.3.2.3.1 Gas Bottle Area (A-0177)

This storage area (A-0177) is a fenced and roofed area and is located outdoors on the south side of the Lab facility. This storage area is at elevation +0 ft. 0 in. and is classified as C1/R1. This area contains:

- Helium gas cylinders for the bottled helium gas system (BHG) are stored in two separate banks (BHG-RK-00001) to provide 14-day supply
- MXG cylinders are stored in two banks (MXG-RK-00004) of high pressure gas cylinders and associated piping, valve and instruments and controls
- Backup breathing air area stored in a rack (BSA-RK-00048)

4.1.3.2.3.2 Liquid Gas Storage

Two bulk liquid argon storage tanks (BAG-VSL00001/00002)) and one bulk liquid nitrogen storage tank (BNG-VSL-00001) are located outdoors on the east side of the Lab building. These tanks store a 14-day supply of argon and nitrogen.

4.1.3.2.3.3 Dewar Filling Room (A-0120)

Room A-0120 is located on the east side of the building, is used for Dewar Filling, and is provided with oxygen monitoring and alarm to allow safe access for system inspection and operation. This room is at elevation +0 ft. 0 in. and is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.3 Hotcell Area

The hotcell area is in the southwest quadrant, and houses the hotcells and related equipment necessary for AHL and LIH in 14 hotcells.

4.1.3.3.1 Hotcell Bay (A-0141)

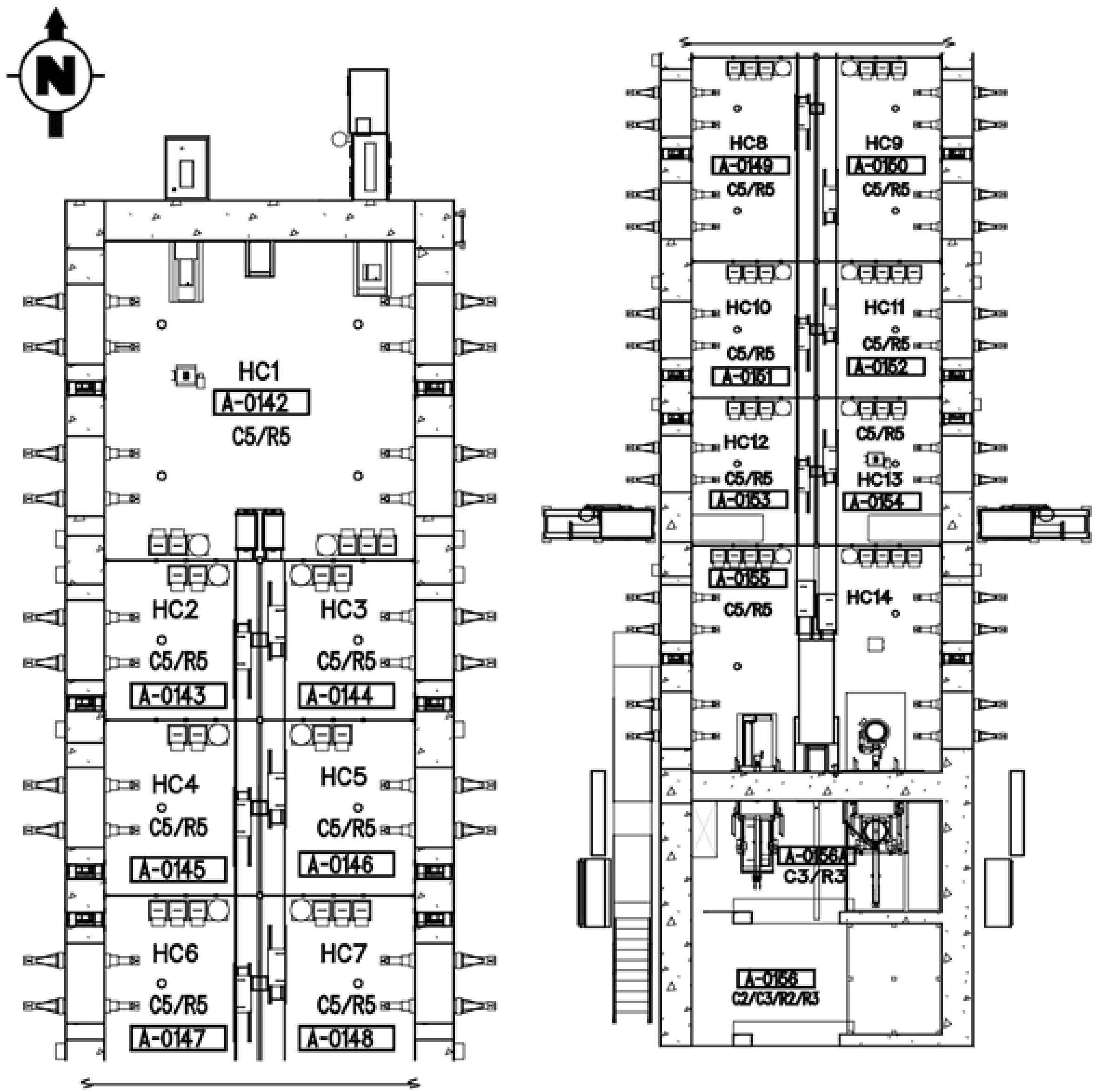
The hotcell bay (A-0141) is in the southwest quadrant of the Lab. The hotcell bay serves as an operating gallery for remote operations using MSMs inside the hotcells. The hotcell bay area is at elevation +0 ft. 0 in. and is classified as C2/R2 because dose rates are low, and there's low potential for contamination.

4.1.3.3.2 Hotcells (A-0142 through A-0155)

The hotcell suite is in the hotcell bay (A-0141) and contains 14 individual hotcells designed to accommodate remote handling of samples and other material with potentially high direct dose rates. It is split into two back-to-back process lines (Figure 4-3). The hotcells are interconnected through openings in the partition walls that separate them. The hotcell suite floor is at elevation +2 ft. 6 in. The hotcells are classified as C5/R5 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

The AHL in-cell operations are performed remotely by the LIH system. The physical boundaries of system LIH are the hot cell bay (room A-0141), the maintenance access room (room A-0156A), and the hot cell (rooms A-0142 through A-0155).

Figure 4–3 Hot Cell General Arrangement



4.1.3.3.2.1 Hotcell 1 (A-0142), Sample Receiving

The sample receiving hotcell is located at the north end of the series of analytical hotcells. This hotcell receives samples (LIH-HST-00002) and transport them to other hotcells for analysis. This hotcell is outfitted with four pairs of MSM arms (LIH-MANIP-00001/ 00002/ 00003/ 00004/ 00027/ 00028/ 00029/ 00030); two pairs on the east and west sides, MSM finger stand to remove/replace fingers, and leveling racks for the analytical equipment.

4.1.3.3.2.2 Hotcells 2 (A-0143) and 3 (A-0144), Sample Preparation

The equipment required for sample preparation is duplicated in hotcells 2 and 3 to allow analytical functions to proceed when equipment failure occurs. Each hotcell is equipped with one set of MSMs (LIH-MANIP-00031/ 00032/ 00025/ 00026), a MSM finger stand to remove/replace fingers, and leveling racks for each piece of analytical equipment (LIH).

4.1.3.3.2.3 Hotcell 4 (A-0145), Limited Process Technology

The process technology testing hotcell is equipped with one pair of MSMs (LIH-MANIP-00033/ 00034), a MSM finger stand to remove/replace fingers, and leveling racks for each piece of analytical equipment (LIH).

4.1.3.3.2.4 Hotcell 5 (A-0146), Physical Properties

The physical properties hotcell is equipped with one pair of MSMs (LIH-MANIP-00023/ 00024), a MSM finger stand to remove/replace fingers, and leveling racks for each piece of analytical equipment (LIH).

4.1.3.3.2.5 Hotcells 6 (A-0147) and 7 (A-0148), Dissolution/Dilution

The dissolution/dilution hotcells contain one pair of MSMs (LIH-MANIP-00035/ 00036/ 00021/ 00022), a MSM finger stand to remove/replace fingers, and leveling racks for each piece of analytical equipment (LIH). These hotcells are used to perform thermal-assisted acid and alkali fusion dissolutions of solid components of process samples delivered to the Analytical Laboratory.

4.1.3.3.2.6 Hotcell 8 (A-0149) and 9 (A-0150), Radionuclide Preparation

The radionuclide preparation hotcells are outfitted with two pairs of MSMs (LIH-MANIP-00037/ 00038/ 00039/ 00040/ 00017/ 00018/ 00019/ 00020), a MSM finger stand to remove/replace fingers, and leveling racks for analytical equipment (LIH). The equipment in these duplicate hotcells is used to reduce radiological dose rate of samples for hotcell export and separate radionuclides for further isolation and quantitation.

4.1.3.3.2.7 Hotcell 10 (A-0151), Ion Chromatography and Total Carbon Preparation

The equipment required to prepare sub-samples for anion analyses by ion chromatography (IC) and total inorganic carbon (TIC)/total organic carbon (TOC) quantitation are in hotcell 10. This hotcell is outfitted with one pair of MSMs (LIH-MANIP-00041/ 00042), a MSM finger stand to remove/replace, and leveling racks for analytical equipment (LIH). Solids are digested in DI water and aliquots of the digestant are transferred to the ARL for quantitation. This preparation in the hotcell reduces the radiological dose rate to an acceptable level for contact handling.

4.1.3.3.2.8 Hotcell 11 (A-0152), Boil down and Compatibility

Hotcell 11 provides the capability to determine the volume reduction of sample material achievable before solids form and to test the compatibility of different waste types. The hotcell is outfitted with one pair of MSMs (LIH-MANIP-00015/ 00016), a finger stand to remove/replace MSM fingers, and leveling racks for the analytical equipment (LIH).

4.1.3.3.2.9 Hotcell 12 (A-0153) and 13 (A-0154), Inductively Coupled Plasma Preparation and Analysis

Each inductively coupled plasma (ICP) preparation hotcell is outfitted with one pair of MSMs (LIH-MANIP-00043/ 00044/ 00013/ 00014), a finger stand to remove/replace MSM fingers, and leveling racks for the analytical equipment (LIH). These hotcells receive liquid sub-samples previously diluted or segregated in the sample preparation hotcells (HC 2 and HC 3) or from the dissolution/dilution hotcells (HC 6 and HC 7). Prepared coupons may also be received for laser ablation introduction to the ICPs. A glovebox is attached perpendicular to the exterior of each hotcell. An ICP/optical emission spectrometer (ICP/OES) and ICP/mass spectrometer (ICP/MS) are integrated with each of the gloveboxes.

4.1.3.3.2.10 Hotcell 14 (A-0155), Waste Segregation and Packaging

Hotcell 14 provides the capability to segregate and package solid waste. The hotcell is outfitted with four pairs of MSMs (LIH-MANIP-00005/ 00006/ 00007/ 00008/ 00009/ 00010/ 00011/ 00012), a finger stand to remove/replace MSM fingers, and leveling racks for the analytical equipment (LIH).

4.1.3.3.2.11 Hotcell Airlock and Maintenance Access Room (A-0156, A-0156A)

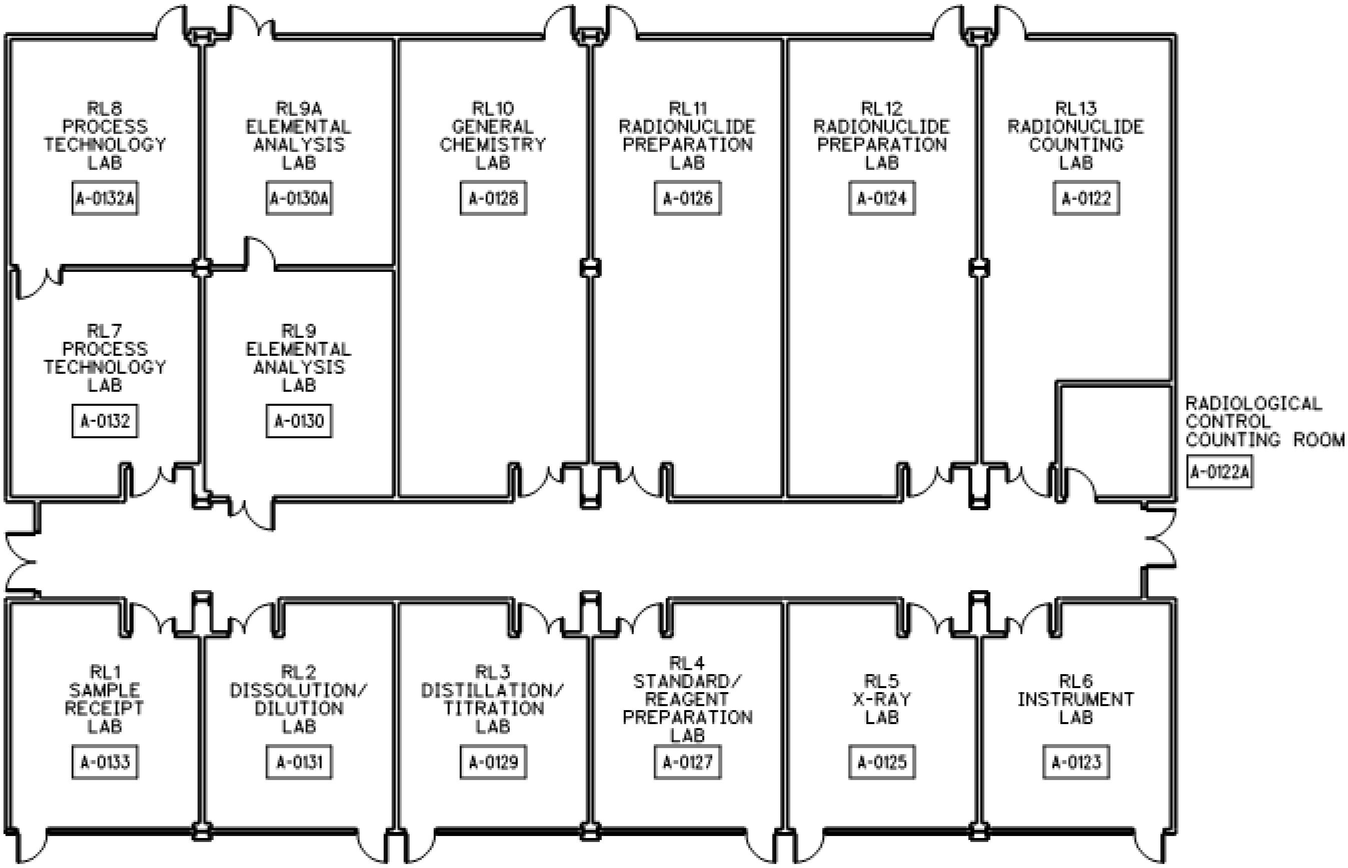
Bagless Waste Transfer Pit is a shielded cavity in the embed liner of the waste transfer port in HC14 and this waste transfer pit accommodates a 55-gallon drum and lift table. A steel shield door isolates the pit and liner on the side facing the maintenance access room. The pit design includes bogie rails to support transfer of waste drums on a waste drum bogie (RWH-TRLY-00009). This room is at elevation -2 ft. 6 in. and is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

The hotcell maintenance access room and hotcell airlock are located just south of hotcell HC14 (A-0155) in the southwest quadrant of the Lab building. The hotcell maintenance access room (A-0156A) is classified as C3/R3 and the associated hotcell airlock (A-0156) is at elevation +0 ft. 0 in. and is classified as C2/C3/R2/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.4 Analytical Radiological Laboratories (A-0122 through A-0133)

The ARL area is south of the office area and east of the hotcell bay. The ARL system consists of 14 laboratories. The dose rates on the samples are expected to be low enough to meet the R2 target dose rate of 0.25 mRem/hr. for the general work area. The ARL system houses the fume hoods, equipment, storage space, reagents, and other items necessary to support low activity sample analyses activities. The rad labs are at elevation +0 ft. 0 in. and are classified as C3/R2 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

Figure 4–4 General Arrangement of Radiological Laboratories



4.1.3.4.1 RL 1, Sample Receipt Laboratory (A-0133)

The Sample Receipt Laboratory is designated to be a sample receipt (ASX-SMPLR-00034) for ASX delivered samples and the distribution point for samples. Sample receipt is by pneumatic transport and manual receipt. Higher activity samples are initially received in the Hotcells and suitably diluted there prior to being sent to the Rad Labs.

4.1.3.4.2 RL 2, Dissolution/Dilution Laboratory (A-0131)

The Dissolution/Dilution Laboratory primary function is general wet chemistry involved in the preparation of samples for analyses that will be performed in the other Rad Labs. RL 2 is capable of dissolving slurry and solid samples using a microwave-assisted acid digestion with $HF\text{-}HNO_3\text{-}H_3BO_3\text{-}HCL$ and $KOH\text{-}Na_2O_2$ fusion for subsequent elemental and radionuclide analyses. It will also be used as the primary location for the decontamination of glassware and equipment for re-use.

4.1.3.4.3 RL 3, Distillation/Titration Laboratory (A-0129)

The Distillation/Titration Laboratory is used for preparation and analysis of medium level radioactive samples for acid/base titrations and other electrochemical techniques. Distillations, titrations, and physical measurements are performed in this lab. RL 3 contains two ventilated hoods, laboratory benches, computer workstations, and a sink.

4.1.3.4.4 RL 4, Standard/Reagent Preparation Laboratory (A-0127)

The primary purpose of this laboratory is to prepare, stage, and distribute reagents and quality control standards for use during the analyses of process samples. RL 4 provides a location for several different types of reagents and standards make up. One activity involves the dilution of purchased standards to make working level tracers and calibration standards for use in analytical procedures. Analytical instrumentation is available for verification of a limited selection of analytes (e.g. pH, conductivity).

4.1.3.4.5 RL 5, X-Ray Laboratory (A-0125)

The X-ray Laboratory has four fume hoods for sample preparation, X-ray fluorescence, and optical microscopy. This lab is used for quantifying metals concentrations utilizing the X-ray fluorescence system . The optical microscopes (two) are used for qualitatively identifying crystals, as needed, during process troubleshooting. Non-routine measurements are made of constituents resulting from process studies or recovery from upset conditions.

4.1.3.4.6 RL 6, Instrument Laboratory (A-0123)

The Instrument Laboratory is used primarily for process technology testing. As an example, space is provided for the setup of test beds for evaluation of ion exchange resins and laboratory scale filtration units. RL 6 contains three ventilated hoods and the equipment required for the unique functions associated with non-routine analyses, which includes a Fourier transform-infrared instrument (FT-IR), and a UV-Vis Spectrophotometer.

4.1.3.4.7 RL 7, Process Technology Laboratory (A-0132)

The functions of the Process Technology Laboratory are intended to provide non-routine measurements of physical characteristics of low activity process samples and process tests using synthetic samples. RL 7 and 8 are used for particle size analysis, differential scanning calorimeter/ thermal gravimetric analysis, non-routine tests, analytical method development, and process support using synthetic solutions. The unique requirements for the Process Technology Lab are met by the provisions of the equipment detailed in the following sections.

4.1.3.4.8 RL 8, Process Technology Laboratory (A-0132A)

The Process Technology Laboratory conducts tests on laboratory scale equipment to observe the behavior of low activity material during processing through a process unit operation and define anomalies to routine processing. Low activity and synthetic materials are used for testing.

4.1.3.4.9 RL 9, Elemental Analysis Laboratory (A-0130)

The Elemental Analysis Laboratory is used for the preparation and analysis of medium level radioactive samples. Elemental and selected radionuclide analyses are performed on one ICP/OES and one ICP/MS that are installed. The Lab contains two fume hoods for mercury analysis systems, and two workstations that are close coupled with the ICP instruments, benches, and computer workstations.

4.1.3.4.10 RL 9A, Elemental Analysis Laboratory (A-0130A)

Rad Lab 9A is outfitted with supply and exhaust ventilation, liquid waste drains, water supply, and gas supplies for the installation of an ICP/OES and ICP/MS as backup to the systems in RL 9.

4.1.3.4.11 RL 10, General Chemistry Laboratory (A-0128)

General chemistry lab is used for the preparation and analysis of medium level radioactive samples for selected anions, organic acids, total inorganic carbon, and total organic carbon. The equipment is split such that instrument electronics are on benches adjacent to fume hoods and the components for sample contact are inside the fume hoods.

4.1.3.4.12 RL 11 and RL 12, Radionuclide Preparation Laboratories (A-0126/0124)

In RL 11 and RL 12, aliquots of samples are prepared for radionuclide quantitation in RL 13. Samples are weighed, evaporated, and purified. Each hood is dedicated to the preparation of selected radionuclides required to characterize process samples. Limited redundancy in capability is available in the two rooms for preparation of radionuclide aliquots that are critical to process support.

4.1.3.4.13 RL 13, Radioisotope Counting Laboratory (A-0122)

The radioisotope counting laboratory contains the instrumentation to quantify the concentration of alpha, beta, and gamma emitting radioisotopes. Methods of quantitation include gamma spectrometry, gas proportional counting, alpha spectrometry, and liquid scintillation counting. Duplicate instrumentation is available to minimize the impact of instrumentation failures. Shielded cabinets are available to stage sealed radioisotope standards for use in monitoring the performance of the instrumentation. There are no fume hoods, water distribution, or sinks in this room.

4.1.3.4.14 Sample Receiving/Shipping Area (A-0141F)

Sample Receiving/Shipping Area (A-0141F) provides space for loading shipping containers with outsourced sample material to laboratories and for initial receipt of manually delivered samples. This area is located at the south end of the hotcell bay A-0141 and is adjacent to the hotcell bay airlock A-0141G. The area is at elevation +0 ft. 0 in. and is classified as C2/R2 because dose rates are low, and there’s low potential for contamination.

4.1.3.5 Maintenance Areas

The Lab has two areas dedicated to equipment maintenance. The C3 maintenance shop provides space to decontaminate, maintain, and store contaminated equipment. The C2 Maintenance shop provides space for the maintenance/repair of equipment that is not expected to be radioactively contaminated.

4.1.3.5.1 C2 Maintenance Shop (A-0172, A-0172B)

The C2 Maintenance shop provides space for the maintenance/repair of equipment that is not expected to be radioactively contaminated, is at elevation +0 ft. 0 in., and is classified as C2/R2 because dose rates are low, and there’s low potential for contamination. [3.8.5.8]

The following equipment is in the C2 maintenance shop:

- Variable speed 20” drill press (60-TOOL-00001)
- Pedestal grinder with ventilated hood (60-TOOL-00005)
- Preventive maintenance cabinet (60-TOOL-00011)
- Chemical storage cabinet (60-TOOL-00018)
- Two work tables with drawers (60-BENCH-00001 and -00002)

- Rigger locker (60-BENCH-00006)
- Tool storage cabinet (60-BENCH-00007)
- Transporter cart (60-TRLY-00002)
- Electric tow truck (60-TRLY-00006)
- Battery powered narrow aisle reach truck (60-MHAN-00005)
- Pallet truck (60-MHAN-00006)
- Storage cabinet (60-TOOL-00007)
- Lockable storage cabinet (60-TOOL-00008)
- Electrical consumables cabinet (60-TOOL-00013)
- Calibration work bench (60-BENCH-00019)
- Lockable storage cabinet #1 C2 (60-BENCH-00008)
- Lockable storage cabinet #2 C2 (60-BENCH-00009)
- Platform truck (60-MHAN-00008)

4.1.3.5.2 C3 Maintenance Shop, Manipulator Maintenance Shop, and Airlock (A-0141A/B/CD)

C3 maintenance shop (A0141 A/B/C/D) is located on the south side of the building. The C3 maintenance shop provides space to decontaminate, maintain, and store contaminated equipment that is designed to be changed out during their operating life, such as hotcell manipulators. The C3 maintenance shop is classified as C3/R3 because it is expected to handle equipment with low levels of contamination and radiation. The airlock is at elevation +0 ft. 0 in. and is classified as C2/C3/R2 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information). [3.8.5.9]

The C3 maintenance shop houses the Lab maintenance glovebox (60-MHAN-00003) which is used to decontaminate tools and equipment removed from the hotcells, especially manipulators, prior to repairing them. This glovebox is equipped with pressurized water for decontamination and a backdraft damper to prevent the backflow of the contamination in the event of a loss of the C5 ventilation fans. The decon glovebox drains to the hotcell collection vessel (RLD-VSL-00165). The glovebox is ventilated by the C5 ventilation system with HEPA filters that reduce the buildup of contamination inside the duct from the maintenance shop to the C5 HEPA filters. The CO_2 decontamination blast unit (60-MAINT-00001) is connected to the glovebox through a wall connector and is used to decontaminate equipment inside the decon glovebox via the blast gun.

The following additional equipment is also located in the C3 maintenance shop:

- Variable speed 20” drill press (60-TOOL-00002)
- C3 workshop 25-ton hydraulic press (60-TOOL-00004)
- Pedestal grinder (60-TOOL-00006) is connected to the C3 ventilation system.
- Weld machine (60-TOOL-00012) is connected to an articulated welding exhaust (60-HOOD-00002) the hood is vented to the C3 ventilation system.
- Welding burn table (60-BENCH-00011)
- Two work tables (60-BENCH-00003, -00004)
- Tool storage (60-BENCH-00005)

- Two MSM removal/installation cart (60-TRLY-00001/00004)
- Transporter cart (60-TRLY-00003)
- C3 Shop Monorail Hoist (60-HST-00002)
- Decon Glovebox Monorail Hoist (60-HST-00003
- Two special parts tool storage cabinets (60-TOOL-00009 and -00010)
- General storage rack (60-TOOL-00016)
- Three MSM storage carts (60-BENCH-00013, -00014, and -00015)
- MSM tape cable work table (60-BENCH-00012)
- Two roll about ladders (60-MHAN-00011 and -00012)
- MSM Maintenance Cradle C3 Workshop (60-TOOL-00003)
- MSM Maintenance Cradle C3 Workshop (60-TOOL-00014)
- Rigging Locker C3 Workshop (60-BENCH-00006)

4.1.3.6 Waste Management

Lab operations will generate waste, which will require storage and packaging.

4.1.3.6.1 Liquid Waste

The Lab facility has three cells and four pits below grade used to management liquid waste. Three vessel cells house the three Lab RLD vessels, one cell for each vessel. Four of the five pits house the maintainable Lab RLD equipment. The vessel cell sumps are stainless steel. There are four pits below grade that confine leaks or releases from pumps, valves, or piping within the cells in the Lab facility. These pits are structural compartments that house maintainable equipment in segregated locations where the equipment is readily accessible for maintenance and remote manual operation. These pits provide secondary containment and access for anticipated maintenance activities.

4.1.3.6.1.1 C2 Fire Water Vault (A-B001)

C2 fire water vault (A-B001) houses the floor drain collection vessel (RLD-VSL-00163) and the floor drain collection vessel pumps (RLD-PMP-00190A/B). The vault low point elevation is –18 ft. 8-1/2 in. and is classified as C2/R2 because does rates are low, and there’s low potential for contamination.

4.1.3.6.1.2 C3 Effluent Vessel Cell (A-B003)

C3 effluent vessel cell (A-B003) is a stainless steel lined, rectangular cell that houses the laboratory sink drain collection vessel (RLD-VSL-00164) and provides secondary containment for this dangerous waste vessel. The cell low point elevation is –18 ft. 7 in. and is classified as C5/R4 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.1.3 C5 Effluent Vessel Cell (A-B004)

C5 effluent vessel cell (A-B004) is SS and is stainless steel lined. The rectangular cell houses the hotcell drain collection vessel (RLD-VSL-00165) and provides secondary containment for this dangerous waste vessel. The cell elevation is –19 ft. 2 in. level and is classified as C5/R5 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.1.4 C5 pump pit (north) (Room A-B005)

C5 pump pit (north) (Room A-B005) houses the hotcell drain collection vessel pump RLD-PMP-00183B. The low point is at elevation –6 ft. 7 in. and is classified as R5/R3/C5/C3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.1.5 C5 pump pit (south) (Room A-B007)

C5 pump pit (south) (Room A-B007) houses the hotcell drain collection vessel pump RLD-PMP-00183A. The pit low point elevation is –6 ft. 7 in. and is classified as R5/R3/C5/C3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.1.6 C5 piping pit (Room A-B006)

C5 piping pit (Room A-B006) contains RLD-SUMP-00044. The pit low point is at elevation –6 ft. 7 in. and is classified as R5/R3/C5/C3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.1.7 C3 pump pit (Room A-B002)

C3 pump pit (Room A-B002) houses the laboratory sink drain collection vessel pumps (RLD-PMP-00182A/B). The pit low point is at elevation –6 ft. 8-1/2 in. and is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.2 Waste Drum Management (A-0139, A-0139A, A-0139B, A-0139C, A-0139D, A-B0156A)

The waste drum management areas are in the southeast corner of the Lab and are used for the packaging, handling, volume reduction, and storage of secondary wastes generated in the Lab.

4.1.3.6.2.1 Waste Storage Room (A-0139)

Waste storage room (A-0139) is the primary room that provides segregation of waste containers, and is designated for the storage of dangerous and mixed secondary wastes. This room is at elevation +0 ft. 0 in. and is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.2.2 Lab Pack Room (A-0139A)

Lab pack room (A-0139A) houses equipment for packaging of organic or chemical wastes and Lab pack wastes generated in the ARL areas. There is a walk-in fume hood (RWH-HOOD-00085) that provides contamination control while packaging Lab packs and re-packing drummed secondary waste. This room is at elevation +0 ft. 0 in. and is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.2.3 Waste Management Airlock (A-0139B)

Waste Management Airlock (A-0139B) separates the main waste drum area (A-139), the Lab pack room (A-0139A), and volume reduction areas (A-0139C). This room is at elevation +0 ft. 0 in. and is classified as C2/C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.2.4 Volume reduction area (A-0139C)

Volume reduction area (A-0139C) houses equipment for waste minimization. There is an in-drum compaction unit (RWH-CPT-00003) designed to reduce the volume of low activity wastes generated in the Lab by compacting the waste inside a 55-gallon drum. This room is at elevation +0 ft. 0 in. and is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information).

4.1.3.6.2.5 Bag-less Waste Transfer Pit (A-B0156A)

Bag-less Waste Transfer Pit is a shielded cavity in the embed liner of the waste transfer port in HC14 and this waste transfer pit accommodates a 55-gallon drum and lift table. A steel shield door isolates the pit and liner on the side facing the maintenance access room. The pit design includes bogie rails to support transfer of waste drums on a waste drum bogie (RWH-TRLY-00009). This room is at elevation –2 ft. 6 in. and is classified as C3/R3 (see 24590-WTP-RPT-ENS-10-005, *WTP Classification of Areas Report*, for more information.

4.1.4 Principles of Operation

4.1.4.1 Principles of Operation of the Analytical Laboratory

This section provides a general description of the Lab processes. System description documents include the Principles of Operation for each Lab system. The Lab facility design incorporates features and capability necessary to ensure efficient WTP operations and meet permitting, process control, authorization basis, and waste form qualification requirements.

The Lab routinely receives samples for analysis from BOF LAW, PT, and HLW facilities, in the PT operating configuration. During DFLAW, the Lab routinely receives samples for analysis from the BOF LAW and EMF. The frequencies of sampling and types of analyses are stated in the sampling schedule included in the design basis document, 24590-WTP-PL-PR-01-004, *Analytical Laboratory Design Requirements: WTP Sampling and Analysis Plan*. The sampling schedules are based on design rates of 6.0 metric tons of glass (vitrified waste) (MTG) per day immobilized high level waste (IHLW) and 30 MTG per day immobilized low activity waste (ILAW). These production rates project an analytical support workload of about 10,000 samples per year.

The analytical requirements for the operation of the Lab are described in 24590-WTP-PL-PR-04-0001, *Integrated Sampling and Analysis Requirements Document (ISARD)*. The sample path for each individual sample is outlined in the revised transmittal of input for the operations research (OR) laboratory model (CCN 117633).

An assessment of the Lab operation was performed using the OR Lab model to validate the Lab design. The assessment, 24590-WTP-RPT-PET-08-014, *2008 WTP Operations Research Report*, confirmed that the laboratory completed the sample analyses with the analytical time available (ATA) and that the laboratory configuration adequately supports the WTP sampling needs at the expanded HLW rate of 7.5 MTG per day IHLW. Non-routine samples that may be analyzed for non-routine purposes (e.g., process technology, optimization, off-normal conditions, or analytical methods improvements) will be accommodated based on priority, but will not necessarily constitute an operational basis of the Lab.

The Lab facility includes remotely operated hotcells in the AHL system and radiological laboratory rooms in the ARL system. These laboratories contain equipment and instrumentation to receive and prepare samples for analyses, and perform analysis using chemical separations and elemental, molecular, and radioisotope quantification. The Lab facility is designed to manage liquid waste and provide secondary containment to prevent a release of dangerous waste to the environment. Liquid effluents resulting from laboratory analysis, sample disposal, maintenance activities, decontamination wash downs, system flushing, fire protection water collection, and safety shower/eye wash water and other Lab areas are collected by the Lab RLD system. The vessels, hardware, and associate piping can be cleaned and drained. Liquid wastes from the hotcells are transferred to the RLD C5 subsystem via hotcell drains. Liquid wastes from the rad labs and other C3 sources are drained to the Lab RLD C3 subsystem. Demineralized water is used to flush the drain lines and ensure that the liquid wastes reach the radioactive effluent collection vessels. The piping and valves system carrying contaminated or potentially contaminated liquid are fully drainable and flushable. The collected radioactive effluents are transferred to the PTF plant wash and disposal (PWD) system for treatment in the PT configuration and to the EMF in the DFLAW configuration. Liquid wastes from Lab floor drains and other C2 sources are drained to the RLD C2 subsystem, and then disposed of via the BOF NLD system. Cooling coil condensates from the HVAC system and sanitary sewage effluent generated in the Lab facility are collected, treated, and processed in the sanitary disposal (SND) system. BOF receives and transfers secondary aqueous wastes discharged from the WTP processes to the LERF/ETF and treated effluent disposal facility (TEDF). Prior to hot commissioning, if the other facilities are not ready to receive effluent, the effluent may be transferred to a tanker truck for transfer to TEDF or a permitted Treatment Storage Disposal Facility.

Since the Lab processes air, liquid, and sludge samples, and tank farm grab samples, radionuclide particulate and aerosols are expected in the analytical laboratory exhaust systems due to the handling and analysis of these samples. Thus, appropriate confinement and ventilation systems are provided to avoid releases and minimize the spread of contamination and hence, the potential to receive an internal dose. The AHL is equipped with a hotcell suite and ventilated hood and/or glovebox assemblies and the ARL laboratories are equipped with fume hoods or shielded storage cabinets, which are vented to the Lab ventilation system to provide containment of contamination.

The Lab ventilation systems support contamination control by providing airflow from areas of low or no contamination to areas of higher potential contamination in a cascading ventilation arrangement. The Lab C2V, C3V, and C5V ventilation systems provide ducts, exhaust fans, and HEPA filters to remove airborne radioactive contamination and non-radioactive particulates to maintain emissions below applicable limits before the treated vent gases are discharged to the atmosphere. The HVAC systems provide heating and cooling within the building, and allow areas within the building to be maintained at design temperatures. Stack exhaust is monitored continuously to ensure compliance with environmental permits. In-line stack monitors monitor radionuclide concentrations in the gaseous emissions from the Lab facility.

4.1.5 System Reliability Features

The Lab facility has a 40-year minimum design (operating) life. Essential Lab safety and non-safety designated equipment and components shall be designed to operate and/or provide primary confinement for a minimum design life of 40 years, inclusive of maintenance, but not replacement. Where maintenance is required to achieve the required design life, the equipment shall be accessible or be designed to support remote maintenance activities. Equipment with a design life less than 40 years shall be designed to be replaceable, remotely if in a high radiation or contamination area.

4.1.6 System Control Features

The following sections describe the system indications, alarms, and control features that are used for operation and performance monitoring. Refer to the detailed design documents for additional detail. The Lab facility design incorporates features and capability necessary to ensure efficient WTP operations and meet permitting, process control, authorization basis, and waste form qualification requirements. The Lab facility contains various types of instrumentation (e.g. level, temperature, flow, etc.) to provide indication of system conditions and control of the systems. These instruments, the control loops, alarms, and interlocks are discussed in the system design description sections for the individual Lab systems.

The laboratory process operations are controlled from the LAW control room. Status indications and alarms from process and service systems are provided locally where needed, with main status and alarm signals repeated in the LAW control room and the PT Facility main control room (MCR), including information that serves to monitor conditions in the Lab.

The Lab facility does not contain any control features unique to the Lab facility. All control features are contained within the operating systems housed in the Lab facility. The following sections describe the indicators, alarms, and controls of the one safety significant control within the Lab facility.

4.1.6.1 Facility Monitoring

Refer to the detail design documentation for additional detail.

4.1.6.2 Control Capability and Locations

Refer to the detail design documentation for additional detail.

4.1.6.3 Automatic and Manual Action

Refer to the detail design documentation for additional detail.

4.1.6.4 Set Points and Ranges

Refer to the detail design documentation for additional detail.

4.1.6.5 Interlocks, Bypasses, and Permissives

Refer to the detail design documentation for additional detail.

4.1.6.5.1 RI-6164

When RI-6164 detects a high level of gamma radiation, the interlock closes isolation valve YV-6554 to prevent the transfer of a highly-contaminated sample carrier or a carrier still containing a sample to the carrier receipt and maintenance fume hood (ASX-SMPLR-00047) in the LAB vacuum pump room (A-0172A). If the high gamma reading does not clear the interlock allows the operator to initiate a sequence to move the carrier into position to be dropped into HC1.

4.2 Operations

The scope of this section is to provide an overview of the Lab facility operations to provide an understanding of the scope and intent of approved documents. The facility operations will be described in a general manner that will aid the reader in understanding the detailed procedure steps, their required sequence, and how the facility operates. This section is intended to be used in support of startup testing and commissioning activities. This section is limited to Lab facility features that support production and/or protects equipment, personnel, and the environment. This includes, but is not limited to the civil, structural, and architectural features such as building roof, walls, floors, embeds/anchors, portals, bulges/enclosures, sumps, penetrations, coatings and liners, as well as those operations tied to the overall functioning of the facility. The contents are specifically intended to not include or be redundant to operations more appropriately allocated to and defined in System Descriptions or System Design Descriptions, if available. Where appropriate, from a “system of systems” perspective, some operations that are overarching to the facility mission or function are included, even though they may depend on contributions from multiple individual systems.

The purpose of the Lab facility is to provide the required analytical, utility, logistical, and other interfaces needed to carry out its operational mission in support of Hanford Tank Waste Treatment and Immobilization Plant (WTP) activities, including WTP secondary waste effluent streams (NLD and RLD). The Lab facility will receive waste samples for analysis from the BOF, EMF, PTF, High- HLW, and LAW facilities and from the Tank Farms. The samples are comprised of tank farm wastes, treated tank farm wastes (for DFLAW), as-received tank farm wastes (at PTF), the prepared HLW feed fraction, and the prepared LAW feed fraction. The samples will be prepared and analyzed in the Lab facility and analytical information will be captured, stored, and reported.

Lab operations will generate waste, some of which will be dangerous waste regulated under the RCRA and Washington State Regulations, and must meet specific treatment and performance standards for storage and disposal in accordance with the specific requirements of the WTP Contract and WTP Dangerous Waste Permit. The Analytical Laboratory Facility is designed to ensure efficient WTP operations and meet all permitting, process control, authorization basis, and waste form qualification requirements.

4.2.1 Initial Configuration (Pre-startup)

This section describes the pre-startup configuration in general terms and provides reference to applicable documentation. The initial configuration check has two areas of focus, the physical structures of the Lab, and the interfacing systems (utility and safety) present in the Analytical Laboratory.

4.2.1.1 Structures

The Analytical Laboratory Facility structures provide three primary purposes: the hotcell structure and related components (such as shield doors and windows) shall provide radiation shielding for facility workers, interior walls and structure that are part of the C5V boundary, and structures provide protection from NPH.

4.2.1.1.1 Hotcell Confinement

The Lab structural steel and concrete are considered SS to support the following credited safety functions: structurally support safety Structures, Systems, and Components (SSCs) during a seismic event and normal operations, provide confinement of radioactive liquids and particulates, and provide radiation shielding for facility workers at the hotcell structure and related components (such as shield doors and windows). Hotcell confinement boundary consists of the hotcell structure (including shield doors and shield windows that penetrate them), the hotcell receipt station docking unit components that provide confinement, and the hotcell gloveboxes. The functional requirement of the Hotcell and C5 Effluent Cell confinement boundaries is to provide bulk confinement of radioactive materials. The hotcell structure is a passive design feature for the Lab facility, and does not require maintenance or surveillance. No testing needs to be performed relative to this feature to support its credited safety function.

4.2.1.1.2 C5 Vessel Cell Confinement

The C5 effluent vessel boundary consists of the C5 effluent vessel cell and the hotcell drain collection tank pump and valve pits. Several lengths of jacketed piping are included in the Lab design. The outer jacket is sealed to the inner pipe just inside the C5 vessel cell. The function of the jacketed piping is to contain liquid and particulates in the C5 areas by maintaining the C5 boundary of the vessel cell. The piping sections include:

- The portion (within the C5 vessel cell) of the exterior jacket on the transfer line from the C3 vessel cell to the C5 vessel cell
- The portion (within the C5 vessel cell) of the exterior jacket on the truck transfer line and the flange on the truck side of the transfer pipe in the C5 cell
- The portion (within the C5 vessel cell) of the exterior jacket on the transfer line to the PTF (the SS exterior jacket of the waste transfer piping extends from the C5 effluent vessel cell to 5 ft. outside the Lab facility exterior wall)
- The portion of the exterior jacket on the drain lines between the hotcell gloveboxes (located outside the hotcells) and the base mat penetration

The transfer pipe outer jacket is a design feature that does not require routine maintenance or surveillance to demonstrate operability. The WTP configuration management program, addressed as administrative controls in the technical safety requirements (TSRs), will ensure that design features continue to fulfill their safety functions.

4.2.1.1.3 Protection from Natural Phenomena Hazard

The Lab structural steel and concrete are considered SS to support credited safety functions. Additionally, the steel and concrete structure will limit structural degradation due to NPH events. The initial configuration review of the Lab structure shall include inspections to identify any structural cracking and any significant air infiltration. The exterior of the structure shall also be undamaged and capable of providing protection from wind driven missiles. There are two SS confinement boundaries within the Analytical Laboratory that shall also be inspected: the Hotcell Confinement Boundary and the C5 vessel cell Confinement boundary. Confinement is considered SS to provide confinement of radioactive materials during a release event.

4.2.1.1.4 Support Areas

In addition to the safety functions, the Lab provides space, structural support, and anchorage for analytical processes, utilities, and maintenance equipment and activities. The Lab provides the enclosure and enclosure integrity to allow for environmental control of temperature, humidity, and pressure within the various spaces of the facility. The Lab structure will provide space for the follows support areas:

- Radiological health physics (HP) operation
- Staff and administration
- Regulated (C3/R3) shop
- Maintenance shop in a C2 area
- General storage areas supply and equipment needed to operate the plant
- Clean and used regulated and non-regulated clothing storage
- Mechanical and utility (ventilation, electricity, laboratory gases and water supplies, and other support functions)
- Three bulk storage tanks outside the Lab building (one tank of liquid nitrogen and two tanks of liquid argon)
- Pressurized container storage area (helium, breathing air, and miscellaneous) located outside of the rad lab.
- Process by-products awaiting permanent disposal
- Weather protected storage for Dry Active Waste in cardboard cartons
- Waste management areas (waste packaging, volume reduction, and waste drum management)

- Radioactive Liquid Waste Disposal (RLD) system

4.2.1.2 Utility/Safety Systems

4.2.1.2.1 Utility/Safety Systems

Prior to start-up of the hotcell and radiological laboratories, the following systems must be in the normal operation mode. As part of the initial configuration check of the Lab, the following systems must be ready for normal operation to allow the start-up of the other Lab systems listed in section 4.2.2. Startup of the following systems shall be conducted in accordance with the listed documentation and other start-up procedures.

4.2.1.2.2 Atmospheric Reference Ventilation System

The atmospheric reference ventilation system (ARV) system provides a common pressure reference point to outside ambient air for the differential pressure instrumentation used in monitoring and controlling the building ventilation system. ARV initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3ZD-60-00002, *Analytical Laboratory Ventilation System Design Description.*

4.2.1.2.3 Autosampling System

The ASX system collects samples and transfers them from the requesting facility to the Lab via a pneumatic transfer system to a hotcell or fume hood sample receipt area. ASX initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3ZD-ASX-00001, *System Design Description of the Autosampling System (ASX)*.

4.2.1.2.4 Bottled Argon Gas System

The bottle argon gas system (BAG) system provides argon for the Lab Gamma Energy Spectroscopy Systems, ICPs, Ion Chromatographs (ICs), TIC/TOC Analyzers, Alpha/Beta Counters, Mercury Analyzers, and other instruments located throughout the Radiological Laboratories (RLs) and Analytical Hotcells (HCs). BAG initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-BAG-00001, *System Description for the Lab Bottled Argon and Bottled Nitrogen Gas Systems*.

4.2.1.2.5 Bottled Nitrogen Gas System

The Lab bottled nitrogen gas system (BNG) system provides nitrogen for the Lab Gamma Energy Spectroscopy Systems, ICPs, ICs, TIC/TOC Analyzers, Alpha/Beta Counters, and Mercury Analyzers, and other instruments located throughout the RLs and HCs. BNG initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-BAG-00001, *System Description for the Lab Bottled Argon and Bottled Nitrogen Gas Systems*.

4.2.1.2.6 Bottled Helium Gas System

The Lab BHG provides helium gas to end users throughout the HCs and RLs. BHG initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-BHG-00001, *System Description for the Lab Bottled Helium Gas System*.

4.2.1.2.7 Breathing Service Air System

Breathing air is supplied to the Lab by a dedicated, stand-alone compressor located in room A-0202. BHG initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-BSA-00001, *System Description for the Waste Treatment Plant Breathing Service Air*.

4.2.1.2.8 Laboratory Ventilation System

The Lab facility HVAC system provides heating, cooling, humidification, and ventilation through a low airflow confinement ventilation system. HVAC initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3ZD-60-00002, *Analytical Laboratory Ventilation System Design Description*.

4.2.1.2.9 Chilled Water System

The WTP CHW system provides a continuous supply of chilled water for cooling of selected equipment within the Lab. The CHW system supplies chilled water from the chiller/compressor plant (CCP) to the Lab. The Lab is equipped with a secondary CHW loop that draws from the primary yard distribution. The secondary loop supplies water to the HVAC system and breathing air compressor. The BOF CHW system consists of chillers, pumps, vessels, air separator, piping, valves, and instruments. CHW initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-CHW-00001, *System Description for LAB, BOF, LAW, HLW and BOF-Supplied PTF Chilled Water System*.

4.2.1.2.10 Communication Electrical System

The WTP plant-wide CME uses Voice over Internet Protocol (VoIP) and includes: Telephone/PC, wireless access, public address and building evacuation, take-cover alarms, building electronic access and control system, keep out warning lights, and noisy area warning lights. CME initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-CME-00001, *System Description for the Communications Electrical System (CME) and Facility Network Infrastructure (FNJ)*.

4.2.1.2.11 Cathodic Protection Electrical System

The impressed cathodic protection electrical system (CPE) provides the elimination or mitigation of corrosion for protected underground metallic pipes. CPE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-CPE-00001, *System Description for Waste Treatment Plant Cathodic Protection*.

4.2.1.2.12 Demineralized Water System

The demineralized water system (DIW) system treats process service water to produce demineralized water. DIW initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-DIW-00001, *System Description for the Demineralized Water System*.

4.2.1.2.13 Domestic Water System

The domestic (potable) water system (DOW) system provides a continuous supply of potable water to the Lab. DOW initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-DOW-00001, *System Description for the Waste Treatment Plant Domestic Water System*.

4.2.1.2.14 Environmental Monitoring System

The environmental monitoring system (EMJ) system detects airborne contamination or radiation and warns personnel in the immediate vicinity of the determined hazard. EMJ initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-EMJ-00001, *System Description for Environmental Monitoring System*.

4.2.1.2.15 Fire Detection and Alarm System

The FDE system monitors the FPW system as well as other initiating devices. The FDE device signals will summon the Hanford Fire Department and be displayed in the MCR. FDE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*.

4.2.1.2.16 Fire Protection Water System

The FPW system distributes fire protection water throughout the Lab facility. FPW initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*.

4.2.1.2.17 Fire Service Water Storage and Distribution System

The FSW system stores and delivers water to the Lab sprinkler system. The FSW system consists of water storage tanks, piping, fire hydrants, diesel driven fire pumps, jockey pumps, tank heaters, and diesel day tanks. FSW initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*.

4.2.1.2.18 Grounding and Lightning Protection Electrical System

The grounding and lightning protection electrical system (GRE) system consists of two interconnecting sub-systems: the grounding system and lightning protection system. The grounding system provides protection of plant personnel from electric shock and provides protection to electrical equipment and instruments from electrical noise. The lightning protection system protects the Lab building and equipment against damage due to lightning strikes and protects site personnel from shock hazards associated with lightning strikes. GRE initial configuration, start-up, and normal operation procedures are described in *24590-WTP-3YD-GRE-00001, System Description for Grounding and Lightning Protection System*.

4.2.1.2.19 High Pressure Steam System

The high-pressure steam system (HPS) system and low pressure steam system (LPS) system provide a continuous supply of steam to the Lab for process HVAC uses. The saturated HPS received from the BOF HPS via an above-ground piping system to the Lab. The LP steam is generated within the Lab for HVAC heating by taking a portion of the HP steam and reducing the pressure. HPS initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-HPS-00001, *System Description for the Waste Treatment Plant High Pressure Steam (HPS), Low Pressure Steam (LPS) and Steam Condensate Water (SCW).*

4.2.1.2.20 Heat Trace Electrical System

The heat trace electrical system (HTE) system provides freeze protection for pipes, instrument air lines, and instrument sensing lines that are exposed to outdoor ambient temperatures. The Lab does not require heat tracing inside the facility. HTE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-HTE-00001, *System Description for the Waste Treatment Plant Heat Trace Electrical System*.

4.2.1.2.21 Low Pressure Steam System

The HPS system and LPS system provide a continuous supply of steam to the Lab for process and HVAC uses. The saturated HP steam is received from the BOF HPS, which is distributed via an above-ground piping system to the Lab. The LPS is generated within the Lab for HVAC heating by taking a portion of the HP steam and reducing the pressure. LPS initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-HPS-00001, *System Description for the Waste Treatment Plant High Pressure Steam (HPS), Low Pressure Steam (LPS) and Steam Condensate Water (SCW).*

4.2.1.2.22 Lighting Electrical System

The lighting electrical system (LTE) system provides artificial illumination for the Lab. LTE provides normal lighting and emergency lighting. LTE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-LTE-00001, *System Description for Lighting Systems*.

4.2.1.2.23 Low Voltage Electrical System

The low voltage electrical system (LVE) system provides 480/208/120 V low voltage electrical power to the Lab facility for all processes and functions. LVE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3ZD-MVE-00001, *LAW, BOF, and Lab Medium Voltage Electrical (MVE) Low Voltage Electrical (LVE) and DC Electrical (DCE) System Design Description*.

4.2.1.2.24 Miscellaneous Gas System

The Lab MXG system provides continuous supply of miscellaneous (90% argon and 10% methane) gases to alpha/beta counters and X-ray fluorescence instruments throughout the RL and HC in the Laboratory Facility. MXG initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-MXG-00001, *System Description for the Analytical Laboratory Miscellaneous Gases System*.

4.2.1.2.25 Medium Voltage Electrical System

The MVE system provides 13.8kV medium voltage electrical power to the Lab facilities. MVE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3ZD-MVE-00001, *LAW, BOF, and Lab Medium Voltage Electrical (MVE) Low Voltage Electrical (LVE) and DC Electrical (DCE) System Design Description*.

4.2.1.2.26 Non-Radioactive and Non-Dangerous Liquid Waste Disposal System

The NLD system collects non-dangerous, non-radioactive effluent from the Lab. NLD initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-NLD-00001, *System Description for the Waste Treatment Plant Non-Radioactive Liquid Waste Disposal System*.

4.2.1.2.27 Plant Service Air System

The plant service air system (PSA) system distributes the air it produces to distribution piping networks within the Lab. PSA initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-PSA-00002, *System Description for the Waste Treatment Plant (WTP) Plant Service Air (PSA) System*.

4.2.1.2.28 Analytical Laboratory Process Vacuum Air System

The process vacuum air system (PVA) system provides vacuum to the radiological laboratory RAS station, fume hood vacuum stations, and bench top stations. PVA initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-PVA-00001, *System Description for the Analytical Laboratory Process Vacuum Air System*.

4.2.1.2.29 Analytical Laboratory Radioactive Liquid Waste Disposal System

The RLD system collects liquid effluent from the RL, HC, and other Lab areas for eventual transfer to other facilities for final disposal. RLD initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3ZD-RLD-00001, *Lab Radioactive Liquid Waste Disposal (RLD) System Design Description*.

4.2.1.2.30 Radiological Solid Waste Handling System

The RWH system provides mechanical handling equipment necessary to package and handle radioactive solid waste. RWH initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-RWH-00001, *System Description for the WTP System RWH Radioactive Solid Waste Handling*.

4.2.1.2.31 Steam Condensate System

The steam condensate water system (SCW) system removes condensate that results from the use of high pressure and low-pressure steam. SCW initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-HPS-00001, *System Description for the Waste Treatment Plant High Pressure Steam (HPS), Low Pressure Steam (LPS) and Steam Condensate Water (SCW).*

4.2.1.2.32 Stack Discharge Monitoring System

The stack discharge monitoring (rad and non-rad) system (SDJ) system monitors and samples the Lab ventilation and process stacks. SDJ initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-SDJ-00001, *System Description for Stack Discharge Monitoring (Rad and Non-Rad)*.

4.2.1.2.33 Sanitary Disposal System

The SND system collects, treats, and disposes sanitary sewage effluent generated by the analytical laboratory. SND initial configuration, start-up, and normal operation procedures are described in 24590-BOF-3YD-SND-00001, *System Description for Balance of Facility Sanitary Disposal (SND) System*.

4.2.1.2.34 Storm Water Disposal System

The storm water disposal system (SWD) system provides positive drainage of surface water away from structures and paved areas to prevent flooding. SWD initial configuration, start-up, and normal operation procedures are described in 24590-BOF-3YD-SWD-00001, *System Description for Balance of Facility Storm Water Disposal (SWD) System*.

4.2.1.2.35 Uninterruptible Power Electrical System

The uninterruptible power electrical system (UPE) system provides power from battery-backed source of acceptable quality,without delay or transients, when normal power is not available. UPE initial configuration, start-up, and normal operation procedures are described in 24590-WTP-3YD-UPE-00001, *System Description for the UPE Power System*.

4.2.2 System Startup

The Lab houses the following systems; each system shall be started in accordance with the listed documentation and any other start-up procedures. All utility/safety systems listed in section 4.2.1.2 must be in normal operational mode prior to start-up of the following systems:

4.2.2.1 Analytical Hotcell Laboratory System

The AHL provides the capacity to perform analyses in support of production facilities on samples with high radiation dose rates. The analytical equipment and operations occur in hotcells 1-13. AHL initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-AHL-00001, *System Description for the Analytical Hotcell Laboratory*.

4.2.2.2 Analytical Radiological Laboratory System

The ARL provides the capacity to perform analyses in support of production facilities on samples with low radiation dose rates. The analytical equipment and operations occur in fume hoods in labs RL 1-13. ARL initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-ARL-00001, *System Description for the Analytical Radiological Laboratory*.

4.2.2.3 Laboratory In-Cell Handling System

The LIH provides the capacity to manipulate, operate, handle, repair, move, and remove the analytical equipment and material located inside each of the 14-stainless-steel lined hotcells, in addition to providing a means to manipulate the sample materials to be analyzed. Materials to be handled within the hotcell include analytical equipment, unusable equipment, samples, waste, and supplies. LIH equipment includes trolley, master-slave-manipulates, and monorail hoist. LIH initial configuration, start-up, and normal operation procedures are described in 24590-LAB-3YD-LIH-00001, *System Description for Laboratory In-Cell Handling System*.

4.2.3 Normal Operations

Normal operations are defined as the operating condition in which all Lab internal and external interfacing systems are operational and functioning without limitations to achieve the design throughput for the facility. Normal operation includes routine operational activities, such as flushing of transfer piping, that are to be performed in concert with production/processing activities.

During normal operations, the Lab facility receives waste samples for analysis from the BOF, EMF, PTF, HLW, and LAW facilities and from the Tank Farms. The samples are analyzed to support process control, environmental compliance and waste form qualification. Additionally, the Analytical Laboratory has reserve capacity for limited technology testing or increase waste treatment throughput. Limited technology testing includes investigation of anticipated WTP operational performance, evaluation of process upsets, process improvements, analytical methods optimization, and qualification of new instruments. Lab operations will generate waste, some of which will be dangerous waste regulated under RCRA and Washington State Regulations, and must meet specific treatment and performance standards for storage and disposal in accordance with the specific requirements of the WTP Contract and WTP Dangerous Waste Permit.

System Description/System Design Description documents include the Principles of Operation for each Lab internal and external interfacing systems. This section provides a general description of the Lab processes. All the systems in the Analytical Laboratory are sized and operated to support the mission of the Lab and support Waste Treatment Plant. The frequencies of sampling and types of analyses are stated in the sampling schedule included in the design basis document, 24590-WTP-PL-PR-01-004, *Analytical Laboratory Design Requirements:*

WTP Sampling and Analysis Plan. The sampling schedules are based on design rates of 6.0 MTG per day IHLW and 30 MTG per day ILAW. These production rates project an analytical support workload of about 10,000 samples per year. The analytical requirements for the operation of the Lab are described in 24590-WTP-PL-PR-04-0001, *Integrated Sampling and Analysis Requirements Document (ISARD)*.

The general workflow for samples, waste, materials, and information transfer in AHL and the ARL is as follows:

- Receive Samples
- Stage Samples
- Prepare Samples
- Transfer Samples
- Analyze Samples
- Stage Solid Waste
- Transfer Solid Waste
- Transfer Aqueous Waste
- Receive Reagents and Material
- Store Reagents and Material
- Transfer Reagents and Material
- Capture, Store, and Report Analytical Information

4.2.3.1 Analytical Hotcell Laboratory Equipment System

The AHL hotcells are operated remotely. The hotcells contain equipment and instrumentation to receive and prepare samples for analyses, and perform analysis using chemical separations and elemental, molecular, and radioisotope quantification. The AHL contains 14 analytical hotcells (24590-LAB-P1-60-00012) designed to accommodate remote handling of samples and other material with potentially high direct dose rates. Objects are moved within and between cells by the LIH. The hotcells form a C5 confinement boundary and are ventilated by the C5V exhaust system. The hotcells are normally maintained at pressures lower than the surrounding areas by the HVAC system (see section 4.2.3.6) to ensure that contamination is not released into occupied areas.

AHL Operational Flow:

- Samples received pneumatically via the ASX system arrive at the ASX hotcell receipt station (ASX-SMPLR-00039) and hotcell receipt and disposal station (ASX-SMPLR-00043) located on the roof of the hotcell. Drop tubes are provided for depositing sample bottles into HC1. The design of these receipt stations maintains the C5 boundary of the hotcell. Manually transferred samples will be introduced into HC14 via the transfer drawer in the maintenance area.
- Samples received in the hotcells are unpackaged as necessary, and readied for sample preparation activities.
- Specific types of activities related to sample preparation and handling include the following:
- Representative aliquots of the original sample are taken in most cases.
- Weight and volume is measured and recorded, as needed, to support the analysis for a given sample.
- DIW and/or mineral acids are used to dilute samples to prepare the samples for analysis and to minimize direct radiation from the sample.
- Some samples are dried by an oven to prepare the samples for analysis. Samples heated in this fashion are subsequently cooled to support further preparation activities.

- Radiological dose rate of sample aliquots is reduced by ion exchange, removing most of the radio cesium, for transfer out of the hotcells.
- Some samples undergo separation of the liquid and solid phases, by centrifuges or filtration equipment, to support analysis needs.
- Multi samples may be mixed or composited into a single sample.
- Some samples are split into multiple subsamples to support different types of analyses to be conducted on the original sample.
- Some samples may require the solids fraction to be dissolved. To support such dissolution, three processes are used: water solubilization, heat assisted acid dissolution (e.g., microwave or oven), and alkali fusion dissolution.
- In-cell handling is performed by the LIH MSM, and samples are moved from cell to cell by the LIH trolley.
- Prepared samples are transferred to radiological laboratory areas for specific analysis.
- Specific types of activities related to sample analysis include the following:
- Selected samples are analyzed using laser ablation/inductively coupled plasma atomic optical spectrometry or laser ablation/inductively coupled plasma mass spectrometry.
- Hotcell sampling processes may include particle size analysis and rheology of sample waste feed materials.
- Solid wastes generated inside the hotcells include such items as plastics, glassware, failed equipment, spent ion exchange resin, sample bottles and contaminated carriers, and cleaning and decontamination wipes. Waste is segregated, collected, and stored in 55 gal. drums.
- Solid wastes are exported from the hotcells via the waste transfer port in HC14. A solid waste transfer port, designed for use with a standard 55 gal. drum, is provided for solid waste transfer from the hotcells. The transfer port is equipped with a gamma monitor to detect and display dose rates, to avoid inadvertently removing a high activity item (e.g., undiluted sample) from the hotcells.
- Transfer secondary liquid waste out of the hotcells. Liquid wastes are transferred to the C5 RLD system via hotcell drains. DIW is used to flush the drain lines and ensure that the liquid wastes reach the C5 vessel.
- Reagents, bottles, and other small materials to support ongoing operations are introduced into the hotcell provided with a drop tube. The tubes allow the materials to enter the hotcells by gravity. Drop tubes minimize the need for staging reagents and bottles in the hotcells because such items can be prepared outside the hotcells and introduced as needed. Reagents and materials are introduced directly to the hotcell where they are used to minimize the transfer of reagents and material. There is no provision for items to be removed from the hotcells via the drop tubes.
- Records and data management for all samples are maintained by the LIMS to ensure adequate tracking of sample processing.

4.2.3.2 Lab In-Cell Handling System

The LIH system provides the mechanical handling equipment needed to operate the analytical hotcells. This equipment performs diverse operations that include movement of samples, material, and equipment within the hotcells, and movement of objects into and out of the hotcell. Objects are moved between cells by a trolley system, overhead monorail hoists, or MSMs. The hotcells are interconnected through openings in the partition walls that separate each hotcell. The trolleys are used primarily to transport smaller, lighter objects from cell to cell, especially for frequent movements. The monorail hoists accommodate larger and less frequently transferred objects. Work is accomplished in the hotcells by MSMs, with visual observation through shield windows. The major equipment in the mechanical handling systems for the hotcells includes the following:

- MSMs each cell
- Shield windows
- Monorail and hoists
- Hotcell trolley and trolley trough
- Hotcell partition walls
- Shielded transfer imports and exports
- Sample export glovebox - the export glovebox is attached to the export location on the hotcells, and supports export activities.
- Import/export fume hoods - fume hoods are adjacent to the export glovebox and the shielded transfer import (which does not have a glovebox) on the north side of the hotcells. The fume hoods provide a measure of contamination control for items being removed from the glovebox or being imported through the shielded transfer import.

4.2.3.3 Analytical Radiological Laboratory Equipment System

The ARL is made up of multiple radiological laboratory rooms, which contain equipment and instrumentation to receive and prepare samples for analyses, and perform analysis using chemical separations and elemental, molecular, and radioisotope quantification. The ARL equipment system consists of 14 laboratories (24590-LAB-P1-60-00012). The ARL system, also called the rad labs, houses the equipment, storage space, reagents, and other items necessary to conduct sample analyses in the Lab facility.

Typically, a rad lab consists of one or more laboratory hoods with interior working space, benches, shelves, cabinets, and equipment for operations. Airflow is maintained from the personnel area through the hoods to the C3 exhaust system, thus protecting workers from spills and other releases of airborne contamination.

The types of analyses conducted in the rad labs are dictated by WTP needs and defined sample points.

The sample points and associated analyses are documented in the 24590-WTP-PL-PR-04-0001, *Integrated Sampling and Analysis*

Requirements Document (ISARD).

ARL Operational Flow:

- LAW facility samples are received through the ASX system. Additional, samples are received manually from the BOF, EMF, and LAWPS.
- Samples are staged in shielded cabinets prior to processing.
- Specific types of activities related to sample preparation include the following:
    - Samples are weighed, measured for volume, diluted, dried, separated (solid-liquid), mixed, and split, depending on the analysis needs.
    - Solids fraction of a sample may be dissolved to support some analyses. To support such dissolution, three processes are used: water solubilization, heat assisted acid dissolution (e.g., microwave or oven), and alkali fusion dissolution.

    - Prepare samples for radiation counting, and to measure the radioactivity emitted by samples, including alpha, beta, and gamma radiation. Preparation can involve separation and purification, as well as other methods.

- Items (samples, material, and equipment) are moved manually by hand or cart between rad labs.
- Specific types of activities related to sample analysis include the following:
    - Distillations and titrations
    - X-ray fluorescence for metal analyses on selected samples and to investigate off-normal condition in the process
    - Particle size, thermal gravimetry, differential scanning calorimetry, process tests, and analytical methods development are performed
    - Glass samples are laser ablated for elemental analysis using ICP/OES, ICP/MS, and mercury analysis equipment
    - Preparation and analysis of radioactive samples using equipment including ion chromatography, pH probes, and oxidation units
        - This equipment is used to analyze samples for selected anions, organic acids, TOC, and TIC
- The solid wastes generated during rad lab operations are collected in small containers in the hoods. Waste is transferred from the hoods to a waste drum in the rad lab before transfer to the RWH area.
- Liquid wastes involving the samples are transferred to the C3 vessel via drains. DIW is used to flush the liquid wastes to the vessel. Incompatible secondary liquid wastes are collected in containers or lab packs for disposal with the solid waste streams.
- Reagents and standards are diluted or prepared, as necessary, from purchased materials for specific roles in the rad labs.
- Materials, standards, and reagents required to support on-going analysis are staged in cabinets in the laboratories where they are used. An inventory of stock chemicals to produce these standards and reagents are stored elsewhere in the Rad Labs for make-up and distribution.
- Records and data management for all samples are maintained by the LIMS to ensure adequate tracking of sample processing.

4.2.3.4 Radioactive Liquid Waste Disposal System

The Lab facility is designed to manage liquid waste and provide secondary containment to prevent a release of dangerous waste to the environment. Liquid effluents resulting from laboratory analysis, sample disposal, maintenance activities, decontamination wash downs, system flushing, fire protection water collection, and safety shower/eye wash water and other Lab areas are collected by the Lab RLD system. The RLD system collects liquid effluent from the rad labs, hotcells, and other Lab areas for transfer from the facility. The RLD system is divided into three distinct groups: the C5 RLD components, the C3 RLD components, and the C2 RLD components. RLD pipe that conveys wastes from one containment area to another is double-walled. The double-walled pipe is sloped to ensure that the jacket drains to a leak detection box or to a pit that is monitored for leakage. Although the C2 vessel is identified as part of the RLD system, it is not designed or permitted to manage dangerous wastes.

Table 4–1 RLD Sources

Liquid Waste Source	RLD Subsystem	Disposal/Treatment Facility
Hotcells and DIW flush and other C5 sources: • Hotcell floor drains • Laboratory area sink drain collection vessel (RLD-VSL-00164) and sumps • Floor drain collection vessel (RLD-VSL-00163) and sump • Hotcell glovebox drains • Hotcell transfer port drains • C3 decontamination booth drain • C5 pump and valve pit sumps • Laboratory area sink drain collection vessel sump • Hotcell drain collection vessel pit sump	RLD C5 including Hotcell drain collection vessel (RLD-VSL-00165)	PTF PWD
Sink Drain and DIW flush and other C3 sources: • Rad lab sinks • Rad lab fume hood sinks • Floor drain collection vessel (RLD-VSL-00163) • Decon room showers and sinks • Process vacuum pump skid • Hotcell maintenance access area drain • C3 maintenance shop floor/sink drains • ASX equipment drains • C3 pump pit sump	RLD C3 including Sink drain collection vessel (RLD-VSL-00164)	PTF PWD
Lab Floor and other C2 sources: • Rad Lab corridor floor drains • Janitor closet sink and floor drains • C5 filter/fan room floor drains • C2 hotcell corridor floor drains • Eyewash and safety shower runoff via various C2 floor drains • Fire water discharge in the event of a fire	RLD C2 including Floor drain collection vessel (RLD-VSL-00163)	BOF NLD

Liquid Waste Source	RLD Subsystem	Disposal/Treatment Facility
• C2 maintenance shop floor drain systems • ASX vacuum pump room drains • C2 and C3 filter/fan room floor drains • HP personnel decontamination room floor drains • Floor drain collection vessel sump		
HVAC Cooling coil condensate and sanitary sewage	Lab facility effluent system	SND system

The vessels, hardware, and associated piping can be cleaned and drained. Demineralized water is used to flush the drain lines and ensure that the liquid wastes reach the radioactive effluent collection vessels.

4.2.3.5 Solid Waste

The RWH system for the Lab transfers secondary solid radiological and mixed waste from Lab areas into 55-gallon waste drums or shielded 55-gallon waste drums. The waste is the result of Lab facility operations and includes material from the hotcells and the rad labs, as well as other areas of the facility. The solid waste streams could include mixed wastes. Typical waste streams include the following:

- Laboratory glassware
- Sample bottles
- Contaminated carriers
- Plastic containers
- Contaminated organic liquid waste (lab packs)
- Failed equipment
- Debris, and waste, such as personal protective equipment
- HEPA filters and pre-filters (HEPA filters might be disposed of in containers other than 55 gal drums)
- Organic ion exchange resin columns

Solid waste from the hotcells is accumulated in smaller containers and then placed into the waste drum remotely using the waste transfer system equipment. The size of the solid waste may be reduced to minimize waste volumes exported from the hotcells. Compaction and equipment disassembly, as well as other methods, may be used to accomplish size reduction.

The solid waste transfer system is used to export solid waste from the waste cell (HC14). The solid waste is transferred to the waste cell and exported from the hotcell through the waste transfer port into a drum in the hotcell maintenance access room. System components are shown on drawings 24590-LAB-M7-RWH-00001 and 24590-QL-POA-HCHH-00003-10-00001 through 00014. The waste transfer system and related components are designed to export solid waste from the waste cell (HC14). The RCP, as implemented in the Lab facility, is relied upon to ensure that high dose rates from waste drums do not endanger facility workers. A gamma monitor with probe located near the midpoint of the waste drum is used to monitor the dose rate from the drum, such that the contact dose rate remains acceptable.

The typical Hotcell waste transfer process includes the following steps:

- The waste transfer port shield door (RWH-DOOR-00027) on the maintenance access room side of the bag-less waste transfer pit is opened. A standard 55-gallon waste drum and liner (with attached liner lid) are loaded onto the waste cell drum bogie in the maintenance access room.
- The motorized waste cell drum bogie, which includes a lift mechanism, moves the waste drum to the shielded cavity under the waste transfer port (RWH-HTCH-00026) in the waste cell.
- The shield door is closed. The waste drum is lifted into position and the drum liner is mated to the waste transfer port assembly.
- The drum liner lid is removed by the waste cell transfer port lid when the port is opened. A funnel is lowered into the opening and waste is then placed in the drum.
- When loading is complete, the port lid is closed (which places the lid back on the drum liner), the drum is lowered, the shield door is opened, and the drum is moved to the maintenance access area. Containment is provided by the drum liner when the port is open. The shield door provides shielding when the waste cell transfer port lid is open and if high dose rate material is inadvertently loaded in the drum.
- After the drum is in the maintenance access room, the drum lid is placed on the drum and the drum is staged or removed from the facility.

Solid waste from other areas is accumulated in smaller containers and then transferred to a waste drum. The waste drum is then transferred to the waste drum management areas, where volume reduction is achieved as needed. The compactor (RWH-CPT-00003) is a standard industrial in-drum compactor fitted with HEPA pre-filters that vent to the C3V system.

Separable organic secondary wastes are sorted by compatibility, accumulated in smaller containers in the rad lab hoods, and transferred to the lab pack area of the waste drum management areas. In the lab pack area, compatible organic wastes are placed in larger containers, packed with absorbents, and placed in interim storage.

Ventilation system HEPA filters are removed, handled, and packaged in accordance with the Radiological

Control Program ([RCP] 24590-WTP-PL-NS-01-001), and removed from the facility in an appropriate waste container.

4.2.3.6 Lab Ventilation

The Lab ventilation systems support contamination control by providing airflow from areas of low or no contamination to areas of higher potential contamination in a cascading ventilation arrangement. The Lab C2V, C3V, and C5V ventilation systems provide ducts, exhaust fans, and HEPA filters to remove airborne radioactive contamination and non-radioactive particulates to maintain emissions below applicable limits before the treated vent gases are discharged to the atmosphere. The HVAC systems provide heating and cooling within the building, and allow areas within the building to be maintained at design temperatures.

The AHL ventilation flows from C2 area cascades through in-bleed filters into the hot cell of a C5 area and out the C5V stack. The ARL ventilation supply is the C2V system and is cascaded through the fume hoods to the C3V system and stack.

Stack exhaust is monitored continuously to ensure compliance with environmental permits. In-line stack monitors monitor radionuclide concentrations in the gaseous emissions from the Laboratory.

Since the Lab processes air, liquid, and sludge samples, and tank farm grab samples, radionuclide particulate and aerosols are expected in the analytical laboratory exhaust systems due to the handling and analysis of these samples. Thus, appropriate confinement and ventilation systems are provided to avoid releases and minimize the spread of contamination and hence, the potential to receive an internal dose. The AHL is equipped with a hotel suite and ventilated hood and/or glovebox assemblies and the ARL laboratories are equipped with fume hoods or shielded storage cabinets which are vented to the Lab ventilation system to provide containment of contamination.

4.2.3.7 Utilities

Prior to receipt of samples, all utility systems listed in section 4.2.1 and 4.2.2 shall be in the normal operation mode.

4.2.3.8 Decontamination and Leak Containment

Vessel cells and pump/pipe pits are stainless steel lined. In areas where the need for decontamination is anticipated, exposed surfaces are coated as necessary to provide durability and ease of decontamination. Designated areas have wash down capabilities, including spray rings and water jets in inaccessible areas. These areas aid decontamination and deactivation by the presence of the stainless-steel liner and floors with special protective coatings.

- A-0142 to A-0155 C5 Hotcells (HC1 to HC14)
- A-B002 C3 Pump Pit (RLD-PMP-0182A/B)
- A-B003 C3 Effluent Vessel Cell (RLD-VSL-00164, RLD-LDB-00005/00006/00007/00008/00011)
- A-B004 C5 Effluent Vessel Cell (RLD-VSL-00165, RLD-LDB-00002/00004/00009)
- A-B005 C5 Hotcell Drain Collection Pump pit (RLD-PMP-00183B)
- A-B006 C5 Piping pit
- A-B007 C5 Hotcell Drain Collection Pump pit (RLD-PMP-00183A)
- A-0141B C3 Lab Maintenance Glovebox (LAB-60-MHAN-00003)

[3.6.2.2]

Stainless steel liners used to facilitate decontamination can extend up the walls, only to the regulatory required height. The walls above the steel may be sealed with suitable finishes depending upon the conditions and as established by ADR for the special protective coatings. [3.6.2.4]

4.2.3.9 Access Control

4.2.3.9.1 Loading Bays and Docks

The Lab has four loading docks for receipt and shipment of supplies, waste, and equipment. At the north end of the building, there is a large loading dock area with dock bumpers and associated insulated exterior roll-up door. This area is equipped with dock provisions for loading or unloading two trucks at a time. On the east side of the building outside the receiving area, there is a loading area with an insulated exterior roll-up door protected by bollards. At the south end of the facility, there are two loading areas, each with an insulated exterior roll-up door protected by bollards. The roll-up door of airlock A-0141G has exterior weather protection. The other three loading docks and roll-up doors do not have weather protection beyond the facility exterior. The loading areas on the north end of the building and outside of room A-0139D do not require weather protection as they are on the gable ends of the building. Prior to start of sample analysis, the Loading Dock must be in operational mode.

4.2.3.9.2 Change Room

The Lab facility provides areas for changing between personal clothing and contractor-provided clothing and into radiological protective clothing, directly adjacent to controlled radiological areas. Change rooms with showers, lockers, and benches are at each of the processing facilities for plant personnel to change between personal clothing and contractor-provided clothing.

To prevent spread of contamination, prevention change rooms incorporate control to prevent commingling of workers wearing potentially contaminated protective clothing or respiratory protection with those who are not potentially contaminated. Contractor provided clothing is donned or removed in the clean change rooms.

4.2.3.9.3 Access

The Lab access is controlled by computer-based data verification. An employee identification badge, capable of interfacing with the access control system, is used to uniquely identify each employee and gain authorized admittance. Access control is provided at each facility entrance. Lab design facilitates emergency access and intervention by Hanford and/or the local emergency service. Access control information is also used to support personnel accountability in emergency scenarios. However, this can only be achieved through positive identification on both ingress and egress (i.e. identification badge readers or request to exit sensors on exits). Emergency exits will only provide post emergency entrance (i.e. after "All clear" announcement). Rollup doors will not be operable from outside the facility. [3.8.4.1]

4.2.3.9.4 Toxic Environments

There are three rooms within the Lab where a toxic/oxygen deficient environment may exist, the filling room A-0120, the C&I room A-0117, and the Radiological Counting Room (RL 13).

In the C3 Maintenance Shop, A-0141B Carbon Dioxide (CO_2) is used for decontaminating equipment. There is a potential for release of excess CO_2, creating a toxic environment in the room. The room is equipped with a CO_2 monitor, which will alarm at high CO_2 levels.

4.2.3.10 Personnel Safety Features

The Lab design supports the project goal of zero accidents. The Lab facility provides the following industrial safety design features that ensure personnel safety and minimize industrial safety concerns in the Lab operating areas: Eyewash stations, first-aid supplies for chemical burn, an emergency chemical spill kit, and portable, dry-chemical fire extinguishers (provided in each laboratory room), safety showers (provided near chemical laboratories), and intra-laboratory public address and telephone communication system.

4.2.4 Off-Normal Operations

4.2.4.1 Over Production

An assessment of the Lab operation was performed using the OR Lab model to validate the Lab design. The assessment, 24590-WTP-RPT-PET-08-014, *2008 WTP Operations Research Assessment*, confirmed that the laboratory completed the sample analyses with the ATA and that the laboratory configuration adequately supports the WTP sampling needs at the expanded HLW rate of 7.5 MTG per day IHLW from normal operation of 6.0 MTG per day IHLW. Non-routine samples that may be analyzed for non-routine purposes (e.g., process technology, optimization, off-normal conditions, or analytical methods improvements) will be accommodated based on priority, but will not necessarily constitute an operational basis of the Lab.

4.2.4.2 Fire

In the event of a fire (which is an off-normal event), Lab structures are designed and built to provide 2-hour rated fire barriers to provide protection from fire internal and external to the structure. The structures are equipped with a Fire Protection System. The following are fire protection design features:

- Two hour rated fire barriers are provided throughout the facility in accordance with Fire Hazard Analysis, Building Code, and Life Safety Code requirements to prevent the propagation of fires between areas and limit the impact of fires.
- The SS fire barriers provide a minimum 2-hour fire resistance rated enclosure based on the fire exposure and acceptance criteria specified in ASTM E119 and NFPA 101, Chapter 8.
- HEPA filter enclosures located inside the process facilities are separated from all process areas of the building with 2-hour fire barriers.
- Door openings into 2-hour rated filter plenum housings are 1 1/2-hour minimum fire-rated.
- Door openings into 1-hour rated filter plenum housings are ¾-hour minimum rated.
- Design of mechanical and electrical penetrations of fire barriers are fire stopped by materials listed in accordance with ASTM E814 or approved engineering evaluation and are to be of a fire rating not less than the barrier or enclosure as required by IBC 2000 and DOE-STD-1066-97 (Tailoring).
- Fire dampers and doors are rated as required in the (Uniform Building Code/International Building Code) UBC/IBC and in NFPA 101, Chapter 7.
- Design of interior finish materials are Class A in accordance with ASTM E84.
- Design of interior floor coverings are Class I in accordance with ASTM E648.
- Design of Lab roofing system are Class II as listed by Factory Mutual.
- Fireproofing of structural steel are provided in accordance with UBC/IBC and where applicable, the requirements of DOE O 420.1B and DOE STD 1066-97 (Tailoring).
- The fire barriers mitigate the consequences of an airborne release to the public and/or co-located workers by providing a high-integrity confinement boundary evaluated for accident (seismic and fire) conditions.

4.2.4.3 Earthquake

All components and parts of the equipment that provide or contribute to the safety functions and accident monitoring functions, including equipment supports and anchorage, are qualified accordingly. This qualification ensures SSCs meet the designated seismic design requirements. SSCs designated as safety SSCs can withstand the effects of NPH events (e.g., earthquakes, wind, and floods) without loss of capability to perform specified safety functions. [3.6.1.2]

In areas containing equipment designated to have safety functions following a design basis event, the piping for standpipe and hose valve stations located within the stairwells have been analyzed for the earthquake loads.

4.2.4.4 Lightning

In the off normal event of the Analytical Laboratory Facility being struck by lightning, the facility is protected by the GRE system. The design basis lightning event poses a potential threat to the safety designated electrical power supply that could result in temporary loss of facility power and safety designated control and instrumentation systems resulting in component degradation or failure. Safety-designated SSCs internal to the

Lab facility are protected from environmental conditions and events such that they are available to perform their designated safety function when called upon. The Lab facility safety MCCs, switchgear, distribution, and UPE for control and instrumentation are protected for lightning. This protection consists of the grounding grid connection to the surge protection device on the safety control and instrumentation and safety power supplies.

4.2.4.5 Loss of Power

Exit Travel Path lighting is provided at locations that will aid safe evacuation. Egress Lighting is self-contained battery backed (Bug Eye type) light fixture assemblies. The dry type batteries for egress lighting fixtures are rated to provide illumination levels consistent with the requirements of NFPA 101-2000, Section 7.9.2.1.

4.2.4.6 Leaks

The facility structure provides secondary containment for liquid wastes that escape their primary containment boundary (tanks/vessels, ancillary systems, waste containers. The secondary containment has a leak detection system that detects the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste or accumulated liquid in the secondary containment system within 24 hours. Detection of a leak of at least 0.1 gallons per hour within 24 hours is defined as being able to detect a leak within 24 hours. [3.6.3.5]

4.2.5 System Shutdown

In the event of the need to shut down the Laboratory Facility, all utility and safety systems listed in section 4.2.1 must maintain operation until the AHL and ARL are shut down. The affected process area shall be placed in a stable condition that is unlikely to challenge limiting conditions of operations or to result in an uncontrolled release of hazardous chemical or radioactive material. Maintenance activities and SRs may be performed unless prohibited by an limiting conditions of operation.

4.2.6 Safety Management Programs and Administrative Controls

The Lab facility will comply with all Safety Management Programs applicable and available to this system, including ALARA programs and radiological procedures. Additional administrative controls unique to this system are discussed below Safety management programs and administrative controls are in place to protect workers and minimize exposure, to the greatest extent practical, in keeping with ALARA principles of design. Lab is designed to limit personnel exposure by limiting access to high dose areas, limiting spread of contamination by controlling personnel movement and airflow, and providing leak detection and built-in decontamination methods.

Interior walls and structure that are part of the C5V boundary are designated as SS and Seismic Category (SC)-III to provide secondary containment/confinement. Other Lab building interior and exterior walls and structure are designated as non-safety and SC-III, as a minimum.

4.2.6.1 Personnel Exposure

The Lab facility has one or more of the following physical controls at each entrance or access point to a high radiation area[1] (area classified R5):

[1] High radiation area is any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.1 rem (0.001 Sv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

- Where there is potential for equipment failure within higher than normal radiation areas, means are to be provided for recovery of that equipment. Floor access plates are provided to access vaults/pits for removal or replacement of vessel ancillary equipment located in below grade C5/C3/C2 effluent cells that will require routine maintenance, calibration, recovery, etc. Floor plates provide shielding.
- Lab facility instrumentation is located outside of R5/C5 areas, wherever possible. For instrumentation required to be located, in-cell will be run to failure. Instrumentation is located on remotely removable and maintainable jumpers, or in areas where the dose rate can be readily reduced to acceptable radiation levels, unless exempted by Operations (OPS). [3.6.2.7]
- When equipment located in high radiation cell areas cannot be designed to last the life of the facility, Lab facility are designed to include provisions for in-cell maintenance or replacement of equipment without human intervention. [3.6.2.5]

4.2.6.2 Control of Contamination

The Lab facility decreases the spread of contamination by sealing wall penetrations and by monitoring personnel movement between clean and regulated areas. Penetrations are designed such that the safety function of the structure they penetrate is not impaired and will support the function of the SSC using the penetration. All wall and floor penetrations are sealed as per Underwriters Laboratories listing requirements for penetrations. [3.6.2.9]

In the AHL, all cell penetrations can be closed to prevent the spread of contamination or prevent unintended intrusion for cells that cannot be satisfactorily decontaminated. This is to be accomplished with pipe stubs (or threaded connections to add pipe stubs). [3.9.2.4]

4.2.6.3 Leak Detection/Decontamination

Lab facility is designed such that all leaks can be controlled and contained. [3.5.3.4] Containment includes leak detection systems that will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste or accumulated liquid in the secondary containment system within 24 hours. [3.6.3.5.2] Stainless steel liners are used in areas where leaks may occur to facilitate decontamination. It is acceptable for stainless liners to extend up the walls only to the regulatory required height. The walls above the steel may be sealed with suitable finishes depending upon the conditions and as established by ALARA Design Review for the special protective coatings. [3.6.2.4]

In locations where significant contamination could arise, built-in decontamination facilities such as spray rings and water jets are installed. Design features that simplify and facilitate decontamination and decommissioning, minimize contaminated equipment, and minimize the generation of radioactive waste during deactivation, decontamination, and decommissioning are incorporated into the Lab design based. Lab facility design includes provisions for decontamination of hotcells, vessels, gloveboxes, and pits to reduce contamination levels and personnel exposure. [3.6.2.2]

The containment design feature includes special protective coatings (SPCs) in work areas designated as ALARA areas or ALARA zones where personnel exposure to radiation and radioactive materials is managed and controlled at levels ALARA by employing SPCs. These coatings are provided to inhibit radioactive surface contamination ALARA and facilitate deactivation and demolition. Typically, this includes C2 area floors, C3, and occupied C5 areas (floors, walls, ceilings and various commodities), up to 7.5 feet above the floor finish or platform and reachable surfaces within 40 inches of the "Work Area". Work area is defined as the physical area of the facility that operations personnel can encounter contaminated surfaces of the building structure. [3.6.2.2]

4.3 Testing and Maintenance

This section describes the Lab testing and maintenance requirements but does not cover details related to specific systems within the Lab facility, which are covered under their own system descriptions or system design descriptions.

4.3.1 Temporary Configurations

Temporary modifications used to support maintenance are developed in accordance with 24590-WTP-GPP-RAEN-EN-0013, *Temporary Modification Control*. Temporary modifications are not considered changes to the permanent plant configuration, and therefore do not need to conform to the design requirements established in section 3, but they are screened for engineering and operational acceptability. See individual system descriptions or system design descriptions.

4.3.2 TSR-Required Surveillances

Procedures that implement any TSR- Required Surveillances for the Lab facility are indicated in Section 3.10, Table 3-4. There are no TSR-Required Surveillances for the Lab facility.

4.3.3 Non-TSR Inspections and Testing

TBD

4.3.4 Maintenance

Periodicities for periodic maintenance activities are established in accordance with 24590-WTP-GPP-CMNT-004, *Periodic Maintenance and Surveillance Process*, and documented in the computerized maintenance management system.

4.3.4.1 Post Maintenance Testing

See individual system descriptions or system design descriptions.

4.3.4.2 Post Modification Testing

See individual system descriptions or system design descriptions.

4.4 Supplemental Information

No additional information is applicable now. This section is reserved for future use as needed.

5 References and Design Documents List

5.1 Source / Basis References

Document Number	Title	Text Ref.
24590-WTP-DB-ENG-01-001	*Basis of Design*	(BOD)
24590-WTP-PSAR-ESH-01-002-06	*Preliminary Documented Safety Analysis to Support Construction Authorization - LAB Facility Specific Information*	(PDSA – Lab Facility)
24590-WTP-RPT-OP-01-001	*Operations Requirements Document*	(ORD)
24590-WTP-SRD-ESH-01-001-02	*Safety Requirements Document, Volume II*	(SRD)
DE-AC27-01RV14136	*DOE/BNI Contract*	(WTP Contract)
24590-WTP-ICD-MG-01-009	*Interface Control Document for Land Siting*	(ICD-9)
WA7890008967	*Dangerous Waste Portion of RCRA Permit*	(DWP)

5.2 Other References

Document Number	Title
CCN 076664	*Lab Hot Cell Fire Integrity Evaluation*
CCN 108409	*Hot Cell Integrity*
CCN 147402	*Lab Hotcell Fire Integrity Evaluation Technical Justification*
DE02NWP-002	*Non-Radioactive Air Emissions Notice of Construction Application for the River Protection Project-Waste Treatment Plant East of the 200-East Area of Hanford for the Department of Energy (NOC 626)*
RPT-W375-RU00003	*Applicability of DOE Documents to the Design of TWRS-P Facility for Natural Phenomena Hazards*
24590-BOF-3YD-SND-00001	*System Description for Balance of Facility Sanitary Disposal (SND) System.*
24590-BOF-3YD-SWD-00001	*System Description for Balance of Facility Storm Water Disposal (SWD) System*
24590-LAB-3YD-AHL-00001	*System Description for the Analytical Hotcell Laboratory (AHL)*
24590-LAB-3YD-ARL-00001	*System Description for the Analytical Radiological Laboratory (ARL)*
24590-LAB-3YD-BAG-00001	*System Description for the LAB Bottled Argon and Bottled Nitrogen Gas Systems (BAG and BNG)*
24590-LAB-3YD-BHG-00001	*System Description for the LAB Bottled Helium Gas System (BHG)*
24590-LAB-3YD-LIH-00001	*System Description for the Analytical Laboratory In-Cell Handling System*
24590-LAB-3YD-MXG-00001	*System Description for the Analytical Laboratory Miscellaneous Gases System (MXG)*
24590-LAB-3YD-PVA-00001	*System Description for the Analytical Laboratory Process Vacuum Air System*
24590-LAB-3ZD-60-00002	*Analytical Laboratory Ventilation System Design Description*
24590-LAB-3ZD-RLD-00001	*Lab Radioactive Liquid Waste Disposal (RLD) System Design Description*
24590-LAB-A5-A19T-05200001	*Analytical Laboratory Architectural Room Finish Schedule*
24590-LAB-A5-A19T-05200002	*Analytical Laboratory Architectural Room Finish Schedule*
24590-LAB-DBC-S13T-00001	*Drop Load Calculation*

Document Number	Title
24590-LAB-DB-S13T-00019	*Analytical Laboratory C5 Cell Structural Concrete Forming Sections and Details*
24590-LAB-DB-S13T-00020	*Analytical Laboratory C2 Vault and C3 Cell Structural Concrete Forming Plans and Sections*
24590-LAB-M6C-RLD-00016	*Dangerous Waste Permit (DWP) Liner Heights in the LAB Facility*
24590-LAB-M6C-RLD-00027	*LAB Minimum Leak Rate, Detection Capabilities for Cell Sumps, Pit Sumps, and Leak Detection Boxes*
24590-LAB-M6-RLD-00002001	*P&ID - LAB Radioactive Liquid Waste Disposal System C3 Collection & Transfer RLD-VSL-00164*
24590-LAB-M6-RLD-00002002	*P&ID - LAB Radioactive Liquid Waste Disposal System C3 Collection & Transfer*
24590-LAB-M6-RLD-00002003	*P&ID - LAB Radioactive Liquid Waste Disposal System C3 Collection & Transfer RLD-PMP-00182A/B*
24590-LAB-M7-RWH-00001	*Analytical Laboratory System RWH, Mechanical Handling Diagram, Radioactive Waste Handling*
24590-LAB-P1-60-00008	*Analytical Laboratory General Arrangement Plan at EL 0'-0"*
24590-LAB-P1-60-00012	*Analytical Laboratory General Arrangement Partial Plan at EL 0'-0"*
24590-LAB-PER-M-02-001	*Dangerous Waste Permit (DWP) Liner Heights in the LAB Facility*
24590-LAB-PER-M-02-002	*Sump Data for LAB Facility*
24590-LAB-PER-M-04-0001	*LAB Minimum Leak Rate Detection Capabilities for Leak Detection Boxes, Cell Sumps, and Pit Sumps*
24590-LAB-PER-M-04-0002	*LAB Waste Removal Capability for the Effluent Vessel Cells*
24590-LAB-RPT-ENS-12-001	*LAB Post Accident Monitoring Report*
24590-LAB-U0D-W16T-00001	*Analytical Laboratory (LAB) Room Environment Data Sheet*
24590-QL-POA-HCHH-00003-10-00001	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00002	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00003	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00004	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00005	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00006	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00007	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00008	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-QL-POA-HCHH-00003-10-00009	*Drawing – LAB Waste Transfer System Waste Transfer Port Embed Liner Assembly, Section & Details*
24590-WTP-3DP-G04B-00046	*Engineering Drawings*
24590-WTP-3DP-G04B-00092	*System Verification*
24590-WTP-3DP-G04B-00093	*System and Facility Design Descriptions*

Document Number	Title
24590-WTP-3YD-BSA-00001	*System Description for the Waste Treatment Plant Breathing Service Air (BSA)*
24590-WTP-3YD-CHW-00001	*System Description for Lab, BOF, LAW, HLW and BOF-Supplied PTF Chilled Water System (CHW)*
24590-WTP-3YD-CME-00001	*System Description for the Communications Electrical System (CME) and Facility Network Infrastructure (FNI)*
24590-WTP-3YD-CPE-00001	*System Description for Waste Treatment Plant Cathodic Protection (CPE)*
24590-WTP-3YD-DIW-00001	*System Description for the Water Treatment Plant Demineralized Water System (DIW)*
24590-WTP-3YD-DOW-00001	*System Description for the Waste Treatment Plant Domestic Water System (Dow)*
24590-WTP-3YD-EMJ-00001	*Stem Description for Environmental Monitoring System (EMJ)*
24590-WTP-3YD-FSW-00001	*System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*
24590-WTP-3YD-GRE-00001	*System Description for Grounding and Lightning Protection System*
24590-WTP-3YD-HPS-00001	*System Description for the Waste Treatment Plant High Pressure Steam (HPS), low Pressure Steam (LPS) and Steam Condensate Water (SCW)*
24590-WTP-3YD-HTE-00001	*System Description for the Waste Treatment Plant, Heat Trace Electrical System (HTE)*
24590-WTP-3YD-LTE-00001	*System Description for Lighting Systems (LTE)*
24590-WTP-3YD-NLD-00001	*System Description for the Waste Treatment Plant Non-radioactive Liquid Waste Disposal (NLD) System*
24590-WTP-3YD-PSA-00002	*System Description for the Waste Treatment Plant (WTP) Plant Service Air (PSA) System*
24590-WTP-3YD-RWH-00001	*System Description for the WTP System RWH Radioactive Solid Waste Handling*
24590-WTP-3YD-SDJ-00001	*System Description for the Stack Discharge Monitoring (Rad and Non-Rad)*
24590-WTP-3YD-UPE-00001	*System Description for the UPE Power System*
24590-WTP-3ZD-ASX-00001	*System Design Description of the Autosampling System (ASX)*
24590-WTP-3ZD-MVE-00001	*LAW, BOF and LAB Medium Voltage Electrical (MVE), Low Voltage Electrical (LVE), and DC Electrical (DCE) System Design Description*
24590-WTP-COR-MGT-15-00001	*Engineering, Procurement, and Construction (EPC) Code of Record*
24590-WTP-ES-J-11-001	*Guidance for the Application of Emergency Stops on Equipment at the WTP*
24590-WTP-GPP-CMNT-004	*Periodic Maintenance and Surveillance Process*
24590-WTP-GPG-ENG-0170	*Impact Evaluation*
24590-WTP-GPG-ENG-033	*Evaluation for Seismic Interaction Effects*
24590-WTP-GPP-RAEN-EN-0013	*Temporary Modification Control*
24590-WTP-ICD-MG-01-003	*ICD 03 - Interface Control Document for Radioactive Solid Waste*
24590-WTP-ICD-MG-01-005	*ICD 05 – Interface Control Document for Non-radioactive, Non-dangerous Liquid Effluents*
24590-WTP-ICD-MG-01-006	*ICD 06 – Interface Control Document for Radioactive, Dangerous Liquid Effluents*
24590-WTP-PER-M-08-001	*Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Analytical Laboratory and LAW Facility)*
24590-WTP-PL-NS-01-001	*Radiological Control Program*

Document Number	Title
24590-WTP-PL-PR-01-004	*Analytical Laboratory Design Requirements: WTP Sampling and Analysis Plan*
24590-WTP-PL-PR-04-0001	*Integrated Sampling and Analysis Requirements Document (ISARD)*
24590-WTP-PL-RACT-RT-0001	*WTP Remotability Verification Plan*
24590-WTP-PSAR-ESH-01-002-01	*Preliminary Documented Safety Analysis to Support Construction Authorization; General Information*
24590-WTP-RPT-ENS-10-005	*WTP Classification of Areas Report*
24590-WTP-RPT-PET-08-014	*2008 WTP Operations Research Assessment*
HNF-SD-GN-ER-501	*Natural Phenomena Hazards for Hanford, Washington*
WTSC99-1036-42-17	*RPP-WTP Geotechnical Investigation, by Shannon & Wilson Inc., H-1616-51, May 2000, as amended by CCN 024564*
24590-CM-SRA-CY20-00002-01-01	*WTP Site Topographic Survey, by Rogers Survey, Inc.*
Table III.10.E.D (DWP)	*Analytical Laboratory Tank Systems Description*
Table III.10.E.P (DWP)	*Laboratory Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, and Floor Drains*
WA7890008967, Part III, Operating Unit Conditions 10.1, Table III.10.E.D (DWP)	*Analytical Laboratory Tank Systems Description*
WA7890008967, Part III, Operating Unit Conditions 10.1, Table III.10.E.P (DWP)	*Laboratory Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, and Floor Drains*

5.3 System Design Documents

Document Number	Title
24590-LAB-M6-BSA-00003001	*P&ID - LAB Breathing Service Air System Distribution*
24590-LAB-M6-RLD-00001001	*P&ID - LAB Radioactive Liquid Waste Disposal System - C5 Collection and Transfer RLD-VSL-00165*
24590-LAB-M6-RLD-00001002	*P&ID - LAB Radioactive Liquid Waste Disposal System - C5 Collection and Transfer RLD-PMP-00183A*
24590-LAB-M6-RLD-00001003	*P&ID - LAB Radioactive Liquid Waste Disposal System - C5 Collection and Transfer RLD-PMP-00183B*
24590-LAB-M6-RLD-00001004	*P&ID - LAB Radioactive Liquid Waste Disposal System - C5 Collection and Transfer Valve Pit*
24590-LAB-M6-RLD-00005001	*P&ID - LAB Radioactive Liquid Waste Disposal System - C2 Collection & Transfer RLD-VSL-00163*
24590-LAB-M6-RLD-00007001	*P&ID - LAB Radioactive Liquid Waste Disposal System - C3 Leak Detection Boxes*
24590-LAB-M6-RLD-00008001	*P&ID - LAB Radioactive Liquid Waste Disposal System - C5 Leak Detection Boxes*
24590-LAB-M6-RLD-00008002	*P&ID - LAB Radioactive Liquid Waste Disposal System - C5 Drain Collection Headers*
24590-LAB-P1-60-00009	*Analytical Laboratory General Arrangement Plan at EL 17'-0"*
24590-LAB-P1-60-00010	*Analytical Laboratory General Arrangement Sections A-A, B-B, C-C, & D-D*
24590-LAB-P1-60-00011	*Analytical Laboratory General Arrangement Plan At Roof*

Appendix A Test Objectives, Conditions, and Acceptance Criteria

The testing activities included in this appendix are limited to those identified as needing to be performed by Startup and Commissioning to support the verification of requirements in Section 3. This appendix does not restrict Startup or Commissioning from performing other routine system testing or grooming.

Requirement (para #)	Plan (Including SSCs)	Acceptance Criteria ((test acceptance criteria) TAC or GTC)*	Notes/Comments	Test Conditions
3.8.6.7	Test to verify that the facilities have acoustic level below 109dBA	**(GTC):** The acoustic levels are below 109dBA.	The measurements will be made by ES&H using MT&E. Spaces where acoustic levels are measured to be greater than 85dBA and less than 109dBA, need appropriate signage/controls to be determined by ES&H.	All equipment in the space needs to be in its normal operation configuration.

*Note 1: TAC are based on requirements from authorization basis documents and General Test Criteria (GTC) are requirements from other sources.

Appendix B Not Currently Used

Appendix C Matrix of Lab Facility Associated Systems

Deleted

Appendix D Active Safety Instruments and Functions [Reserved]

Appendix E Operations Procedures [RESERVED]

Appendix F Programmatic (Non-Design) System/Facility Requirements

Fulfillment of the programmatic requirements listed in the table below are activities and/or operational actions necessary to satisfy the level 1 through 3 source documents requirements for the facility. The programmatic requirements listed in the table below are limited to equipment/components of the facility addressed by this FDD.

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
WTP Contract				
1.1	There are no WTP Contract programmatic requirements applicable to the Lab Facility.			
Nuclear Safety (e.g. TSRs; SACs)				
2.1	N/A	[Section 5.5.4, 24590-WTP-PSAR-ESH-01-002-06]	Surveillances related to this LCO include functional tests of the gamma monitor and interlock located in the Hotcell Receipt Station (SMPLR-00039) to ensure that they function properly. In addition, periodic calibrations of the gamma monitor are required to ensure operability.	(TBD)
2.2	N/A	[Section 5.6.8, 24590-WTP-PSAR-ESH-01-002-06]	The sampling system shall be configured to limit the volume of samples that are sent to the Analytical Hotcell by use of the ASX carrier that can only accept a specific size of sample bottle.	(TBD)

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
2.3	N/A	[Section 5.5.10.8, 24590-WTP-PSAR-ESH-01-002-06]	Installed process instrumentation (IPI) and measuring and test equipment (M&TE) shall be identified and programmatically controlled when used to perform SS control functions. Instruments used as alternate measuring devices to comply with TSR required actions that are part of the IPI or M&TE programs shall be within their calibration frequencies. Key elements of this program include: • Traceability of TSR-related instrument calibrations • Calibration frequencies for TSR-related instruments that can be calibrated • Evaluation of TSR-related items found outside of calibration tolerances • Traceability of M&TE used to calibrate TSR-related instruments (National Institute of Standards and Technology-traceable standards) • Use of calibration standards and M&TE of equal or greater accuracy than the instrument under test	(TBD)
Environmental Permit Conditions				
3.1	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility shall notify the department seven days in advance of any planned pre-operational testing of the emission unit's control, monitoring or containment systems. Six months prior to commencement of testing of a regulated system, the WTP shall provide a schedule for testing of all regulated components of that system to WDOH. The department reserves the right to observe such tests. [WAC 246-247-060(4)]	(TBD)
3.2	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility must meet all reporting and record keeping requirements of 40 CFR 61, Subpart H. [WAC 246-247-080(2)]	(TBD)
3.3	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility shall report all measured or calculated emissions annually. [WAC 246-247-080(3)]	(TBD)

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
3.4	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility shall report to the department within 24 hours, any unexpected release of radioactivity, shutdown or other condition that, if allowed to persist, or lasts more than four hours, would result in the emission of radionuclides more than any standards or limitation in the license. Applicable standards (WAC 246-247-040) include unit specific emission limits (paragraph 5), the offsite dose standard (paragraph 1), BARCT (paragraph 3) or ALARACT (paragraph 4), whichever is applicable, or any limitation included in this approval (paragraph 5). [WAC 246-247-080(5)]	(TBD)
3.5	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	All facilities must maintain records documenting the source of input parameters including the results of all measurements upon which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine effective dose equivalent. This documentation should be sufficient to allow an independent auditor to verify the accuracy of the determination made concerning the facility's compliance with the standard. These records must be kept at the site of the facility for at least five years and, upon request, be made available for inspection by the WDOH. [40 CFR 61.95; WAC 246-247-080(8)]	(TBD)
3.6	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility shall ensure all emissions units are fully accessible to department inspectors. In the event the hazards associated with accessibility to a unit require training and/or restriction or requirements for entry, the facility owner or operator shall inform the department, prior to arrival, of those restrictions or requirements. The owner or operator shall be responsible for providing the necessary training, escorts, and support services to allow the department to inspect the facility. At a minimum for unannounced inspections, such requirements or restrictions must be told to inspectors to	(TBD)

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
			provide an opportunity for inspectors to meet those requirements prior to the inspection. WDOH inspectors shall be allowed to use audio/visual equipment to document inspections. [WAC 246-247-080(9)]	
3.7	N/A	[Emission Units LB-C2, LB-S1, NOCs 1044 and 1045]	The total number of samples received annually in the analytical laboratory shall not exceed 25,804 20 ml process samples, 1865 ASX 40 ml samples, 375 40 ml non-process samples, and 795 40 ml outsourced samples. [WAC 246-247-030(5); WAC 246-47-110 (10)]	(TBD)
3.8	N/A	[Emission Unit LB-S2, NOC 1046]	The total number of samples received annually in the analytical laboratory shall not exceed 9,201 process and non-process samples with an average sample volume not exceeding 20 ml. [WAC 246-247-030(5.); WAC 246-47-110 (10)]	(TBD)
3.9	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility must be able to demonstrate that it has a quality assurance program compatible with applicable national standards. [WAC 246-247-040(5); WAC 246-247-060(6); WAC 246-247-075(6); 40CFR61.93(b)(2)(iv); 40CFR61, Appendix B, Method 114	(TBD)
3.10	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility must be able to demonstrate that workers associated with this emission unit are trained in the use and maintenance of control and monitoring systems, and in the performance of associated tests and emergency procedures. [WAC 246-247-075(12)]	(TBD)
3.11	N/A	[Emission Units LB-C2, LB-S1, LB-S2, NOCs 1044, 1045 and 1046]	The facility must be able to demonstrate the reliability and accuracy of emissions data from this emission unit. [WAC 246-247-075(13)]	(TBD)
3.12	N/A	[Section III.10.E.5, WA7890008967]	The Permittees will inspect all secondary containment systems for WTP Unit Tank Systems listed in Permit Tables III.10.E.A through D and I through P, as approved/modified pursuant to Permit Condition III.10.E.9., in accordance with the Inspection Schedule specified in Operating Unit Group 10, Addendum E1	(TBD)

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
			of this Permit, as approved pursuant to Permit Conditions III.10.E.9.e.v. and III.10.C.5., and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-320, WAC 173-303-640(5)(c), WAC 173-303-640(6), WAC 173-303-640(7), WAC 173-303-806(4)(a)(v)]:	
Other				
4.1	3.6.3.7.8	[Section 14.10.1.2, 24590-WTP-DB-ENG-01-001]	Ecology shall be notified if the removal of spills, leaks, or accumulated liquids from the secondary containment system cannot be accomplished within 24 hours.	(TBD)
4.2	N/A	[Sections 14.10.1.2, 14.10.1.3, 24590-WTP-DB-ENG-01-001]	The secondary containment for ancillary equipment shall be designed to provide a means to inspect the visible portion of the secondary containment system of a daily basis. (WAC 173-303-640[6][b][iii])	(TBD)
4.3	N/A	[Section 14.10.1.5, 24590-WTP-DB-ENG-01-001]	Tank system must be inspected on a regular basis to identify leaks and faulty equipment. In terms of the inspection requirements, the design shall provide means to daily inspection of tank systems for areas without secondary containment. (WAC 173-303-640[4][f])	(TBD)
4.4	N/A	[Section 11.14.3, 24590-WTP-RPT-OP-01-001]	Information associated with batch products will be recorded at various stages in the WTP manufacturing process using paper and electronic means. Movement of the waste shall be monitored and volume transfers recorded. Information includes tracking the processing history of any given batch material, from receipt of raw feed to disposition of finished products. It also includes monitoring and recording of data associated with the processing and movement of materials within the WTP, and defining the physical, chemical, and radionuclide content of each container and all wastes exported from the WTP. The data collected forms part of the product quality record for each product container and shall include the following: • Analytical data (including all associated	(TBD)

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
			analyses performed on a given waste batch) • Status of batch (including process parameters and mass balance information) • Container and canister data (including locations, cooling times, weights, and heat generation) • Raw material, intermediate, and finished product inventories • Feed sample results • Product sample results, if required • Container surface contamination • Pour data (including start or stop dates and times) • Weld data Provisions shall be made for collecting and storing certain product quality information against the container and canister number.	
4.5	N/A	[Section 14.14, 24590-WTP-RPT-OP-01-001]	Sampling requirements shall include: • The samples tracked using bar codes. • To reduce personnel exposure and operator time requirements, automatic sampling of process streams used where possible. Active ORD Exceptions: 24590-WTP-ORDX-OP-15-0049 • Direct sampling reserved for low-active, low frequency, and high-volume sample applications, or where needle-sampling methods are inappropriate. • Minimization of the need for sampling and to minimize the number of analyses per sample. • Wastes generated as a result of sampling to comply with all safety and disposal criteria. • A disposal route for excess sample and secondary waste. • Provision for the effective homogenization of tanks in order to obtain representative samples. • The design shall include capability to obtain samples of ILAW and IHLW glass. • Sampling systems designed to preclude secondary hazards - such as loss of	(TBD)

Item #	Associated Section # (or N/A)	Requirement Source	Programmatic Requirement	Document in which implemented (TBD until doc developed)
			containment. • Sampling shall not introduce a bottleneck in the processing of material. • Use of in-line monitors, where appropriate, low maintenance, and ALARA to reduce sampling frequency for gaseous effluent control.	