R11040950

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RPP-WTP PDC

# Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Analytical Laboratory and Low-Activity Waste Vitrification Facility

Document title: Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Analytical Laboratory and Low-Activity Waste Vitrification Facility

Document number: 24590-WTP-PER-M-08-001, Rev 0

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Contract deliverable number: Support for Contract Deliverable 7.5

Contract number: DE-AC27-01RV14136

Department: Engineering


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Issue status: Approved

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# History Sheet

| Rev | Reason for revision | Revised by |
|---|---|---|
| 0 | Initial Issue. | RB Draper |

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# Notice

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

# Executive Summary

This document satisfies the requirements of the River Protection Project Waste Treatment and Immobilization Plant (WTP) Dangerous Waste Permit (DWP) and the Washington Administrative Code (WAC), 173-303-640(3)(b), which provide for development and submittal of a program and schedule for conducting integrity assessments over the life of the regulated tanks and miscellaneous units identified in the DWP. This document addresses the WTP analytical laboratory and the low-activity waste (LAW) vitrification facility regulated tanks and miscellaneous units (and associated secondary containment and ancillary equipment) and has been developed to ensure that these regulated plant items, which manage dangerous waste, will not collapse, rupture, or fail. The regulated equipment in the WTP pretreatment facility (PTF) and high-level waste (HLW) vitrification facility is addressed in the Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Pretreatment Facility and High-Level Waste Vitrification Facility (24590-WTP-PER-M-08-002).

The WTP analytical laboratory and LAW vitrification facility contain new tank systems and miscellaneous units designed and installed in accordance with WAC 173-303-640(3) and WAC 173-303-680. This document describes the design features, materials of construction, and supplier and installation quality programs that establish the baseline conditions and measurements to allow comparisons with future integrity assessment measurements for tanks, miscellaneous units, sumps, bulges, and piping installed in the analytical laboratory and LAW vitrification facility. The baseline conditions in conjunction with operating conditions are used to establish the schedule for the initial integrity assessment following hot commissioning.

# Acronyms

| | |
|---|---|
| ABMA | American Bearing Manufacturers Association |
| ADS | air displacement slurry |
| AEA | Atomic Energy Act of 1954 |
| AHL | analytical hot cell laboratory equipment system |
| AISC | American Institute of Steel Construction, Inc. |
| ALARA | as low as reasonably achievable |
| AMCA | Air Movement and Control Association |
| ANSI | American National Standards Institute |
| API | American Petroleum Institute |
| ARL | analytical radiological laboratory equipment system |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| ASX | autosampling system |
| CCTV | closed-circuit television |
| CDR | construction deficiency report |
| CFR | Code of Federal Regulations |
| $CO_2$ | carbon dioxide |
| CRV | concentrate receipt vessel |
| DOE | United States Department of Energy |
| DWP | dangerous waste permit |
| ETF | Effluent Treatment Facility |
| °F | degrees Fahrenheit |
| ft | feet |
| HCl | hydrogen chloride |
| HEPA | high efficiency particulate air |
| HF | hydrogen fluoride |
| HI | Hydraulic Institute Standards |
| HLW | high-level waste |
| IQRPE | independent, qualified, registered professional engineer |
| LAW | low-activity waste |
| LCP | LAW concentrate receipt process system |
| LDB | leak detection box |
| LERF | Liquid Effluent Retention Facility |
| LFP | LAW melter feed process system |
| LMP | LAW melter process system |
| LOP | LAW primary offgas process system |
| LVP | LAW secondary offgas/vessel vent process system |
| MFPV | melter feed preparation vessel |
| MFV | melter feed vessel |
| MTG/day | metric tons of glass per day |
| $N_2O$ | nitrous oxide |
| NCR | nonconformance report |
| NDE | non-destructive examination |
| NEMA | National Electrical Manufacturers Association |
| NLD | nonradioactive liquid waste disposal system |

| | |
|---|---|
| NO | nitrogen oxide |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxides |
| $O_2$ | oxygen |
| % | percent |
| psig | pounds per square inch gauge |
| PTF | pretreatment facility |
| RLD | radioactive liquid waste disposal system |
| SBS | submerged bed scrubber |
| SCO | selective catalytic oxidizer |
| SCR | selective catalytic reduction |
| SNT | American Society for Nondestructive Testing, Inc. |
| $SO_2$ | sulfur dioxide |
| $SO_x$ | sulfur oxides |
| UNS | unified numbering system |
| UPS | uninterruptible power supply |
| VOC | volatile organic compound |
| WAC | Washington Administrative Code |
| WESP | wet electrostatic precipitator |
| wt% | weight percent |
| WTP | Waste Treatment and Immobilization Plant |

# 1 Purpose

The Washington Administrative Code (WAC), 173-303-640(3)(b) requires that: "The owner or operator must develop a schedule for conducting integrity assessments over the life of the tank to ensure that the tank retains its structural integrity and will not collapse, rupture, or fail. The schedule must be based on the results of past integrity assessments, age of the tank system, materials of construction, characteristics of the waste and any other relevant factors."

River Protection Project Waste Treatment and Immobilization Plant (WTP) Dangerous Waste Permit (DWP) conditions require, prior to the initial receipt of dangerous waste, the submittal of an integrity assessment program and schedule for all tanks managing dangerous waste (DWP condition III.10.E.9.e.i), the pretreatment facility (PTF) miscellaneous unit systems (DWP condition III.10.G.10.e.i), the low-activity waste (LAW) vitrification system (DWP condition III.10.H.5.e.i and III.10.I.1.a.v) and the high-level waste (HLW) vitrification system (DWP condition III.10.J.5.e.i and III.10.K.1.a.v). This document is not intended to address all of the requirements of WAC 173-303-640(3). Other WAC requirements will be addressed in future permitting submittals such as the inspection plan, contingency plan, waste analysis plan, closure plan, and certifications provided by the independent, qualified, registered professional engineer (IQRPE).

The purpose of performing integrity assessments is to prevent the collapse, rupture or failure of a component that could result in an unacceptable release of dangerous waste to the environment or could result in an impact to plant operations/activities that would adversely affect the capability of the WTP facilities to perform the overall mission for waste disposal. The purpose of this document is to describe the design features associated with the tanks and miscellaneous units managing dangerous waste and to provide an approach and schedule for integrity assessments for regulated equipment in the analytical laboratory and LAW vitrification facility. The tanks and miscellaneous units described in this document are those presented in 24590-WTP-RPT-ENV-03-002, *Tanks and Miscellaneous Units Regulated by the Dangerous Waste Permit.* The design features provided in this document were compiled from other approved WTP documents; no new design features were developed. Based on a review of the existing information, the schedule for integrity assessments was prepared.

The integrity assessment program and schedule for regulated equipment in the PTF and HLW vitrification facility is presented in 24590-WTP-PER-M-08-002, *Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Pretreatment Facility and High-Level Waste Vitrification Facility.*

# 2 Establishing a Baseline

The WTP analytical laboratory and LAW vitrification facility contain new tank systems and miscellaneous units designed and installed in accordance with WAC 173-303-640(3) and WAC 173-303-680. This section presents information on supplier and installation quality programs, pre-operations baseline measurements, materials of construction, and corrosion and erosion considerations that is used to establish baseline conditions and measurements to allow comparisons with future integrity assessment measurements. The baseline conditions in conjunction with operating conditions are also used to identify tanks and miscellaneous units with lower potential for corrosion and erosion and with higher potential for corrosion and erosion.

This information is then used to establish the schedule for the initial integrity assessment following hot commissioning. Additionally, this section describes the radiological area classifications for the WTP facilities, which determine the accessibility of tanks and miscellaneous units for integrity assessments following hot commissioning.

Section 3 of this document provides a general description of the analytical laboratory and LAW vitrification facility, including the layout of each facility and the distribution of the DWP regulated units within each facility. This information is part of the baseline to establish accessibility of tanks and miscellaneous units for integrity assessments.

Sections 4 and 5 provide detailed descriptions of each DWP regulated tank and miscellaneous unit including ancillary equipment, associated equipment bulges, and secondary containment for the tanks, miscellaneous units, and bulges. This information provides the basis for establishing an integrity assessment schedule for each regulated tank and miscellaneous unit.

Section 6 provides a description of underground piping and secondary containment features for transfer of waste between the WTP PTF and the analytical laboratory or LAW vitrification facility.

Section 7 describes the approach and schedule for integrity assessments to be conducted in comparison to the general baseline conditions and the specific construction and operation details for the DWP regulated tanks and miscellaneous units described in Sections 2 through 6.

## 2.1 Supplier Quality Program

This section describes the vessel supplier quality control requirements described in 24590-WTP-3PS-MV00-T0001, *Pressure Vessel Design and Fabrication*, that are used in conjunction with the pre-operational measurements described in Section 2.3 to establish the non-destructive examination (NDE) baseline prior to installation. The information provided in this section is primarily focused on suppliers of tanks and vessels. The overall supplier quality program that is applicable to tanks, miscellaneous units, pumps, piping, and sumps is described in 24590-WTP-3PS-G000-T0001 and supplier submitted Quality Assurance manuals.

Vessel shell and head sections that are subjected to concentrated or large loads through welded attachments are, prior to welding, ultrasonically examined over 100 percent (%) of the areas in accordance with the following:

- For connections or attachments directly welded to the shell or head, the area tested extends 3 inches beyond the extremity of the weldment.
- For connections or attachments welded via a reinforcement or doubler plate, the shell area tested extends 5 inches beyond each side of the perimeter of the fillet weld attaching the reinforcing or doubler plate to the shell or head.

All full penetration welds attaching internal or external structural components to the heads or shell are radiographically or ultrasonically tested. If fillet welds are used and are not readily radiographically or ultrasonically tested, they are dye-penetrant tested. All full penetration welds forming part of a jacket are radiographically or ultrasonically tested. All welds joining the nozzle neck to the shell or heads, which are not radiographically or ultrasonically tested, are dye-penetrant tested.

Radiography, ultrasonic testing, and dye-penetrant examinations are performed in accordance with American Society of Mechanical Engineers (ASME) Section VIII, Division 1 and ASME Section V.

All NDEs (visual, surface flaw, and radiography) of vessels are carried out after the completion of fabrication, including any heat treatment. NDEs are performed by an inspector certified to the requirements of American Society for Nondestructive Testing, Inc. (SNT) SNT-TC-1A. The interpretation of the results is by either Level II or Level III inspectors certified to SNT-TC-1A.

Ultrasonic testing is in accordance with Appendix 12 of ASME Section VIII, Division 1. Radiographic acceptance criteria are in accordance with ASME Section VIII, Division 1, paragraph UW-51 for full radiography and UW-52 for spot radiography.

The weld and NDE inspection records and associated quality control documents are used to establish the baseline condition of tanks, miscellaneous units, and piping prior to start-up and operations. If supplier documentation is not sufficient, additional NDE is conducted as described in Section 2.3 to establish a baseline prior to start of hazardous waste operations. Results of future integrity assessments will be compared to the baseline condition to evaluate the structural integrity of tanks, miscellaneous units, and piping and to determine whether the schedule of future assessments should be adjusted.

## 2.2 Installation Quality Program

Prior to covering, enclosing, or placing new regulated plant item(s) in use, an independent, qualified installation inspector or an IQRPE, either of whom is trained and experienced in the proper installation of regulated plant items, inspects the system for the presence of any of the following items:

- weld breaks
- punctures
- scrapes of protective coatings
- cracks
- corrosion
- other structural damage or inadequate construction/installation

The following documentation is considered by the independent, qualified installation inspector, or IQRPE, in certifying proper installation of regulated plant items:

- approved welding procedures
- welder qualifications and certifications
- field installation reports
- tightness test reports in accordance with the codes specified by design
- inspector credentials
- field waiver reports (i.e., nonconformance reports [NCRs], construction deficiency reports [CDRs])
- non-compliance reports, corrective action and repair reports (i.e., NCRs, CDRs)

The results of the independent, qualified installation inspector's or IQRPE's inspections at the time of installation of tanks, miscellaneous units, and piping and review of associated documents are used to establish the baseline condition of tanks, miscellaneous units, and piping prior to start-up and operations. Results of future integrity assessments will be compared to the baseline condition to evaluate the structural integrity of tanks, miscellaneous units, and piping and to determine whether the schedule of future assessments should be adjusted.

## 2.3 Pre-Operational Baseline Measurements

Pre-operational baseline NDE measurements are performed on regulated plant items in the analytical laboratory and LAW vitrification facility prior to the initial receipt of dangerous waste. The objective of these measurements is to provide representative data of the initial thicknesses of the plant items. Results of future integrity assessments will be compared to these pre-operational baseline NDE measurements to evaluate the structural integrity of equipment and to determine whether the schedule of future assessments should be adjusted. Integrity assessments conducted during the life of a regulated plant item are discussed in Section 7.

Corrosion and erosion rates are affected by parameters such as material of construction, temperature, chemistry, flow rate, stress, vibration, fluid velocity, particle size, and particle shape. Regulated plant items in the analytical laboratory and LAW vitrification facility are susceptible to various types of damage by several corrosion and erosion mechanisms. The portions of regulated plant items most likely affected by corrosion and erosion are dependent on the kind of equipment (e.g., tanks versus miscellaneous equipment) and can be markedly different. Therefore, this section provides general locations that are considered susceptible areas where pre-operational baseline NDE thickness measurements are to be recorded. In consultation with a corrosion specialist or engineer, specific NDE measurement locations are selected after the installation of the regulated plant item and before the initial receipt of dangerous waste. The portions of regulated plant items that are identified as locations for NDE measurements are based on:

- Material of construction
- Corrosive characteristics of the waste
- Erosive characteristics of the waste
- The velocity or turbulence of waste at the NDE measurement location
- Scope of information to be obtained (representative of other tanks or piping)
- Access to the NDE measurement location (either manually or remotely)
- NDE measurement methods, scope, tools, and techniques that can be used
- Radiation exposure to personnel performing NDE measurements

Specific NDE measurement locations for welds or wall thicknesses are illustrated in Appendix B. These illustrations are provided as information becomes available. NDE measurement locations are also marked on the regulated plant items to allow repetitive measurements at the same locations. Repeating measurements at the same locations improves accuracy of the expected remaining corrosion and erosion allowances of the regulated plant items.

Baseline thickness measurements are made in accordance with written procedures implementing the requirements of ASTM E 797, Standard Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method. Section 9 of ASTM E 797 provides the requirements for developing a detailed written procedure.

### 2.3.1 Accessible Tanks and Other Regulated Equipment Designed to ASME Pressure Vessel or API Tank Standards

At least one accessible location for thickness monitoring is selected at each of the following major components of an accessible tank:

- Top head (e.g., an area where a connection or attachment is directly welded to the head)
- Bottom head, especially in an area of high potential erosion (e.g., an area where eductor discharge impinges on the bottom head)
- Shell (e.g., an area where a connection or attachment is directly welded to the shell, longitudinal weld attaching the head to the shell, region of the normal operating liquid-vapor interface or high-liquid level, vertical strip along the accessible height of the tank, and horizontal arc along the accessible height of the tank)

For tanks with cooling jackets, measurements are made in the accessible portions of the tank directly above or below the cooling jacket.

### 2.3.2 Other Miscellaneous Units

Several miscellaneous units such as filters, which have internal components that are replaced periodically, are contained in housings that are not designed to ASME pressure vessel standards. Thickness measurements are performed on the external containment housings of these units. At least one accessible location for thickness monitoring is selected at the top, side, and bottom of the housing, especially in an area where a pipe, connection, or attachment is directly welded to the top, side, or bottom.

### 2.3.3 Piping and In-Line Components

For a piping system connecting tanks, miscellaneous units, bulges, and sumps, at least one accessible location for thickness monitoring is selected at the following:

- An area along the straight section of the pipe
- An area near a connecting fitting where flow direction or velocity changes (e.g., elbow, mixing tee, wye, cross, reducer, flange, and valve)
- An area near the insulation, if applicable, where operating temperatures cause frequent or continuous condensation and re-evaporation of moisture

For in-line components such as electric heaters, heat exchangers, and fans, thickness measurements are performed on the external containment housings of these units. At least one accessible location for thickness monitoring is selected at the top, side, and bottom of the housing, especially in an area where a pipe, connection, or attachment is directly welded to the top, side, or bottom.

### 2.3.4 Bulges Containment and Sumps

For bulges containment and sumps, at least one accessible location for thickness monitoring is selected at the following:

- Bottom, especially at the lowest point of a sloped bottom
- Sidewall (e.g., an area where a pipe, connection, or attachment is directly welded, longitudinal weld attaching the head to the shell for circular sumps, and vertical weld attaching the sidewalls for rectangular sumps)

### 2.3.5 Underground Transfer Lines

Since access to the underground transfer lines between the WTP facilities are not possible without excavation, pre-operational baseline and future NDE measurements of these lines are not conducted. As described in Section 6, the underground transfer lines are double-walled. The secondary encasement pipe has a fusion bounded epoxy coating with shrink wrap sleeves covering the clamshell welds and a cathodic protection system using an impressed current system. Corrosion of the secondary containment pipe is not expected to occur due to the epoxy coating and cathodic protection system.

## 2.4 Materials of Construction

In order to ensure tanks, miscellaneous units, and ancillary equipment last for 40 years, corrosion resistant materials, based on operating conditions and expected waste chemistries have been identified; sufficient corrosion and erosion allowances have been specified; and robust design codes (such as ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and ASME B31.3-96, Process Piping) have been used. Table 1 lists design codes for regulated tanks, miscellaneous units, bulges, sumps, and piping in the analytical laboratory and LAW vitrification facility. Table 2 presents the materials of construction and corrosion and erosion allowances for these regulated tanks, miscellaneous units, bulges, sumps, and piping.

Where a potential for erosion exists (due to entrained solids and/or velocities), additional allowance, more erosion resistant materials, or hardfacing is provided. Documentation of positive material identification is provided by vendors and field inspectors and contributes to establishing the baseline for integrity assessments.

The following paragraphs provide background information on the materials of construction and selection rationale used for regulated equipment in the analytical laboratory and LAW vitrification facility.

### 2.4.1 Stainless Steel 304L and 316L

Eight of the regulated tanks, 15 miscellaneous units, and most piping, and all of the bulges in the LAW vitrification facility are made of stainless steel 316L. In the analytical laboratory, piping is generally made of stainless steel 316L. The sumps in the analytical laboratory are made of stainless steel 304L. The primary containment pipe for the double-walled, underground lines that carry wastes between the WTP facilities is made of stainless steel 316L. The materials of construction are listed in Table 2 for regulated plant item.

Stainless steel 304L and 316L are used for sodium hydroxide-containing waste at temperatures between 140 and 200 degrees Fahrenheit (°F). Stainless steel 304L is better than stainless steel 316L in nitric acid, but in the presence of chlorides, stainless steel 316L is more resistant to pitting and cracking. However, at a pH greater than 12, chlorides are not a major concern, except possibly in tight crevices.

The presence of acids and/or halides and higher temperatures can increase the corrosion rates of stainless steel 304L and 316L.

### 2.4.2 Nickel, Chromium, Molybdenum Alloys

The two regulated tanks, the C3 and C5 cell sumps, and some of the piping in the analytical laboratory are made of 6% molybdenum alloy. Three regulated tanks two miscellaneous units, some piping, and most of the sumps in the LAW vitrification facility are made of 6% molybdenum alloy. Several miscellaneous units and some piping in the LAW vitrification facility are made of alloys such as Alloy C-22, and Alloy 625. These alloys tend to be more resistant to acids (low pH) and chlorides than are the 300 series stainless steels. High nickel alloys are somewhat better in alkaline conditions, especially at higher temperatures.

The presence of acids and/or halides and higher temperatures can increase the corrosion rates of stainless steel 304L and 316L.

### 2.4.3 Stainless Steel 347

The housing or hot-side/high temperature elements of a few miscellaneous units in the LAW vitrification facility are made of stainless steel 347. These units are part of the system managing secondary offgas. Stabilized austenitic type 347 stainless steel is suitable for high temperature applications where stainless steel 316L is precluded and dry-air conditions are not conducive to general corrosion.

## 2.5 Corrosion and Erosion Considerations

The following section describes the potential corrosion and erosion degradation mechanisms that may impact the integrity of the tanks and miscellaneous units in the analytical laboratory and LAW vitrification facility. These corrosion and erosion mechanisms are factors used in Sections 4 and 5 to characterize the tanks and miscellaneous units as having lower or higher potential for corrosion and erosion. This information is used in Section 7 to establish the schedule for the initial integrity assessment following hot commissioning. Corrosion/erosion allowances for each class of piping material are provided in 24590-WTP-3PS-P000-T0001, *Piping Material Classes General Description and Summary*.

### 2.5.1 Corrosion

Corrosion is a degradation process affected by many parameters, including temperature, chemistry, flow rate, stress, and vibration. The underlying process of corrosion may be electrochemical, chemical, mechanical, or a combination of these mechanisms. Combinations of parameters can act synergistically, sometimes reducing the corrosion rate, accelerating the corrosion rate, or changing the corrosion mechanism.

Evaluation, selection, and establishment of corrosion control measures begin with design and are implemented during construction and maintained during operation. Periodic assessments, as described in

Section 7, are performed to ensure that tanks and miscellaneous units have sufficient structural integrity and are acceptable for the storage and treatment of hazardous materials.

The corrosion degradation mechanisms applicable to the materials of construction selected for the regulated tanks and miscellaneous units located in the analytical laboratory and LAW vitrification facility are general corrosion, pitting corrosion, stress corrosion cracking, crevice corrosion, corrosion at welds, and vapor phase corrosion. A minimum standard corrosion allowance of 0.040 inch has been generally specified for tanks and miscellaneous units with a design life of 40 years. This corrosion allowance is increased where required for process chemistry reasons or other corrosion or erosion concerns. The corrosion allowances for the regulated tanks, miscellaneous units, bulges, sumps, and piping located in the analytical laboratory and LAW vitrification facility are listed in Table 2.

Eight of the 12 regulated tanks and 15 of the miscellaneous units in the LAW vitrification facility are constructed of low carbon stainless steel 316L, which is generally more resistant to pitting corrosion, stress corrosion cracking, and crevice corrosion than the higher carbon stainless steel 316. The two regulated tanks in the analytical laboratory, plus two tanks and two miscellaneous units in the LAW vitrification facility are made of 6% molybdenum alloy. Two tanks and eight of the miscellaneous units in the LAW vitrification facility are made of high nickel alloy (e.g., Alloy C-22 and Alloy 625). These 6% molybdenum alloy or high nickel alloy materials were selected depending on process chemistry and are more resistant to corrosion in lower pH or higher halide concentrations than the series 300 stainless steels. These alloy materials also maintain stable structures during exposure to high temperatures.

Table 3 summarizes the selection rationale for the materials of construction of the regulated tanks, miscellaneous units, bulges, sumps, and piping in the analytical laboratory and LAW vitrification facility.

### 2.5.2 Erosion

Erosion is the removal of material from a metal surface by the action of particles in a moving liquid or particles in a moving gas. Erosion is a function of the fluid velocity, particle size, particle shape, particle concentration, and hardness of the particles relative to that of the material of construction, among other factors. Erosion-corrosion is corrosion exacerbated by the erosive removal of protective layers (e.g., oxides), which allows corrosion to proceed at a high rate.

The evaluation, selection, and establishment of erosion control measures begin with design and are implemented during construction and maintained during operation. Periodic assessments are performed to ensure that tanks and miscellaneous units have sufficient structural integrity and are acceptable for the storage and treatment of hazardous materials.

The erosion allowances for the regulated tanks, miscellaneous units, bulges, sumps, and piping located in the analytical laboratory and LAW vitrification facility are presented in Table 2. A minimum erosion allowance of 0.004 inch is generally specified for tanks and miscellaneous units containing liquids with a velocity of less than 12 feet per second and having a design life of 40 years. Normally, a corrosion allowance of 0.040 inch, which includes the expected wear from both corrosion and erosion, is specified. Additional erosion allowances are specified for the LAW concentrate receipt process system (LCP) vessels (LCP-VSL-00001 and -00002) that store waste material received from the PTF and for the LAW melter feed process system (LFP) vessels (LFP-VSL-00001, -00002, -00003, and -00004) that combine and mix the process waste material with the abrasive glass formers.

### 2.6 Radiological Area Classifications

Access to DWP regulated tanks and miscellaneous units for future integrity assessments must be consistent with keeping radiation exposure as low as reasonably achievable (ALARA). Selection of points for future NDE inspection and measurements and scheduling of inspections and measurements must take into account potential radiation exposure. Regulated equipment in the WTP analytical laboratory and LAW is generally accessible in that it can be visually and physically examined.

The areas in the analytical laboratory and LAW vitrification facility are divided into five numbered zones based on radiological dose rates (R1 to R5) and potential for contamination (C1 to C5), with the higher number indicating the greater hazard potential, and therefore, the greater degree of control and restriction required. Radiation and contamination areas are classified independently in order to differentiate between the need for shielding or confinement. This numbering system is also used to determine the type of control to be applied for access to these areas.

Two dose equivalent rate levels have been established for each radiological classification: a target and a maximum dose equivalent rate. The target dose equivalent rate, if achieved, would be expected to readily satisfy both the requirements of ALARA and the annual dose criteria of 10 Code of Federal Regulations (CFR) 835.202. In contrast, the maximum dose equivalent rate is the level beyond which it would be very difficult to show compliance with the ALARA requirements. As a general rule, the dose rate criteria are applicable at 12 inches from the radiation source or 12 inches from any surface the radiation penetrates, consistent with the definitions of 10 CFR 835.202. Table 4 provides the criteria to be used for each radiological area classification based on dose rate.

Systems containing radioactive substances are provided with suitable isolation provisions to mitigate diffusion, backflow, or other methods of leakage of the contents to areas where the material is not intended. Table 5 provides the criteria to be used for each radiological area classification based on potential contamination. Table 6 provides the radiological contamination and access classifications for each plant item in the analytical laboratory and LAW vitrification facility.

# 3 Facility Descriptions

This section provides a brief description of the analytical laboratory and LAW vitrification facility and describes the general layout of each facility and the distribution of DWP-regulated tanks and miscellaneous units that are subject to periodic integrity assessments. It also includes a description of underground transfer lines associated with the WTP facilities.

### 3.1 Analytical Laboratory

The WTP processes require the availability of analytical services. The analytical laboratory's main function is to ensure that the final glass product meets all regulatory requirements and standards. The analytical laboratory building is approximately 320 feet (ft) long, 180 ft wide, and 45 ft high. It consists of facilities and systems that support process control, waste form qualification testing, technology testing, management of outsourced sample analysis, and receipt and analysis of samples.

Two systems in the laboratory provide analytical services support: analytical hot cell laboratory equipment system (AHL) and analytical radiological laboratory equipment system (ARL). Fourteen analytical hot cells in the AHL are designed to accommodate remote handling of high-activity samples

and other material with potentially high dose rates. The hot cell equipment receives highly radioactive samples, performs analytical services to support WTP operations, and provides process technology services when required. Thirteen radiological laboratories in the ARL area are designed to handle low-activity sample analysis activities.

The analytical laboratory's radioactive liquid waste disposal system (RLD) collects liquid effluent from the hot cells, radiological laboratories, and other areas in the laboratory for eventual transfer to other facilities for final disposition. The RLD encompasses all vessels, instrumentation, pumps, valves, mixers, transfer pump pits, piping pits, and cells associated with the collection and transfer of liquid effluent generated from the laboratory systems.

Two rooms in the analytical laboratory contain DWP regulated equipment, including one room on the -18-ft, 2-in elevation level and one room on the -19-ft, 2-in elevation level. The analytical laboratory contains two DWP regulated tanks: one located in room A-B003 on the -18-ft, 2-in elevation level and one located in room A-B004 on the -19-ft, 2-in elevation level. A detailed description of the design and process features that determine the integrity assessment program and schedule for DWP-regulated equipment in the analytical laboratory is presented in Section 4.

## 3.2 LAW Vitrification Facility

The LAW vitrification building is a multi-story structure extending from a basement at 21 ft below grade to a roof at 68 ft above grade. It includes the gaseous effluent stack structure starting at the roof level and terminating 200 ft above grade. The LAW vitrification building is a mixed-use occupancy building with a gross floor area of 257,427 square feet (excluding the 42,276 square feet in the basement or below grade) that houses the vitrification system for production of the immobilized low-activity waste. The LAW vitrification facility consists of several distinct parts, including the main process area and support areas such as the annex (administration) building, LAW switchgear building, loading docks (receiving/storage, container import, and export high truck bays), and breathing service air and fire riser enclosure. The main process building is a 4-story windowless structure with a basement. The building foundation, perimeter basement walls, interior pour cave areas, transfer tunnel walls, and process areas in the building's core are constructed of cast-in-place reinforced concrete. The primary superstructure is a structural steel frame.

The LAW building supports the industrial vitrification process that requires taller than normal building heights and large areas. The primary interior functions in the LAW vitrification building consist of two shielded melters and their adjacent supporting process cells. The melters are designed to melt glass formers and waste material into a molten glass pool, and pour that material into LAW containers. The two shielded melters are in a melter gallery at the 3-ft elevation level. The melter containment system is designed to provide radiological shielding and chemical protection. A pour cave, located beneath the melters, services the two melters, and is equipped to provide lifting and transport services for the product containers. The pour cave is lined with stainless steel cladding to provide contamination control.

Eleven rooms in the main process building contain LAW vitrification facility DWP regulated equipment, including four rooms on the 3-ft elevation level, five rooms on the 48-ft elevation level and one room each on the 28-ft elevation level and on the -21-ft elevation level. The LAW vitrification facility contains 12 DWP tanks: 10 tanks located in rooms on the 3-ft elevation level (L-0123, L-0124, and L-0126) and one each located in the rooms on the 28-ft elevation level (L-0218) and -21-ft elevation level (L-B001B). The LAW vitrification facility contains 27 DWP miscellaneous units: 10 units located in rooms on the

3-ft elevation level (L-0112, L-0123, and L-0124) and 17 units located in the five rooms on the 48-ft elevation level (L-0304C, D, E, F, and H).

The primary equipment and materials for the LAW melter process system (LMP) and portions of the primary offgas process system (LOP) located within the melter gallery (room L-0112) are located on the 3-ft elevation level. The wet process cell melter areas (rooms L-0123 and L-0124) located immediately north of the melter gallery contain the equipment for the treated LAW concentrate receipt process system (LCP) and melter feed process system (LFP). In addition, part of the radioactive liquid disposal system (RLD) is located on this level (room L-0126).

The 28-ft elevation and 48-ft elevation levels contain support equipment and processes for the vitrification process. The equipment of the secondary offgas/vessel vent process system (LVP) is housed on these levels. Most of the space on the 28-ft elevation level is above the actual vitrification process and is used to provide access for servicing the process equipment located in limited-access areas on the 3-ft elevation level. The -21-ft elevation level contains the primary pour cave equipment for placing glass from the melters into containers, and support equipment for transferring the waste containers. Part of the RLD system is also located on this level.

A detailed description of the design and process features that determine the integrity assessment program and schedule for DWP-regulated equipment in the PTF is presented in Section 5.

### 3.3 Balance of Facility

There are 21 underground transfer lines carrying dangerous waste that are connected to, or are within, the WTP facilities. The total lengths of these lines range from 289 to 1078 ft. The transfer lines are double-walled and sloped with low-point leak detection systems.

The PTF receives LAW and HLW feeds from the DOE Tank Farms through three transfer lines. The PTF pretreats the feeds and transfers them to the LAW vitrification facility through three transfer lines or to the HLW vitrification facility through four transfer lines.

Secondary waste from the LAW vitrification facility is returned to the PTF for treatment and disposal through four transfer lines. Secondary waste from the HLW vitrification facility is returned to the PTF through four transfer lines. Secondary waste from the analytical laboratory is transferred to the PTF for treatment and disposal through one transfer line. Secondary waste generated within the PTF is transferred through two transfer lines to the Liquid Effluent Retention Facility (LERF)/Effluent Treatment Facility (ETF).

A detailed description of the design and process features that determine the integrity assessment program and schedule for the underground transfer lines is presented in Section 6.

# 4 Analytical Laboratory

This section provides detailed descriptions of the analytical laboratory's DWP-regulated tanks, sumps, and associated piping included in the DWP. These tanks, sumps, and associated piping are periodically assessed to confirm the integrity of their materials of construction. The tanks are as follows:

- Laboratory area sink drain collection vessel (RLD-VSL-00164)
- Hot cell drain collection vessel (RLD-VSL-00165)

For each regulated tank and sump in the analytical laboratory, information is provided on the location of the tank or sump, its purpose, and its design characteristics, including materials of construction and corrosion/erosion allowances. The design standards used for each tank or sump and the characteristics of the waste managed in each tank or sump are also provided. This information is the unit-specific baseline used to establish the approach and schedule for future integrity assessments for the analytical laboratory DWP-regulated tanks and associated sumps and piping.

There are three RLD vessels: floor drain collection vessel (RLD-VSL-00163), laboratory area sink drain collection vessel (RLD-VSL-00164), and hot cell drain collection vessel (RLD-VSL-00165). The floor drain collection vessel (RLD-VSL-00163) collects, contains, and provides for transfer of non-contaminated liquid effluent. Although the floor drain collection vessel is identified as part of the RLD system, it is not designed or permitted to manage mixed or dangerous waste. Vessels RLD-VSL-00164 and RLD-VSL-00165 are tanks included in the DWP and are addressed in this document.

## 4.1 Laboratory Area Sink Drain Collection Vessel (RLD-VSL-00164)

The laboratory area sink drain collection vessel (RLD-VSL-00164) is located in the below grade C3 effluent vessel cell (C3 cell) in Room A-B003 of the analytical laboratory building. The cell floor and the perimeter walls, up to the maximum height of the fire water overflow volume, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Room A-B003 has a radiological area classification of R4/C5 (Table 6). The C3 cell has an access-plug opening for human access; however, planned human entries in this area are restricted and there is no cell access during normal operations.

Functions of vessel RLD-VSL-00164 include collection and transfer of mixed radioactive liquid streams. It receives effluent from the laboratory sinks, decontamination showers, and autosampling system (ASX) equipment drains; from the receiving and shipping area, process vacuum equipment drains, and floor drains throughout the laboratory; and from the C3 pump pit sump (RLD-SUMP-00045). The contents of the non-DWP floor drain collection vessel (RLD-VSL-00163) are also transferred to vessel RLD-VSL-00164, RLD-VSL-00165, or the non-radioactive liquid waste disposal system (NLD) storage tank NLD-TK-00001. During routine operations, vessel RLD-VSL-00164 discharges to the hot cell drain collection vessel RLD-VSL-00165.

Vessel RLD-VSL-00164 has ASME flanged and dished heads with an approximate inside diameter of 8 ft, 6 inches and a tangent to tangent length of 5 ft, 9 inches. It has a maximum capacity of 3,180 gallons. The vessel has minimum and maximum design pressures of 7 pounds per square inch gauge (psig) and 15 psig, respectively. Its minimum and maximum design temperatures are -20°F and 240°F, respectively.

The vessel RLD-VSL-00164 is equipped with level instrumentation used to maintain the vessel contents within the acceptable operating range and detect primary containment leakage. Laboratory area sink drain collection vessel pumps (RLD-PMP-00182A/B) recirculate vessel contents through three tank eductors (RLD-EDUC-00002A, RLD-EDUC-00002B, and RLD-EDUC-00002C) for mixing, and to

transfer the contents of the tank to RLD-VSL-00165. The eductors are venturi jet devices that use pressurized liquid to entrain solids and mix the vessel contents.

### 4.1.1 Design Standards

Vessel RLD-VSL-00164 is fabricated in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and is code-stamped. The RLD-VSL-00164 vessel system is also designed to meet applicable secondary containment, leak detection, integrity, and other criteria defined in WAC 173-303-640. The vessel is made of a 6% molybdenum alloy (unified numbering system [UNS] N08367 or N08926) to ensure containment for a 40-year life. The vessel shell thickness is 0.375 inch and head top and bottom thicknesses are 0.375 inch (minimum) with the minimum standard corrosion allowance of 0.040 inch, which is approximately 40% more than the 0.024-inch corrosion allowance plus 0.004-inch erosion allowance required for this vessel.

Process piping is designed in accordance with ASME B31.3-96, Process Piping. System piping is generally 316L stainless steel. Piping from the AHL and ARL process drains up to and including the respective collection vessel is typically a higher-grade alloy. In these cases, the piping is typically Alloy C-22 and the vessels are 6% molybdenum alloy.

Pipe that conveys dangerous waste from one containment area to another is double-walled. The outer secondary containment pipes of the double-walled piping are typically carbon steel. System piping is sloped to be self-draining so that liquids drain to vessels, into lines that can be drained, or to leak detection boxes (RLD-LDB-00005 through -00008, and RLD-LDB-00011).

### 4.1.2 Characteristics of the Waste

The volume of influent to vessel RLD-VSL-00164 from the radiological laboratories is estimated to be approximately 67 gallons per day. The contents of the vessel are 91% water by volume, 8.21% chemical source by volume, and negligible solids by volume. Contents include acids (e.g., hydrochloric acid and nitric acid), bases (e.g., sodium hydroxide and potassium hydroxide), metals (e.g., arsenic and chromium), and radionuclides (e.g., thorium and uranium) (24590-LAB-MVC-RLD-00002, 24590-LAB-M0C-60-00008).

The materials of construction for this tank and ancillary equipment are compatible with the waste managed in this system. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the laboratory area sink drain collection vessel is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tank.

## 4.2 Hot Cell Drain Collection Vessel (RLD-VSL-00165)

The hot cell drain collection vessel (RLD-VSL-00165) is located in the below grade C5 effluent vessel cell (C5 cell) in Room A-B004 of the analytical laboratory building. The cell floor and the perimeter walls, up to the maximum height of the fire water overflow volume, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Room A-B004 has a radiological area classification of R5/C5 (Table 6). The C5 cell has an access-plug opening for human access; however, planned human entries in this area are restricted and there is no cell access during normal operations.

Functions of vessel RLD-VSL-00165 include collection and transfer of mixed radioactive liquid streams. It receives effluent from hot cell glovebox drains, hot cell cupsinks, hot cell transfer drawers, master-slave manipulator decontamination gloveboxes, hot cell sample drop stations, and hot cell drain collection vessel pump pits and valve pit sumps. Effluents from the floor drain collection vessel (RLD-VSL-00163) and laboratory area sink drain collection vessel (RLD-VSL-00164) are also transferred to vessel RLD-VSL-00165. During routine operations, vessel RLD-VSL-00165 discharges to the PTF plant wash vessel (PWD-VSL-00044).

Vessel RLD-VSL-00165 has ASME flanged and dished heads with an approximate inside diameter of 16 ft and a tangent to tangent length of 2 ft, 3 inches. It has a maximum capacity of 9,100 gallons. The vessel has minimum and maximum design pressures of 7 psig and 15 psig, respectively. Its minimum and maximum design temperatures are -20°F and 240°F, respectively.

The vessel RLD-VSL-00165 is equipped with level instrumentation used to maintain the vessel contents within the acceptable operating range and detect primary containment leakage. Hot cell drain collection vessel pumps (RLD-PMP-00183A/B) recirculate vessel contents through eight tank eductors (RLD-EDUC-00003A through H) for mixing, and to transfer the contents of the tank to PTF vessel PWD-VSL-00044. The eductors are venturi jet devices that use pressurized liquid to entrain solids and mix the vessel contents.

### 4.2.1 Design Standards

Vessel RLD-VSL-00165 is fabricated in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and is code-stamped. The RLD-VSL-00165 vessel system is also designed to meet applicable secondary containment, leak detection, integrity, and other criteria defined in WAC 173-303-640. The vessel is made of a 6% molybdenum alloy (UNS N08367, N08925, or N08926) to ensure containment for a 40-year life. The vessel shell thickness is 0.5 inch and head top and bottom thicknesses are 0.625 inch (minimum) with the minimum standard corrosion allowance of 0.040 inch, which is approximately 40% more than the 0.024-inch corrosion allowance plus 0.004-inch erosion allowance required for this vessel.

Process piping is designed in accordance with ASME B31.3-96, Process Piping. System piping is generally 316L stainless steel. Piping from the AHL and ARL process drains up to and including the collection vessel is typically a higher-grade alloy. In these cases, the piping is typically Alloy C-22 and the vessels are 6% molybdenum alloy.

Pipe that conveys dangerous waste from one containment area to another is double-walled. The outer secondary containment pipes of the double-walled piping are typically carbon steel. The transfer line from vessel RLD-VSL-00165 to PWD-VSL-00044 is double walled and is stainless steel. System piping is sloped to be self-draining so that liquids drain to vessels, into lines that can be drained, or to leak detection boxes (RLD-LDB-00002, RLD-LDB-00004, and RLD-LDB-00009).

### 4.2.2 Characteristics of the Waste

An average influent volume of 87 gallons per day of liquid waste is collected in vessel RLD-VSL-00165. The contents of the vessel are 92.3% water by volume, 6.9% chemical source by volume, 0.73% sample source by volume, and negligible solids by volume. In addition to the contents of vessel RLD-VSL-00164, RLD-VSL-00165 contents include acids, bases, oxidizers (e.g., sodium peroxide), and instrument

calibration standards (e.g., potassium hydrogen phthalate and potassium chloride) from hot cell glovebox drains, hot cell cupsinks, and other sources (24590-LAB-MVC-RLD-00003).

The materials of construction for this tank and ancillary equipment are compatible with the waste managed in this system. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the hot cell drain collection vessel is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tank.

The hot cell drain collection vessel (RLD-VSL-00165) was designed and NDE was completed by the vendor to the same criteria as tanks located in black cells in the PTF and HLW vitrification facility. Since the location of this tank is inaccessible, integrity assessment is limited to the review of operating history in the same manner as for tanks in black cells. Refer to the document "Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Pretreatment Facility and High-Level Waste Vitrification Facility" (24590-WTP-PER-M-08-002) for details of integrity assessment for tanks in black cells.

## 4.3 Secondary Containment (RLD-SUMP-00041, RLD-SUMP-00042, RLD-SUMP-00043A/B, RLD-SUMP-00044, and RLD-SUMP-00045)

The RLD-VSL-00164 and RLD-VSL-00165 tank systems are designed to meet applicable secondary containment, leak detection, integrity, and other criteria defined in WAC 173-303-640. As described above, each tank is located in a stainless steel lined cell (C3 cell and C5 cell, respectively). Additionally, each cell includes a stainless steel lined sump embedded in the floor:

- sump RLD-SUMP-00041in the C3 cell (A-B003) at elevation -18 ft, 7 in (cell containing RLD-VSL-00164)
- sump RLD-SUMP-00042 in the C5 cell (A-B004) at elevation -19 ft, 2 in (cell containing RLD-VSL-000165)

There are also four stainless steel lined sumps formed by depressions embedded in the floors of the rooms housing sump pumps and valves:

- sumps RLD-SUMP-00043A/B in the two C5 pump pits (A-B005 and A-B007) at elevation -6 ft, 6 in
- sump RLD-SUMP-00044 in the C5 valve/piping pit (A-B006) at elevation -6 ft, 6 in
- sump RLD-SUMP-00045 in the C3 pump pit (A-B002) at elevation -6 ft, 6 in

Room A-B002 has a radiological area classification of R3/C3. Rooms A-B003 and A-B004 have a radiological area classification of R4/C5 and R5/C5, respectively, with no cell access during normal operations. Rooms A-B005, A-B006, and A-B007 have a radiological area classification of R3/R4/C3 (Table 6).

The analytical laboratory C3 cell and C5 cell sumps provide for the collection of tank overflow or leakage; each with a capacity of 30 gallons. The four sumps in the C5 pump pits, C5 valve/piping pit, and C3 pump pit are 0.5-inch deep rectangular depressions embedded in the floors of the stainless steel lined pits and provide for the collection of pump and valve leakage. Pit sump capacities range from approximately 1.4 to 1.6 gallons.

### 4.3.1 Design Standards

The six sumps in the analytical laboratory are dry sumps fabricated in accordance with design methodology specified in American Institute for Steel Construction Inc. (AISC) M016-89, Manual of Steel Construction. The sumps are also designed to meet applicable secondary containment, leak detection, integrity, and other criteria defined in WAC 173-303-640. The C3 cell and C5 cell sumps (RLD-SUMP-00041 and RLD-00042) are made of a 6% molybdenum alloy (UNS N08367) to ensure containment for a 40-year life and have a 30-inches diameter and 13-inch depth. The C5 pump pit sumps (RLD-SUMP-00043A/B), C5 piping pit sump (RLD-SUMP-00044) and C3 pump pit sump (RLD-SUMP-00045) are made of stainless steel 304L (UNS S30403). RLD-SUMP-00043A/B are 0.5-inch deep, 1.5-ft by 3.0-ft depressions in the pit liner. RLD-SUMP-00044 and RLD-SUMP-00045 are 0.5-inch deep, 2-ft by 2.5-ft depressions in the pit liner. Sumps and pit liners have a standard 0.04-inch corrosion allowance. All six sumps are equipped with radar level detection.

### 4.3.2 Characteristics of the Waste

During normal operations, the analytical laboratory sumps are dry. The C3 cell and C5 cell sumps (RLD-SUMP-00041 and RLD-SUMP-00042) in combination with the stainless steel cell liners provide secondary containment for wastes from tanks RLD-VSL-00164 and RLD-VSL-00165, respectively. Previous sections described the wastes contained in these tanks. The C5 pump pit sumps (RLD-SUMP-0043A/B) and the C5 valve/piping pit sump (RLD-SUMP-00044) in combination with the stainless steel pit liners provide secondary containment for leaks from pumps and valves/piping associated with tank RLD-VSL-00165. The C3 pump pit sump (RLD-SUMP-00045) in combination with the stainless steel pit liner provides secondary containment for leaks from pumps associated with tank RLD-VSL-000164.

The materials of construction for secondary containment system are compatible with the waste managed in this system. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the secondary containment system is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction and nature of the waste managed in the system.

# 5 Low-Activity Waste Vitrification Facility

This section provides detailed descriptions of the LAW vitrification facility's DWP-regulated tank systems and miscellaneous unit systems. The tanks, miscellaneous units, bulges, sumps, and piping associated with these systems are assessed periodically to confirm the integrity of their materials of construction. The systems are as follows:

- LCP system (receipt of LAW concentrate from PTF)
- LFP system (preparation and staging of feed for LAW melters)
- LMP system (LAW vitrification )
- LOP system (containment and management of primary off-gas from melters)
- LVP system (management of secondary offgas from melters and gases from vessel vents)
- RLD system (management of radioactive liquid waste and plant wash)

For each tank, miscellaneous unit, bulge, and sump in the LAW vitrification facility, information is provided on the location of the equipment, its purpose, and its design characteristics, including materials of construction and corrosion/erosion allowances. The design standards used for each item of equipment and associated piping, and the characteristics of the waste managed in each tank, miscellaneous unit, bulge, or sump are also provided. This information is the unit-specific baseline used to establish the approach and schedule for future integrity assessments for the LAW vitrification facility DWP-regulated tanks, miscellaneous units, bulges, and sumps.

## 5.1 LAW Concentrate Receipt Process System (LCP)

The LCP system is primarily housed on the 3-ft elevation level in wet process cells L-0123 and L-0124 in the central portion of the LAW building. Most instruments and valves are placed in equipment bulges located on the 28-ft elevation level above the wet process cells. The remainder of the instrumentation can be found on instrument racks located on the same level as the bulges.

### 5.1.1 Melter Concentrate Receipt Vessels (LCP-VSL-00001, LCP-VSL-00002)

The two melter concentrate receipt vessels (CRVs) (LCP-VSL-00001 and -00002) associated with this system are each located in the northwestern corner of separate wet process cells (L-0123 and L-0124). The cell floors and the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Wet process cell L-0123 contains secondary containment sumps RLD-SUMP-00029 and RLD-SUMP-00030. Wet process cell L-0124 contains secondary containment sumps RLD-SUMP-00031 and RLD-SUMP-00032. Each of the two rooms has a radiological area classification of R5/C5 (Table 6).

The CRVs receive LAW from the PTF. Each CRV has a maximum capacity of 18,130 gallons. The vessels have sufficient storage capacity to allow time for sampling and to supply feed continuously to the two melters, each producing 15 metric tons of glass per day (MTG/day).

Each LAW CRV is equipped with the following:

- Mechanical agitator (LCP-AGT-00001 or -00002)
- Two pumps (LCP-PMP-00001A/B or -00002A/B) to transfer the LAW concentrate

The vessels and process piping have all welded construction and are made of 316L stainless steel (UNS S31603) to ensure containment of the LAW concentrate for a 40-year life.

#### 5.1.1.1 Design Standards

The CRVs (LCP-VSL-00001 and -00002) are fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and are code-stamped. The CRVs have ASME flanged and dished heads with an approximate inside diameter of 14 ft and a tangent to tangent length of 12 ft, 9 inches. The vessel shell and head thicknesses are 0.75 inch minimum (shell), 1 inch minimum ASME code flanged and dished (top), and 0.75 inch minimum ASME code flanged and dished (bottom). Thicknesses include the minimum standard corrosion allowance of 0.040 inch, which is adequate for the 0.024-inch corrosion allowance plus a 0.016-inch erosion allowance required for these vessels. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

The CRVs include the following vessel internals, which are of a standard design:

- Mechanical agitators (LCP-AGT-00001 and LCP-AGT-00002) - standard design for all LCP and LFP system vessels
- Vessel spray nozzles - standard design for all LCP, LFP, and RLD system vessels
- Instrumentation - standard design for all LCP and LFP vessels

However, the four identical LCP transfer pumps (LCP-PMP-00001A/B and LCP-PMP-00002A/B) have a non-standard design compared to other WTP pumps to accommodate height requirements and pressurized water seal restrictions. The pumps are vertical centrifugal pumps and flange mounted on the vessel. The nominal 88 gallons per minute discharge from the CRV pumps is routed to a valve bulge where the flow is directed by a valve manifold to either of the melter feed preparation vessels (MFPVs), the autosampler, the other CRV, or to the plant wash vessel (RLD-VSL-00003).

To monitor process operating conditions, the blended vessel contents are pumped into the transfer header from either LCP-VSL-00001 using LCP-PMP-00001A/B or LCP-VSL-00002 using LCP-PMP-00002A/B and routed to the autosampler (ASX-SMPLR-00013). The sampling device is located outside the cell in a shielded but accessible location on the 48-ft elevation level. Samples are collected after each receipt of a batch of treated LAW from the PTF in order to confirm formulation prior to delivery to the MFPVs.

Waste transfer line pipes that convey dangerous waste from the PTF to the LAW LCP vessels are double-walled. The material of construction for the pipes is 316L stainless steel. The transfer lines are each encased with an outer carbon steel pipe that drains to a leak detection box (LDB) located in the PTF. System piping is sloped back to the PTF to be self-draining; liquids drain to the ultimate overflow vessel (PWD-VSL-00033) and are recycled for reprocessing. The outer pipe has a hose connection so it can be flushed from the LCP system to the LDB.

#### 5.1.1.2 Characteristics of the Waste

The LAW process is designed to vitrify the liquid portion of DOE tank farm wastes (designated Envelopes A, B, and C) that have undergone ultrafiltration, cesium removal, and evaporation in the PTF. The wastes are grouped into envelopes based on the waste characteristics: Envelope A wastes are low sulfate wastes and make up the bulk of the waste tanks, Envelope B includes high sulfate wastes, and Envelope C includes high organic wastes.

The CRVs receive LAW melter feed from the PTF that is approximately 57.8 weight percent (wt%) water and 42.2 wt% solids with a pH of 14.6 (24590-WTP-M4C-V11T-00010).

The materials of construction for these tanks and ancillary equipment are compatible with the waste managed in the LCP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the melter concentrate receipt vessels are considered to have a higher potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tanks.

### 5.1.2 LCP Bulges (LCP-BULGE-00001, LCP-BULGE-00002, LCP-BULGE-00003)

The three concentrate receipt valve bulges associated with the LCP system (LCP-BULGE-00001, LCP-BULGE-00002, and LCP-BULGE-00003) are located on the 28-ft elevation level, above the wet process cells, in room L-0202. Most instruments and valves for the LCP system are placed in the bulges. Room L-0202 has a radiological area classification of R3/C3 (Table 6).

The concentrate receipt valve bulges provide secondary containment away from the process cells; where the control valves and valve actuators are accessible for maintenance. The concentrate receipt bulges drain to a sump (RLD-SUMP-00029 or -00031) that is pumped to the plant wash vessel (RLD-VSL-00003).

The bulges and manual valves are made of 316L stainless steel (UNS S31603) to ensure containment of the LAW concentrate for a 40-year life.

#### 5.1.2.1 Design Standards

The concentrate receipt bulge design follows the standard bulge design philosophies used throughout the WTP Project as described in the document 24590-WTP-3PS-MX00-TP001, *Engineering Specification for Process Bulge Design and Fabrication*. Bulge components have a standard 0.040 inch corrosion allowance. Bulge confinement is designed to meet the requirements of AISC M016-89, Manual of Steel Construction. The associated LCP system process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.1.2.2 Characteristics of the Waste

The piping and valves of the LCP bulges (LCP-BULGE-00001, LCP-BULGE-00002, and LCP-BULGE-00003) transfer LAW melter feed received from the CRVs, which is approximately 57.8 weight percent (wt%) water and 42.2 wt% solids with a pH of 14.6 (24590-WTP-M4C-V11T-00010).

The materials of construction for bulges are compatible with the waste managed in the LCP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the LCP bulges are considered to have a higher potential for corrosion and erosion on the basis of the materials of construction and nature of the waste managed in the bulges.

## 5.2 LAW Melter Feed Process System (LFP)

The LFP system is primarily housed on the 3-ft elevation level in wet process cells L-0123 and L-0124 in the central portion of the LAW building. Most instruments and valves are placed in equipment bulges located on the 28-ft elevation level, which are above the wet process cells. The remainder of the instrumentation can be found on instrument racks located on the 28-ft elevation level.

### 5.2.1 Melter Feed Preparation Vessels and Melter Feed Vessels (LFP-VSL-00001, LFP-VSL-00002, LFP-VSL-00003, LFP-VSL-00004)

The two MFPVs (LFP-VSL-00001 and -00003) associated with this system are each located in the northeastern corner and the two melter feed vessels (MFVs) (LFP-VSL-00002 and -00004) are each located in the southeastern corner of separate wet process cells (L-0123 and L-0124). The cell floors and

the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Wet process cell L-0123 contains secondary containment sumps RLD-SUMP-00029 and RLD-SUMP-00030. Wet process cell L-0124 contains secondary containment sumps RLD-SUMP-00031 and RLD-SUMP-00032. Each of the two rooms has a radiological area classification of R5/C5 (Table 6).

The MFPVs receive LAW concentrate from the two CRVs. Each MFPV receives glass formers and sucrose from a dedicated glass former mixer enclosure (GFR-TK-00022 or -00023). Each MFPV has a maximum capacity of 9,123 gallons for receipt and mixing of LAW concentrate with glass formers and sucrose. The MFPVs are sized to support a glass production rate of 15 MTG/day per melter.

The MFVs receive blended LAW melter feed from either of the two MFPVs. Each MFV has a maximum capacity of 9,123 gallons. The MFVs are sized to support a glass production rate of 15 MTG/day per melter.

Each MFPV is equipped with the following:

- One mechanical agitator (LFP-AGT-00001 or -00003)
- Two vertical pumps (LFP-PMP-00001A/B or -00003A/B)

Each MFV is equipped with the following:

- One mechanical agitator (LFP-AGT-00002 or -00004)
- One vertical pump (LFP-PMP-00002 or -00004)
- Six air displacement slurry (ADS) pumps (LFP-PMP-00007 through -00012, or LFP-PMP-00013 through -00018)

The vessels and process piping have all welded construction and are made of 316L stainless steel (UNS S31603) to ensure containment of the LAW melter feed for a 40-year life.

#### 5.2.1.1 Design Standards

The MFPVs (LFP-VSL-00001 and -00003) and MFVs (LFP-VSL-00002 and -00004) are fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and are code-stamped. The MFPVs have ASME flanged and dished heads and an approximate inside diameter of 11 ft and a tangent to tangent length of 10 ft, 6 inches. The MFVs have ASME flanged and dished heads and an inside diameter of 11 ft and a tangent-to-tangent height of 10 ft, 6 inches.

The minimum vessel shell and head thicknesses are 0.75 inch (shell), 1 inch ASME code flanged and dished (top), 0.75 inch ASME code flanged and dished (bottom) with the minimum standard corrosion allowance of 0.040 inch, which is adequate for the corrosion allowance with no erosion allowance required for these vessels. However, due to possible high velocities near the agitators, a 0.125-inch allowance is required for the bottom head and shell (including both corrosion and erosion allowance). Process piping is designed in accordance with ASME B31.3-96, Process Piping.

The MFPVs and MFVs include the following vessel internals, which are of a standard design:

- Mechanical agitators - standard design for all LCP and LFP system vessels
- Vessel spray nozzles - standard design for all LCP, LFP, and RLD system vessels
- Instrumentation - standard design for all LCP and LFP vessels

The MFPV and MFV mechanical agitators continuously mix the vessel contents to keep insoluble solids in suspension. For the MFPVs, the time required for uniform blending of each batch is 2 hours.

Each MFPV is equipped with two vertical pumps (LFP-PMP-00001A/B or -00003A/B) and each MFV is equipped with one vertical pump (LFP-PMP-00002 or -00004). The vertical pump discharges at a maximum flow rate of 50 gallons per minute through a valve bulge (LFP-BULGE-00001 or -00002). Discharge from the MFPVs (concentrate, melter feed, or plant wash) is routed to one of the following:

- Corresponding MFV (LFP-VSL-00002 from LFP-VSL-00001, or LFP-VSL-00004 from LFP-VSL-00003)
- Other MFPV (for melter shutdown or batch shimming)
- Same MFPV (to recirculate for sampling)
- Plant wash vessel (RLD-VSL-00003)

Discharge from the MFVs (melter feed or plant wash) is routed to one of the following:

- Either MFPV (in the event of melter shutdown)
- Same MFV (to recirculate for sampling)
- Plant wash vessel (prior to vessel washdown)

The vertical pumps and transfer lines are flushed after every pump shutdown.

Each MFV is equipped with six ADS feed pumps (two ADS feed pumps per each of the three melter zones). ADS pumps are designed without built-in redundancy. The melter is designed to allow one feed nozzle/ADS pump combination per melter zone to be inoperable. Each ADS pump has a corresponding vent valve assembly and an actuator assembly. The bottom of the chamber is hinged to open by the actuator assembly to fill the chamber with slurry. After the bottom of the chamber is closed, air is supplied through the vent valve assembly to pressurize the chamber. The slurry is transferred to the melter using the plant service air pressure as the motive force. The air blows the line clear of feed with each pump stroke.

To monitor process operating conditions, MFPV LFP-VSL-00001 and MFV LFP-VSL-00002 interface with autosampler ASX-SMPLR-00013, and MFPV LFP-VSL-00003 and MFV LFP-VSL-00004 interface with autosampler ASX-SMPLR-00012. Each MFPV shares a sample recirculation line with its corresponding MFV. The sampling devices are located outside the cell in a shielded but accessible location on the 48-ft elevation level. Sampling the MFPVs and MFVs is not a routine operation. The tank contents are sampled during start-up and commissioning to confirm that the glass formers were successfully added and the agitator system is functioning properly. The tank contents may also be sampled during production for tracking melter feed composition.

#### 5.2.1.2 Characteristics of the Waste

The LAW process is designed to vitrify the liquid portion of DOE tank farm wastes (designated Envelopes A, B, and C) that have undergone ultrafiltration, cesium removal, and evaporation in the PTF. The wastes are grouped into envelopes based on the waste characteristics: Envelope A wastes are low sulfate wastes and make up the bulk of the waste tanks, Envelope B includes high sulfate wastes, and Envelope C includes high organic wastes. The contents of MFPVs and MFVs are LAW concentrate and glass formers. The glass formers include silica, boric acid, aluminum silicate, calcium silicate, ferric oxide, zinc oxide, olivine, zirconium silicate, lithium carbonate, rutile, and sucrose.

The MFPVs receive and blend LAW concentrate and glass formers. The MFVs receive the blended melter feed from the MFPVs prior to delivery to the melters (LMP-MLTR-00001 and -00002). The blended contents are approximately 34.7 wt% water and 65.3 wt% solids with a pH of 14.3 (24590-WTP-M4C-V11T-00010).

The materials of construction for these tanks and ancillary equipment are compatible with the waste managed in the LFP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the melter feed preparation and melter feed vessels are considered to have a higher potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tanks.

### 5.2.2 LFP Bulges (LFP-BULGE-00001 and LFP-BULGE-00002)

The two valve bulges associated with the LFP system (LFP-BULGE-00001 and LFP-BULGE-00002) are located on the 28-ft elevation level, above the wet process cells, in room L-0202. Most instruments and valves for the LFP system are placed in the bulges. Room L-0202 has a radiological area classification of R3/C3 (Table 6).

The valve bulges for the LFP system provide secondary containment away from the process cell where the control valves and valve actuators that are used in the transfer of blended melter feed between tanks are accessible for maintenance. The LFP bulges drain to a sump (RLD-SUMP-00030 or -00032) that is pumped to the plant wash vessel (RLD-VSL-00003).

The bulges and manual valves are made of 316L stainless steel (UNS S31603) to ensure containment of the melter feed for a 40-year life.

#### 5.2.2.1 Design Standards

The LFP bulge design follows the standard bulge design philosophies used throughout the WTP Project as described in the document 24590-WTP-3PS-MX00-TP001, *Engineering Specification for Process Bulge Design and Fabrication*. Bulge components have a standard 0.040 inch corrosion allowance. Bulge confinement is designed to meet the requirements of AISC M016-89, Manual of Steel Construction. The associated LFP system process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.2.2.2 Characteristics of the Waste

The piping and valves of the LFP bulges (LFP-BULGE-00001 and LFP-BULGE-00002) transfer blended melter feed received from the MFPVs and MFVs, which is approximately 57.8 wt% water and 42.2 wt% solids with a pH of 14.6 (24590-WTP-M4C-V11T-00010).

The materials of construction for bulges are compatible with the waste managed in the LFP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the LFP bulges are considered to have a higher potential for corrosion and erosion on the basis of the materials of construction and nature of the waste managed in the bulges.

## 5.3 LAW Melter Process System (LMP)

The LMP system is located on the 3-ft elevation level in the melter process cell/melter cave (room L-0112) in the central portion of the LAW building. The melter has three internal compartments: the melt chamber and two discharge chambers. The melt chamber consists of a glass pool zone sometimes referred to as the glass tank, which is lined with refractory material designed to withstand corrosion from molten glass, and a head space called the plenum, which is lined with refractory material to withstand hot corrosive gases, thermal shock, and glass and feed splatter.

### 5.3.1 LAW Melters (LMP-MLTR-00001 and LMP-MLTR-00002)

The two LAW melters (LMP-MLTR-00001 and -00002) are miscellaneous units associated with this system and are located in the western and central portions, respectively, of the melter process cell. The melter process cell has a radiological area classification of R3/C3/C2 (Table 6).

Each LAW melter receives and vitrifies the blended melter feed from one of the two MFVs at a nominal feed rate of 15 MTG/day and discharges molten glass. The overall size of each of the two identical LAW melters is approximately 16 ft high by 21 ft wide by 30 ft long with an estimated weight of 310 short tons (with glass, 320 short tons).

The glass pool and plenum of each melter are constructed with the following kinds of Monofrax refractory bricks: 30% chrome oxide/60% alumina (Monofrax K-3), 80% chrome oxide (Monofrax E), and approximately 100% alumina (Monofrax H). The outer wall of the glass pool consists of alumina-zirconia-silica bonded brick.

#### 5.3.1.1 Design Standards

The LAW melters (LMP-MLTR-00001 and -00002), which are miscellaneous units, are a slurry-fed joule-heated design using Inconel (Alloy 690; UNS N06690) plate electrodes. In these design features, the WTP LAW melters are similar to HLW melters operated at DOE sites such as the Defense Waste Processing Facility melter at the Savannah River Site and the West Valley Demonstration Project melter at West Valley, New York. The design basis for the WTP LAW melter evolves directly from operational experience with prior Duratek melters utilizing similar design features. The most relevant of the designs are the second-generation DM-5000 melter used to process the Savannah River M-Area low-level waste and the WTP LAW pilot melter at the Duratek Columbia, Maryland site. All of the melters described above use Monofrax K-3 fused-cast ceramic refractory as the glass contact refractory material.

The melters are replaceable and have a 5-year design life. In each melter, the walls of the glass pool are constructed in four layers, from interior to exterior:

1) glass contact refractory layer consisting of a 12-inch thick layer of Monofrax K-3.
2) 5-inch thick layer of Monofrax K-3.
3) first 3-inch thick layer of alumina-zirconia-silica bonded brick.
4) second 3-inch thick layer of alumina-zirconia-silica bonded brick.

The interior wall of the glass pool also contains alloy electrodes (Alloy 690, UNS N06690). The vertical lining of the plenum is constructed of Monofrax H. The melter lid, which consists of three refractory layers, is part of the primary containment of the melter plenum gases and is based on previous successful designs of liquid-fed melters.

Several replaceable melter service components (e.g., startup heaters, bubblers, level detectors, feed nozzles and airlift lances) are mounted on the gas barrier lid and enter the melter by means of cylindrical ports through the shield lid. The ports of the gas barrier lid are lined with Alloy 690 sleeves.

#### 5.3.1.2 Characteristics of the Waste

The contents of the LAW melters are the LAW concentrate blended with glass formers from the MFVs described in Section 5.2.1.2.

The materials of construction for these miscellaneous units are compatible with the waste managed in the LMP. The melters are designed to be replaced every 5 years. The schedule for conducting periodic assessments of this system is provided in Table 7.

## 5.4 LAW Primary Offgas Process System (LOP)

The LOP system is primarily housed on the 3-ft elevation level in wet process cells L-0123 and L-0124 and in the melter process cell L-0112 in the central portion of the LAW building. The LOP system includes melter offgas film coolers, submerged bed scrubbers (SBSs), SBS condensate vessels, and wet electrostatic precipitators (WESPs). The regulated units associated with this system include two tanks and eight miscellaneous units. The LOP system includes two bulges associated with the two tanks. The two melter SBS condensate vessels, the two melter SBSs, and the melter WESPs are located in the wet process cells (rooms L-0123 and L-0124). The melter offgas primary film coolers and secondary film coolers are located in the melter process cell (room L-0112). The combined LOP/LVP system removes mercury, acid gases (mainly sulfur oxides [$SO_x$], hydrogen fluoride [HF], and hydrogen chloride [HCl]), nitrogen oxides ($NO_x$), volatile organic compounds (VOCs), particulates, aerosols, and radionuclides from the LAW melter offgas.

### 5.4.1 Melter SBS Condensate Vessels (LOP-VSL-00001 and LOP-VSL-00002)

The two melter SBS condensate vessels (LOP-VSL-00001 and -00002) associated with this system are each located in the southwestern corner of separate wet process cells (L-0123 and L-0124). The cell floors and the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Wet process cell L-0123 contains secondary containment sumps RLD-SUMP-00029 and RLD-SUMP-00030.

Wet process cell L-0124 contains secondary containment sumps RLD-SUMP-00031 and RLD-SUMP-00032. Each of the two rooms has a radiological area classification of R5/C5 (Table 6).

The SBS condensate vessels receive the liquid overflows from the adjacent SBS, thereby maintaining a constant liquid depth in the SBS. Each SBS condensate vessel has a maximum capacity of 9,056 gallons. The vessel capacity is designed to hold about two days of condensate.

Each SBS condensate vessel is equipped with the following:

- One eductor (LOP-EDUC-00001 or -00002), powered by a side stream from the recycle line, to suspend solids accumulated in the SBS condensate vessel
- One SBS condensate purge pump (LOP-PMP-00001 or -00004) to recycle SBS condensate from the SBS condensate vessel to the SBS
- One spare purge pump (LOP-PMP-00002 or -00005)

The vessels and process piping have all welded construction and are made from Alloy 22 (UNS N06022) to ensure containment of the SBS condensate for a 40-year life.

#### 5.4.1.1 Design Standards

The SBS condensate vessels (LOP-VSL-00001 and -00002) are fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and are code-stamped. The SBS condensate vessels have ASME flanged and dished heads with an approximate inside diameter of 12 ft and a tangent to tangent length of 8 ft, 2 inches. The vessel shell and head thicknesses are 0.625 inch minimum. Thicknesses include the minimum standard corrosion allowance of 0.040 inch, which is approximately 40% more than the 0.024-inch corrosion allowance plus a 0.004-inch erosion allowance required for these vessels. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

Cooled condensate is recycled from the SBS condensate vessel to the SBS at an approximate normal rate of 80 gallons per minute, which is higher than that of the condensate being removed. The recycle of condensate through the SBS condensate vessel maintains the constant liquid level in the SBS. The recycled condensate contributes to the cooling of the SBS and keeps collected solids in suspension for removal.

#### 5.4.1.2 Characteristics of the Waste

The principal gas generated by the melter is steam. Decomposition of salts and organic material also yields carbon dioxide ($CO_2$), sulfur dioxide ($SO_2$), $NO_x$, HCl, and HF. The $NO_x$ is a mixture of nitrogen oxide (NO) and nitrogen dioxide ($NO_2$) with trace amounts of nitrous oxide ($N_2O$). As the offgas cools in the SBS, the steam condenses.

The SBS condensate vessels recirculate overflow from the SBS that is approximately 96.9 wt% water and 3.1 wt% solids (24590-WTP-M4C-V11T-00010). The SBS normally operates at a pH of 9 to minimize impacts to the waste processing at the LERF/ETF. To control stainless steel 316L corrosion rates, the SBS reagent pH can be raised to a pH of 14 when high halide concentrations are measured in the SBS bottoms.

The materials of construction for these vessels and ancillary equipment are compatible with the waste managed in the LOP. The schedule for conducting periodic assessments of this system is provided in Table 7. The SBS condensate vessels are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tanks. However, these accessible tanks are used as surrogates for inaccessible equipment in the PTF or HLW vitrification facility (24590-WTP-PER-M-08-002). Therefore, the frequency of the integrity assessment of these tanks is accelerated to be consistent with the frequency for tanks with higher potential for corrosion and erosion.

### 5.4.2 Melter Primary and Secondary Film Coolers (LOP-FCLR-00001, LOP-FCLR-00002, LOP-FCLR-00003, and LOP-FCLR-00004)

Each of the two melters has one primary film cooler (LOP-FCLR-00001 and -00003) and one secondary film cooler (LOP-FCLR-00002 and -00004). These coolers are miscellaneous units located in the melter process cell (room L-0112). The melter process cell has a radiological area classification of R3/C3/C2 (Table 6). A primary purpose of the LOP system is to control the melter plenum pressure. Introduction of additional control air into the primary offgas film cooler provides this function while maintaining a relatively constant flow of gas.

The primary film coolers receive melter offgas and cool it with injection air to temperatures below the glass sticking temperature in order to minimize solids deposition on the offgas piping walls. High offgas velocities maintained between the melter and the downstream SBS minimize solids deposition. The secondary film coolers receive injection air, which normally vents through the primary film cooler via the melter plenum. However, when a low vacuum set point is reached in the melter plenum, a butterfly valve in the standby offgas line automatically opens to permit offgas flow through the secondary film cooler, thereby supplementing the primary offgas film cooler in restoring the vacuum in the melter plenum.

#### 5.4.2.1 Design Standards

The primary film coolers (LOP-FCLR-00001 and -00003) and secondary film coolers (LOP-FCLR-00002 and -00004) are fabricated in accordance with ASME B31.3-96, Process Piping. Each film cooler is 10 inches in diameter (inside) and is fabricated from Inconel 690 (UNS N06690). Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.4.2.2 Characteristics of the Waste

The principal gas generated by the melter is steam. Decomposition of salts and organic material also yields $CO_2$, $SO_2$, $NO_x$, HCl, and HF. The $NO_x$ is a mixture of NO and $NO_2$ with trace amounts of $N_2O$. The offgas from the LAW melter plus injection air that passes through the film coolers is approximately 26.8 wt% water, 71.7 wt% gases, and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction of these miscellaneous units are compatible with the waste managed in the LOP. The melter primary and secondary coolers are designed to be replaced every 5 years. The schedule for conducting periodic assessments of this system is provided in Table 7.

### 5.4.3 Melter Submerged Bed Scrubbers (LOP-SCB-00001 and LOP-SCB-00002)

The two melter SBSs (LOP-SCB-00001 and -00002) are miscellaneous units associated with this system and are each located in the south central portion of separate wet process cells (L-0123 and L-0124). The cell floors and the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Wet process cell L-0123 contains secondary containment sumps RLD-SUMP-00029 and RLD-SUMP-00030. Wet process cell L-0124 contains secondary containment sumps RLD-SUMP-00031 and RLD-SUMP-00032. Each of the two rooms has a radiological area classification of R5/C5 (Table 6). Each SBS is a passive device designed for aqueous scrubbing of entrained radioactive particulates and removal of aerosols from melter offgas.

Each SBS receives LAW melter offgas and circulates the offgas through the packed bed. Each SBS has a maximum operating volume of 3,690 gallons. The SBS has an offgas inlet flow rate of approximately 1470 standard cubic feet per minute at 600°F and -10 inches of water gauge. A distribution header inside the SBS circulates the liquid to prevent buildup of captured material in the bed by constantly washing the material away. A cooling jacket outside the SBS and cooling coils inside the SBS maintain the scrubbing liquid at a nominal temperature of 122°F.

To help remove solids, the recycle stream is pumped through eight lances that agitate the bottom of the SBS and consolidate the solids near the suction of the SBS water purge pump (LOP-PMP-00003A/B and -00006A/B). The condensate produced, and solids captured, in the SBS are purged every 24 to 48 hours. The SBS water purge pump transfers condensate to a SBS condensate collection vessel (RLD-VSL-00005) at an approximate normal rate of 48 gallons per minute.

The SBSs vessel and process piping have all welded construction and are made from Hastelloy C-22 (UNS N06022) or equivalent to ensure a 40-year life. Each SBS encloses a ceramic packed bed column.

#### 5.4.3.1 Design Standards

The SBS vessels (LOP-SCB-00001 and -00002) are fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and are code-stamped. The SBS vessels have ASME flanged and dished heads and an approximate inside diameter of 10 ft and is 6.5 ft high (tangent to tangent). The enclosed packed bed column has a diameter of 6 ft, 2 inches, and a packed bed height of 24 inches.

The minimum SBS shell and head thicknesses are 0.625 inch with the minimum standard corrosion allowance of 0.040 inch, which is approximately 40% more than the 0.024-inch corrosion allowance plus a 0.004-inch erosion allowance required for the vessels housing these miscellaneous units. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.4.3.2 Characteristics of the Waste

The principal gas generated by the melter is steam. Decomposition of salts and organic material also yields $CO_2$, $SO_2$, $NO_x$, HCl, and HF. The $NO_x$ is a mixture of NO and $NO_2$ with trace amounts of $N_2O$. The SBSs receive offgas from the LAW melter plus injection air that has passed through the film coolers and is approximately 26.8 wt% water, 71.7 wt% gases, and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The SBS condensate is approximately 96.9 wt% water and 3.1 wt% solids with a pH of 14.4 (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LOP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the melter SBS units are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.4.4 Melter Wet Electrostatic Precipitators (LOP-WESP-00001 and LOP-WESP-00002)

The two melter WESPs (LOP-WESP-00001 and -00002) are miscellaneous units associated with this system and are each located in the north central portion of separate wet process cells (L-0123 and L-0124). The cell floors and the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. Wet process cell L-0123 contains secondary containment sumps RLD-SUMP-00029 and RLD-SUMP-00030. Wet process cell L-0124 contains secondary containment sumps RLD-SUMP-00031 and RLD-SUMP-00032. Each of the two rooms has a radiological area classification of R5/C5 (Table 6). After initial aerosol and soluble gas removal in the SBS, the cooled offgas is routed to a WESP for further removal of particulates and aerosols.

Each WESP receives offgas from an SBS at a nominal flow rate of 1,280 standard cubic feet per minute at 122°F and -49 inches of water gauge. The design flow is 2,000 actual cubic feet per minute based on the combined offgas from two idled melters. The offgas enters the unit and passes through a distribution plate and then flows upward through the tubes of the WESP. The tubes act as positive electrodes. A strong electric field is generated along the electrode, supplying a negative charge to aerosols as they pass through the tubes. The negatively charged aerosols move toward the positively charged tube walls where they are removed. The inlet is also provided with a spray to enhance rundown and cleaning. The condensate then drains into a C3/C5 drains/sump collection vessel (RLD-VSL-00004).

The WESP vessels and process piping have all welded construction and are fabricated from a 6% molybdenum alloy (UNS N08367) to ensure a 40-year life.

#### 5.4.4.1 Design Standards

The vessels housing the WESP units (LOP-WESP-00001 and -00002) are fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and are code-stamped. The WESP vessels have ASME flanged heads. The WESP shell and head thicknesses include the minimum standard corrosion allowance of 0.040 inch. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.4.4.2 Characteristics of the Waste

The WESPs receive scrubbed melter offgas from the SBS that is approximately 11.4 wt% water, 88.6 wt% gases (primarily nitrogen [$N_2$], oxygen [$O_2$], and $CO_2$), and 0 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LOP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the melter WESP units are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.4.5 LOP Bulges (LOP-BULGE-00001 and LOP-BULGE-00002)

The two valve bulges associated with the LOP system (LOP-BULGE-00001 and LOP-BULGE-00002) are located on the 28-ft elevation level, above the wet process cells, in room L-0202. Most instruments and valves for the LOP system are placed in the bulges. Room L-0202 has a radiological area classification of R3/C3 (Table 6).

The valve bulges for the LOP system provide secondary containment away from the process cell where the control valves and valve actuators that are used in the transfer of condensate between tanks are accessible for maintenance. The LOP bulges drain to a sump (RLD-SUMP-00029 or -00031) that is pumped to the plant wash vessel (RLD-VSL-00003).

The bulges and manual valves are made of 316L stainless steel (UNS S31603) to ensure containment of the SBS condensate for a 40-year life.

#### 5.4.5.1 Design Standards

The LOP bulge design follows the standard bulge design philosophies used throughout the WTP Project as described in the document 24590-WTP-3PS-MX00-TP001, *Engineering Specification for Process Bulge Design and Fabrication*. Bulge components have a standard 0.040 inch corrosion allowance. Bulge confinement is designed to meet the requirements of AISC M016-89, Manual of Steel Construction. The associated LOP system process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.4.5.2 Characteristics of the Waste

The piping and valves of the LOP bulges (LOP-BULGE-00001 and LOP-BULGE-00002) transfer condensate received from the SBS condensate vessels, which is approximately 96.9 wt% water and 3.1 wt% solids with a pH of 14.4 (24590-WTP-M4C-V11T-00010).

The materials of construction for bulges are compatible with the waste managed in the LOP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the LOP bulges are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction and nature of the waste managed in the bulges.

## 5.5 LAW Secondary Offgas/Vessel Vent Process System (LVP)

The LVP system is primarily housed on the 28-ft and 48-ft elevation levels in room L-0218 and L-0304C/D/E/F/H of the LAW vitrification building above process cell melter areas located on the 3-ft elevation level. The LVP system consists of preheaters, high efficiency particulate air (HEPA) filters, exhausters, mercury adsorbers, a catalytic oxidizer/reducer, a caustic scrubber, and a caustic collection

tank. The regulated units associated with this system include one tank and 17 miscellaneous units. The LAW caustic collection tank (LVP-TK-00001) is located in room L-0218 in the central portion of the LAW building. The miscellaneous units are located in rooms L-0304C/D/E/F/H. The combined LOP/LVP system removes mercury, acid gases (mainly $SO_x$, HF, and HCl), $NO_x$, VOCs, particulates, aerosols, and radionuclides from the LAW melter offgas.

### 5.5.1 LAW Caustic Collection Tank (LVP-TK-00001)

The LAW caustic collection tank (LVP-TK-00001) associated with this system is located in the caustic scrubber blowdown pump room (L-0218) that is below the LAW melter offgas caustic scrubber. The room floors and the perimeter walls, up to the maximum height of the fire water overflow volume, are covered by special protective coating, which forms part of the secondary containment for the tank. The room has a radiological area classification of R2/C2 (Table 6).

The caustic collection tank receives scrub solution that drains from the LAW melter offgas caustic scrubber (LVP-SCB-00001). This liquid is recirculated to the top of the scrubber using caustic scrub solution recirculation pumps (LVP-PMP-00003A/B). This tank is designed for a 2-day hold-up of accumulated caustic scrub solution. To neutralize the acid gases collected in the caustic collection tank, 5 molar caustic is added to the suction side of the transfer pump. Periodically, the scrub solution is discharged to PTF alkaline effluent vessels (RLD-VSL-00017A/B) using caustic blowdown transfer pumps (LVP-PMP-00002A/B).

The caustic collection tank and process piping have all welded construction and are made from 316L stainless steel (UNS S31603) to ensure a 40-year life.

#### 5.5.1.1 Design Standards

The caustic collection tank (LVP-TK-00001) is a commercial grade tank fabricated in accordance with the American Petroleum Institute's construction standards API 650 Appendix J (shop built tanks) and Appendix S (material properties and modified equations for the analysis of stainless steel tanks). The tank is 13 ft in diameter by 14 ft, 4 inches high (to the upper tangent) with a maximum operating volume of 11,920 gallons. Corrosion allowance is 0.040 inch, which includes a 0.024-inch corrosion allowance and a 0.004-inch erosion allowance. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.5.1.2 Characteristics of the Waste

The caustic collection tank receives scrub solution from the caustic scrubber and recirculates the solution back to the caustic scrubber or, periodically, discharges scrubber bottoms that are approximately 90.1 wt% water and 9.8 wt% dissolved solids with a pH of 9.0 to 9.5 to the PTF (24590-WTP-M4C-V11T-00010, 24590-QL-POA-MKAS-00003-08-00003).

The materials of construction for this tank and ancillary equipment are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. The caustic collection tank is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tank. However, this tank is used as a surrogate for inaccessible equipment in the PTF or HLW vitrification facility (24590-WTP-PER-M-08-002). Therefore, the frequency of the integrity

assessment of this tank is accelerated to be consistent with the frequency for tanks with higher potential for corrosion and erosion.

### 5.5.2 HEPA Filters (LVP-HEPA-00001A/B, -00002A/B, -00003A)

The HEPA filters (LVP-HEPA-00001A/B, -00002A/B, and -00003A) are miscellaneous units associated with this system and are located in room L-0304H, which has a radiological area classification of R3/C3 (Table 6). HEPA filters provide the final removal of any remaining radioactive particulates from LAW melter offgas to protect downstream equipment from contamination.

The HEPA filters receive the combined offgas stream from the LOP system (WESP offgas) and vent gas from RLD vessels after it is passed through a preheater (LVP-HTR-00001A/B). The heated offgas passes through HEPA filter housings forming two trains: a main train (LVP-HEPA-00001A, -00002A, -00003A) used in normal operations and an auxiliary train (LVP-HEPA-00001B, -00002B) used as an installed back-up. The HEPA filter housings in each train are arranged to form primary and secondary stages of filtration. Each HEPA filter housing contains four individual filters operated in parallel for a total of 20 HEPA filters.

#### 5.5.2.1 Design Standards

The HEPA filters are a vendor package. The two stages of HEPA filters in the LAW vitrification facility consist of parallel banks of HEPA filters, in unshielded, cabinet-type, manual safe-change housings with a standby bank for use during filter change outs. The housings are designed in accordance with ASME AG-1. The HEPA filter inserts are radial flow type, meeting the performance requirements of ASME AG-1. Offgas from the HEPA filters flows through the C3 exhaust ductwork, which is constructed from high-integrity, galvanized, carbon steel, or stainless steel.

#### 5.5.2.2 Characteristics of the Waste

The HEPA filters receive offgas from the LOP system WESP units plus vent gas from the RLD vessels that is approximately 8.3 wt% water, 90.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the HEPA filter units are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.5.3 Melter Offgas Exhausters (LVP-EXHR-00001A/B/C)

The melter offgas exhausters (LVP-EXHR-00001A/B/C) are miscellaneous units associated with this system and are three multistage centrifugal blowers that are located downstream of the HEPA filters in rooms L-0304C/D/E. These rooms have a radiological area classification of R3/C3 (Table 6).

Each exhauster has a design capacity of 2,550 actual cubic feet per minute at the inlet with a minimum turndown ratio of 3 to 1, a total static pressure of 150 inches WC, and a dedicated uninterruptible power supply (UPS). The exhausters discharge the offgas to the mercury adsorbers at a nominal flow rate of

3,910 actual cubic feet per minute at 216°F and 58 inches of water gauge. Each exhauster is fabricated from 316L stainless steel (UNS S31603) to ensure a 40-year life.

#### 5.5.3.1 Design Standards

The exhausters are part of the C3 exhaust ductwork system, which is constructed from stainless steel with a corrosion allowance of 0.040 inch. The C3 exhaust ductwork distribution systems in the LAW vitrification facility are constructed in accordance with the codes and standards (including ASME AG-1, Air Movement and Control Association [AMCA] codes AMCA-201, 210, and 300; and National Electrical Manufacturers Association [NEMA] MG-1) identified in 24590-WTP-RPT-HV-02-001, WTP Cost Benefit Analysis for C2 and C3 HVAC Systems.

#### 5.5.3.2 Characteristics of the Waste

The exhausters draw filtered offgas from the HEPA filters and discharge it to the mercury mitigation equipment skid (LVP-SKID-00001). The offgas is approximately 8.3 wt% water, 90.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the exhausters are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.5.4 Offgas Mercury Adsorbers (LVP-ADBR-00001A/B)

The offgas mercury adsorbers (LVP-ADBR-00001A and -00001B) are miscellaneous units associated with this system and are located downstream from the exhausters in room L-0304F on the mercury mitigation equipment skid (LVP-SKID-00001). The offgas mercury mitigation equipment skid is located in a room that has a radiological area classification of R3/C3 (Table 6).

The adsorbers use activated carbon to remove mercury and acid gases. The offgas from the HEPA filters flows from the exhausters to the two mercury adsorbers (LVP-ADBR-00001A/B), which are normally operated in series. The mercury concentration in the offgas is reduced to a maximum of 45 micrograms per dry standard cubic meter, and the outlet concentration is measured with a continuous emission monitor. The vessels housing the mercury adsorbers are fabricated from 316L stainless steel (UNS S31603) to ensure a 40-year life.

#### 5.5.4.1 Design Standards

Each mercury adsorber vessel is approximately 8 ft high by 11 ft wide by 26 ft long with an activated carbon bed volume of about 223 cubic feet. The mercury adsorber units are a vendor package. The adsorber housing pressure boundary is designed and fabricated to ASME Section VIII, Division 1, the adsorbers and fire protection system are designed and fabricated to applicable ASME AG-1 requirements, and the interconnect piping and valves are designed and fabricated to ASME B31.3-96. The packaged unit is tested to ASME AG-1 with ASME AG-1a-2000 Addenda, and the pressure boundary pneumatically tested per ASME Section VIII, Division 1.

#### 5.5.4.2 Characteristics of the Waste

The mercury adsorbers receive air discharged from the exhausters and discharge treated offgas to the catalytic oxidizer/reducer skid (LVP-SKID-00002). Both the inlet gas and the offgas are approximately 8.3 wt% water, 90.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the mercury adsorbers are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.5.5 Selective Catalytic Oxidizer (LVP-SCO-00001) and Selective Catalytic Reduction Unit (LVP-SCR-00001)

The selective catalytic oxidizer (LVP-SCO-00001) and the selective catalytic reduction unit (LVP-SCR-00001) are miscellaneous units associated with this system and are located on the catalytic oxidizer/reducer skid (LVP-SKID-00002), which is downstream from and in the same room as the mercury mitigation equipment skid. The catalytic oxidizer/reduction unit skid is located in a room that has a radiological area classification of R3/C3 (Table 6).

The offgas from the mercury mitigation equipment skid is passed through the catalytic oxidizer/reducer skid (LVP-SKID-00002) that houses a heat recovery exchanger (LVP-HX-00001), and an electric heater (LVP-HTR-00002), as well as the selective catalytic oxidizer (SCO) catalyst (LVP-SCO-00001), and selective catalytic reduction (SCR) catalyst (LVP-SCR-00001).

The heated offgas is passed through the SCO catalyst to oxidize VOCs and carbon monoxide to carbon dioxide and water vapor. The SCO catalyst is a platinum-based material deposited on a metal monolith, which is held in frames and inserted/removed through access doors. The offgas is then injected with a mixture of ammonia vapor and C3 air from an ammonia/air dilution skid (LVP-SKID-00003). Following ammonia injection, the offgas is passed through the SCR catalyst to reduce $NO_x$, to nitrogen and water vapor. The SCR catalyst is a titanium oxide-based material deposited on a metal monolith, which is held in frames and inserted/removed through access doors.

#### 5.5.5.1 Design Standards

The selective catalytic oxidizer (LVP-SCO-00001) and the selective catalytic reduction unit (LVP-SCR-00001) are part of the vendor package for the catalytic oxidizer/reducer skid (LVP-SKID-00002). The housing for the oxidizer unit will be constructed of stainless steel 316L (UNS S31603) stainless steel with corrosion allowance of 0.010 inch. The reduction unit will be constructed of stainless steel 316L (UNS S31603) for fluid side shell components and for ammonia piping and spray; of stainless steel 347 (UNS S34700) or Inconel 960 (UNS N06690) for frame & instrument housings; and of stainless steel 304L (UNS S30403) for structural support not in contact with offgas stream. Corrosion allowance for the reduction unit is 0.010 inch. The housing for the units is constructed in accordance with ASME AG-1 – 1997 Articles AA-400 and CA-400 and ASME Section VIII, Division 1. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.5.5.2 Characteristics of the Waste

The LAW melter decomposes parent nitrate/nitrite compounds, which results in offgas that has high levels of $NO_x$. Although some of the resultant $NO_x$ is decomposed to nitrogen and water in the melter, and some is removed by scrubbing in the SBSs (LOP-SCB-00001 and -00002), the LVP system treats the remaining $NO_x$, plus any VOCs that are present in the LVP offgas stream.

The selective catalytic oxidation/reduction unit (LVP-SCO-00001 and LVP-SCR-00001) removes remaining $NO_x$, plus any VOCs that are present in the LVP offgas stream, prior to discharging the treated offgas to the melter offgas caustic scrubber (LVP-SCB-00001). The inlet offgas is approximately 8.3 wt% water, 90.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids, and the outlet offgas is approximately 7.2 wt% water, 91.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the selective catalytic oxidizer and the selective catalytic reduction unit are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.5.6 Electric Heaters (LVP-HTR-00001A/B and LVP-HTR-00002) and Heat Exchanger (LVP-HX-00001)

Two electric heaters (LVP-HTR-00001A/B) associated with this system are located in room L-0304H. One electric heater (LVP-HTR- 00002) and the heat exchanger (LVP-HX-00001) associated with this system is located in room L-0304F on the catalytic oxidizer/reducer skid (LVP-SKID-00002). The heaters and heat exchanger are located in rooms that have a radiological area classification of R3/C3 (Table 6).

The two electric heaters LVP-HTR-00001A/B, in individual housings, receive the combined LOP offgas stream and are used to increase the nominal offgas temperature from 131°F to 149°F to avoid condensation in the melter offgas HEPA filters. Both heaters are operated at less than 50% capacity so that if one fails, the required 18°F temperature increase can be maintained. The heaters are provided with an UPS in the event of a loss of normal power.

The heat recovery exchanger (LVP-HX-00001) raises the temperature of offgas from the mercury mitigation unit using the hot offgas from the SCR catalyst beds. The heat exchanger is a shell and tube design. The electric heater LVP-HTR-00002 is used to supplement the heat recovery exchanger on the catalytic oxidizer/reducer skid (LVP-SKID-00002) primarily during startup and when operating with low $NO_x$ concentrations.

The heaters are made from 316L stainless steel (UNS S31503) to ensure a 40-year life. The heat exchanger is has a 316L stainless steel housing, Incoloy 800/825 (UNS N09900/N08825) heating elements, and stainless steel 347 (UNS S34700) or Inconel 600/690 (UNS N06600/N06900) high temperature surfaces.

#### 5.5.6.1 Design Standards

The heaters and the heat exchanger are parts of the vendor packages. The housing for the units is constructed in accordance with ASME AG-1 – 1997 Articles AA-400 and CA-400 and ASME Section VIII, Division 1. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.5.6.2 Characteristics of the Waste

Heaters LVP-HTR-00001A/B receive offgas from the LOP system WESPs plus vent gas from the RLD vessels and is approximately 8.3 wt% water, 90.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids (24590-WTP-M4C-V11T-00010). The heat exchanger and heater LVP-HTR-00002 receive offgas that has passed through the mercury mitigation equipment skid.

The materials of construction for these miscellaneous units are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the heaters and heat exchanger are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

### 5.5.7 Melter Offgas Caustic Scrubber (LVP-SCB-00001)

The LAW melter offgas caustic scrubber (LVP-SCB-00001) is a miscellaneous unit associated with this system and is located in an alcove in room L-0304F, adjacent to the area housing the LVP-SKID-00001 and LVP-SKID-00002. The LAW melter offgas caustic scrubber is located in a room that has a radiological area classification of R3/C3 (Table 6).

The caustic scrubber (LVP-SCB-00001) receives offgas from the catalytic oxidation/reduction skid and further treats the offgas by removing acid gases and providing cooling. This scrubber has a nominal offgas inlet flow rate of 9,670 actual cubic feet per minute at 550°F and 11 inches of water gauge.

The caustic scrubber is fabricated from 316L stainless steel (UNS S31603) with the interior from Hastelloy C-276 (UNS N10276) or 316L stainless steel with Hastelloy C-276 or Hastelloy C-22 (UNS N06022) cladding.

#### 5.5.7.1 Design Standards

The vessel housing the caustic scrubber (LVP-SCB-00001) is fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and is code-stamped. The caustic scrubber vessel has the minimum standard corrosion allowance of 0.040 inch, which is approximately 40% more than the 0.024-inch corrosion allowance and a 0.004-inch erosion allowance required for the caustic scrubber housing. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.5.7.2 Characteristics of the Waste

The inlet offgas is approximately 7.2 wt% water, 91.6 wt% gases (primarily $N_2$, $O_2$, and $CO_2$), and less than 1 wt% solids (24590-WTP-M4C-V11T-00010).

The materials of construction for these miscellaneous units are compatible with the waste managed in the LVP. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the caustic scrubber is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in these miscellaneous units.

## 5.6 Radioactive Liquid Waste Disposal System (RLD)

The RLD system is located on the 3-ft elevation level and -21-ft elevation level of the LAW vitrification building. Three regulated tanks are associated with this system: the plant wash vessel (RLD-VSL-00003) and the SBS condensate collection vessel (RLD-VSL-00005) located on the 3-ft elevation level (room L-0126) in the eastern portion of the LAW building and the LAW C3/C5 drains/sump collection vessel (RLD-VSL-00004) located below grade at the -21-ft elevation level (room L-B001B). The RLD system also includes two bulges associated with the RLD tanks and sumps located in the process, effluent, and C3/C5 drains cells.

### 5.6.1 Plant Wash Vessel (RLD-VSL-00003)

The plant wash vessel (RLD-VSL-00003) for the LAW vitrification facility is located in the northern portion of the effluent cell (L-0126) that also houses the SBS condensate collection vessel (RLD-VSL-00005). The cell floor and the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. The effluent cell L-0126 contains secondary containment sumps RLD-SUMP-00035 and RLD-SUMP-00036. This room has a radiological area classification of R5/C5 (Table 6).

The plant wash vessel receives plant wash and C3/C5 drains from the C3/C5 drains/sump collection vessel. Dedicated lines to the plant wash vessel are provided for the process/effluent cell sump pump discharge header, C3/C5 drains/sump collection cell sump pump discharge, Melter 1 and Melter 2 concentrate receipt pump discharge headers, Melter 1 and Melter 2 feed preparation/feed transfer pump discharge headers, caustic collection berm drain, and each of the C1/C2 and C3/C5 drains/sump collection transfer pump discharge headers. The plant wash vessel has a maximum capacity of 25,780 gallons.

The plant wash vessel is equipped with the following:

- Mechanical agitator (RLD-AGT-00001) to suspend solids accumulated in the vessel
- Two vertical pumps (RLD-PMP-00001A/B)

The vessel and process piping have all welded construction with the body of the vessel made from 6% molybdenum alloy (UNS N08367/N08926) and the top head made from 316L stainless steel (UNS S31603) to ensure containment of plant wash over a 40-year life.

#### 5.6.1.1 Design Standards

The plant wash vessel (RLD-VSL-00003) is fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and is code-stamped. The plant wash vessel has ASME flat flanged top and flanged and dished bottom head with an approximate inside diameter of 16 ft and a height of 15 ft, 5 inches from the top the bottom tangent. The vessel shell and bottom head thicknesses are 0.75

inch minimum. The vessel top thickness is 2.5 inches. The plant wash vessel has the minimum standard corrosion allowance of 0.040 inch, which is approximately 40% more than the 0.024-inch corrosion allowance and a 0.004-inch erosion allowance required. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

A sample supply line to sampler ASX-SMPLR-00012 is routed from the discharge of the transfer pumps (RLD-PMP-00001A/B). Sampling the plant wash vessel is not a routine operation. The tank contents are sampled during start-up and commissioning to confirm proper mixing. Sampling may also occur during production for pH adjustment with sodium hydroxide as required.

#### 5.6.1.2 Characteristics of the Waste

The plant wash vessel is normally empty, but can receive plant wash consisting of sump contents from process and effluent cells, washes or off-specification material from process vessels, drains from the caustic collection berm, and off-specification material from the C1/C2 drains/sump collection vessel, in addition to C3/C5 drains via the C3/C5 drains/sump collection vessel. Plant wash from many of these sources may be corrosive (24590-WTP-M4C-V11T-00010).

The materials of construction for this tank and ancillary equipment are compatible with the waste managed in the RLD. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the caustic collection tank is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tank.

### 5.6.2 LAW C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004)

The LAW C3/C5 drains/sump collection vessel (RLD-VSL-00004) is located in the below grade (-21-ft elevation level) C3/C5 drains cell area (room L-B001B). The cell floor and the perimeter walls, up to the maximum height of the fire water overflow volume, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. The C3/C5 drains cell area (L-B001B) contains secondary containment sump RLD-SUMP-00028. The room has a radiological area classification of R3/C5 (Table 6).

The C3/C5 drains/sump collection vessel receives stack condensate drainage, WESP drains, and C3/C5 drains. Dedicated lines terminating 6 inches above the bottom head within the drains collection vessel are provided for the Melter 1 WESP drain, Melter 2 WESP drain, vessel overflow header, decontamination room drain, melter cooling panel drains, filter room sump transfer, floor drain header at 48-ft elevation level, floor drain header at 28-ft elevation level, and floor drain headers at 3-ft elevation level on the north side and south side. The WESP drains are maintained submerged to ensure the melter offgas does not bypass the WESP. In addition, a dedicated line terminating at the vessel nozzle is provided for the vessel vent header drain. The C3/C5 drains/sump collection vessel has a maximum capacity of 7,696 gallons.

The C3/C5 drains/sump collection vessel is equipped with three mixing eductors (RLD-EDUC-00001A/B/C). Two centrifugal pumps (RLD-PMP-00002A/B) in the C3/C5 drains/sump collection pump bulge (RLD-BULGE-00001) are provided with suction lines from, and a recirculation line to, the C3/C5 drains/sump collection vessel. The recirculated fluid provides the motive force for the mixing eductors.

The vessel and process piping have all welded construction with the body of the vessel made from 316L stainless steel (UNS S31603) and the bottom head clad with 0.1 inch of Inconel 625 (UNS N06625) or better to ensure containment of drains/sump discharge over a 40-year life.

#### 5.6.2.1 Design Standards

The LAW C3/C5 drains/sump collection vessel (RLD-VSL-00004) is fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and is code-stamped. The drains/sump collection vessel has ASME flanged and dished heads and an approximate inside diameter of 10 ft and a tangent-to-tangent height of 11 ft. The vessel shell and head thicknesses are 0.5 inch minimum. The LAW C3/C5 drains/sump collection vessel has the minimum standard corrosion allowance of 0.040 inch, which includes the 0.024-inch corrosion allowance and a 0.016-inch erosion allowance required. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

A sample supply line to sampler ASX-SMPLR-00013 is routed from the discharge of the transfer pumps (RLD-PMP-00002A/B). Sampling the LAW C3/C5 drains/sump collection vessel is not a routine operation. The tank contents are sampled during start-up and commissioning to confirm proper mixing. Sampling may also occur during production for pH adjustment with sodium hydroxide as required.

#### 5.6.2.2 Characteristics of the Waste

The LAW C3/C5 drains/sump collection vessel receives WESP drains and unscheduled C3/C5 drains, which may be corrosive (24590-WTP-M4C-V11T-00010).

The materials of construction for this tank and ancillary equipment are compatible with the waste managed in the RLD. The schedule for conducting periodic assessments of this system is provided in Table 7. The LAW C3/C5 drains/sump collection vessel is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tank. However, this tank is used as a surrogate for inaccessible equipment in the PTF or HLW vitrification facility (24590-WTP-PER-M-08-002). Therefore, the frequency of the integrity assessment of this tank is accelerated to be consistent with the frequency for tanks with higher potential for corrosion and erosion.

### 5.6.3 SBS Condensate Collection Vessel (RLD-VSL-00005)

The SBS condensate collection vessel (RLD-VSL-00005) is located in the southern portion of the effluent cell (L-0126) that also houses the LAW vitrification facility plant wash vessel (RLD-VSL-00003). The cell floor and the perimeter walls, up to the maximum height to contain the volume of the largest tank, are covered by a stainless steel liner, which forms part of the secondary containment for the tank. The effluent cell L-0126 contains secondary containment sumps RLD-SUMP-00035 and RLD-SUMP-00036. This room has a radiological area classification of R5/C5 (Table 6).

The SBS condensate collection vessel collects SBS condensate and receives WESP drains from the C3/C5 drains/sump collection vessel. Dedicated lines to the SBS condensate collection vessel are provided for the Melter 1 SBS water purge/SBS condensate purge pump discharge header, Melter 2 SBS water purge/SBS condensate purge pump discharge header, and C3/C5 drains/sump collection transfer pump discharge. The plant wash vessel has a maximum capacity of 25,780 gallons.
The SBS condensate collection vessel is equipped with the following:

- Mechanical agitator (RLD-AGT-00002) to suspend solids accumulated in the vessel
- Two vertical pumps (RLD-PMP-00003A/B)

The vessel and process piping have all welded construction with the body of the vessel made from 6% molybdenum alloy (UNS N08367/N08926) and the top head made from 316L stainless steel (UNS S31603) to ensure containment of SBS condensate over a 40-year life.

#### 5.6.3.1 Design Standards

The SBS condensate collection vessel (RLD-VSL-00005) is fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and is code-stamped. The SBS condensate vessel has ASME flat flanged top and flanged and dished bottom head with an approximate inside diameter of 16 ft and a height of 15 ft, 5 inches from the top the bottom tangent. The vessel shell and bottom head thicknesses are 0.75 inch minimum. The vessel top thickness is 2.5 inches. Corrosion allowance is 0.040 inch. Process piping is designed in accordance with ASME B31.3-96, Process Piping.

A sample supply line to sampler ASX-SMPLR-00012 is routed from the discharge of the transfer pumps (RLD-PMP-00003A/B). Sampling the SBS condensate collection vessel is not a routine operation. The tank contents are sampled during start-up and commissioning to confirm proper mixing. Sampling may also occur during production for pH adjustment with sodium hydroxide as required.

#### 5.6.3.2 Hazardous Characteristics of the Waste

The SBS condensate collection vessel receives recirculation from the SBS condensate collection vertical pumps or transfers from the plant wash vertical pumps. SBS condensate has a pH of 14.4 (24590-WTP-M4C-V11T-00010).

The materials of construction for this tank and ancillary equipment are compatible with the waste managed in the RLD. The schedule for conducting periodic assessments of this system is provided in Table 7. The SBS condensate collection vessel is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed in the tank. However, this tank is used as a surrogate for inaccessible equipment in the PTF or HLW vitrification facility (24590-WTP-PER-M-08-002). Therefore, the frequency of the integrity assessment of this tank is accelerated to be consistent with the frequency for tanks with higher potential for corrosion and erosion.

### 5.6.4 RLD Bulges (LOP-BULGE-00001 and LOP-BULGE-00004)

The two bulges associated with the RLD system comprise the C3/C5 pump bulge (RLD-BULGE-00001) and the plant wash/SBS condensate collection vessel valve bulge (RLD-BULGE-00004). The C3/C5 pump bulge is located adjacent to the below grade (-21-ft elevation level) C3/C5 cell area in room L-B001A. The plant wash/SBS condensate collection vessel valve bulge is located on the 28-ft elevation level, above the effluent cell, in room L-0202. Most instruments and valves for the RLD system are placed in the bulges. Rooms L-B001A and L-0202 have a radiological area classification of R3/C3 (Table 6).

The pump and valve bulges for the RLD system provide secondary containment away from the C3/C5 and effluent cells where the pumps, control valves, and valve actuators that are used in the transfer of effluent between tanks are accessible for maintenance. The RLD pump bulge drains to a sump (RLD-SUMP-00028) and the RLD valve bulge drains to a sump (RLD-SUMP-00036). Contents of both sumps are pumped to the plant wash vessel (RLD-VSL-00003)

The C3/C5 pump bulge (RLD-BULGE-00001) confinement is made of 316L stainless steel (UNS31603) and the pumps (RLD-PMP-00002A/B) and valves are made of a 6% molybdenum alloy (UNS N08367) to ensure containment of the C3/C5 effluent for a 40-year life. The plant wash/SBS condensate collection vessel bulge (RLD-BULGE-00004) confinement and manual valves are made of 316L stainless steel (UNS S31603) to ensure containment of the plant wash/SBS condensate for a 40-year life.

#### 5.6.4.1 Design Standards

The RLD bulge designs follow the standard bulge design philosophies used throughout the WTP Project as described in the document 24590-WTP-3PS-MX00-TP001, Engineering Specification for Process Bulge Design and Fabrication. Bulge components have a standard 0.040 inch corrosion allowance. Bulge confinement is designed to meet the requirements of AISC M016-89, Manual of Steel Construction. The associated RLD system process piping is designed in accordance with ASME B31.3-96, Process Piping.

#### 5.6.4.2 Characteristics of the Waste

The piping, pumps, and valves of the RLD bulges (RLD-BULGE-00001 and RLD-BULGE-00004) transfer effluent received from the RLD tanks. The materials of construction for bulges are compatible with the waste managed in the RLD system. The schedule for conducting periodic assessments of this system is provided in Table 7. For the purpose of scheduling periodic assessments, the RLD bulges are considered to have a lower potential for corrosion and erosion on the basis of the materials of construction and nature of the waste managed in the bulges.

### 5.6.5 Secondary Containment (RLD-SUMP-00028, RLD-SUMP-00029, RLD-SUMP-00030, RLD-SUMP-00031, RLD-SUMP-00032, RLD-SUMP-00035, and RLD-SUMP-00036)

The LAW vitrification facility tank systems are designed to meet applicable secondary containment, leak detection, integrity, and other criteria defined in WAC 173-303-640. As described above, 11 tanks are located in stainless steel lined cells (wet process cells for Melter 1 and Melter 2), effluent cell, and C3/C5 drain vessel room) and one tank is located inside a berm with a special protective coating (in room L-0218). Each stainless steel lined cell includes a stainless steel lined sump embedded in the floor:

- sump RLD-SUMP-00028 in the C3/C5 drains vessel cell (L-B001B) at elevation -21 ft (cell containing tank RLD-VSL-00004 and drains from RLD-BULGE-00001)
- sumps RLD-SUMP-00029 and RLD-SUMP-00030 in Melter 1wet process cell (L-0123) at elevation 3 ft (cell containing tanks LCP-VSL-00001, LFP-VSL-00001, LFP-VSL-00002, and LOP-VSL-00001; miscellaneous units LOP-SCP-00001 and LOP-WESP-00001; and drains from LCP-BULGE-00001, LCP-BULGE-00002, LFP-BULGE-00001, LMP-LDB-00001, LOP-BULGE-00001)

- sumps RLD-SUMP-00031 and RLD-SUMP-00032 in Melter 2 wet process cell (L-0124) at elevation 3 ft (cell containing tanks LCP-VSL-00002, LFP-VSL-00003, LFP-VSL-00004, and LOP-VSL-00002; miscellaneous units LOP-SCP-00002 and LOP-WESP-00002; and drains from LCP-BULGE-00003, LFP-BULGE-00002, LMP-LDB-00002; LOP-BULGE-00002)
- sumps RLD-SUMP-00035 and RLD-SUMP-00036 in the effluent cell (L-0126) at elevation 3 ft (cell containing tanks RLD-VSL-00003 and RLD-VSL-00005; and drains from RLD-BULGE-00004)

Rooms L-0123, L-0124, L-0126 have a radiological area classification of R5/C5 (Table 6) with no cell access during normal operations. Room L-B001B has a radiological area classification of R3/C5 (Table 6).

The four process cell sumps (RLD-SUMP-00029, RLD-SUMP-00030, RLD-SUMP-00031, and RLD-SUMP-00032), the two effluent cell sumps (RLD-SUMP-00035 and RLD-SUMP-00036), and the C3/C5 drains vessel cell sump (RLD-SUMP-00028) are provided with liquid level detection, alarms, and permanently installed submersible sump pumps. The submersible sump pumps transfer the sump contents to the Plant Wash Vessel (RLD-VSL-00003).

#### 5.6.5.1 Design Standards

The seven sumps in the LAW vitrification facility are dry sumps fabricated in accordance with design methodology specified in AISC M016-89, Manual of Steel Construction. The sumps are also designed to meet applicable secondary containment, leak detection, integrity, and other criteria defined in WAC 173-303-640. The C3/C5 drains/sump collection vessel cell sump is made of 316L (UNS S31603) and the six process/effluent cell sumps are made of a 6% molybdenum alloy (UNS N08367) to ensure containment for a 40-year life. All sumps have a standard corrosion allowance of 0.040 inches. The process and effluent cell sumps are 30-in diameter by 12-in deep and the C3/C5 drains collection cell sump is 24-inches diameter by 30-inches deep.

#### 5.6.5.2 Characteristics of the Waste

During normal operations, the LAW vitrification facility sumps are dry. The four process cell sumps (RLD-SUMP-00029, RLD-SUMP-00030, RLD-SUMP-00031, and RLD-SUMP-00032) in combination with the stainless steel cell liners provide secondary containment for wastes from the following DWP regulated tanks and miscellaneous units, and bulge drains:

- CRVs LCP-VSL-00001and LCP-VSL-00002
- MFPVs LFP-VSL-00001 and LFP-VSL-00003
- MFVs LFP-VSL-00002 and LFP-VSL-00004
- SBSs LOP-SCB-00001 and LOP-SCB-00003
- WESPs LOP-WESP-00001 and LOP-WESP-00002
- SBS condensate vessels LOP-VSL-00001 and LOP-VSL-00002
- LCP bulge drains, LFP bulge drains, LOP bulge drains
- Melter feed line encasement assembly (LMP-LDB-00001 and LMP-LDB-00002) drains

The two effluent cell sumps (RLD-SUMP-00035 and RLD-SUMP-00036) in combination with the stainless steel cell liner provide secondary containment for effluent from the plant wash vessel (RLD-VSL-00003) and the SBS condensate collection vessel (RLD-VSL-00005), plus the effluent vessels bulge (RLD-BULGE-00004) drain. Previous sections described the wastes and effluent contained in these tanks, miscellaneous units, and bulges.

The C3/C5 drains collection sump (RLD-SUMP-000028) in combination with the stainless steel cell liner provides secondary containment for overflow or leakage from the C3/C5 drains/sump collection vessel (RLD-VSL-00004), piping in the C3/C5 drains/sump collection vessel cell, and leakage from piping or valves in RLD-BULGE-00001. Previous sections described the materials managed in the tank and associated piping and bulge.

The materials of construction for secondary containment system are compatible with the waste managed in the LAW vitrification facility. The schedule for conducting periodic assessments of the secondary containment system is provided in Table 7. The secondary containment system is considered to have a lower potential for corrosion and erosion on the basis of the materials of construction and nature of the waste managed in the system. However, these accessible sumps are used as surrogates for inaccessible sumps in the PTF or HLW vitrification facility (24590-WTP-PER-M-08-002). Therefore, the frequency of the integrity assessment of these LAW vitrification facility sumps is accelerated to be consistent with the frequency for sumps with higher potential for corrosion and erosion.

# 6 Underground Transfer Lines

This section provides descriptions of the underground transfer lines, including secondary containment, that are used to transfer wastes from the DOE Tank Farms to the WTP PTF and between the WTP facilities. Information is provided on the purpose of these underground transfer lines, and their design characteristics, including materials of construction and corrosion/erosion allowances. The design standards used for the transfer lines are also provided.

There are 21 underground transfer lines carrying dangerous waste that are connected to, or are within, the WTP facilities. The transfer lines are sloped, with eight of the transfer lines having a minimum slope of 1:50 and the remaining 13 lines having a minimum slope of 1:200. All lines, except the lines from the PTF to the LERF/ETF, are sloped toward the PTF and terminate in leak detection boxes located within the PTF pipe tunnels. The PTF to LERF/ETF lines are sloped toward the LERF/ETF facility, and the leak detection boxes are located at the WTP boundary.

All underground transfer lines are double-walled, with a 3-inch-diameter nominal stainless steel primary pipe and a 6-inch-diameter nominal carbon steel secondary pipe. The secondary encasement pipe has a fusion bounded epoxy coating with shrink wrap sleeves covering the clamshell welds and a cathodic protection system using an impressed current system. The epoxy coating provides corrosion protection and reduces the current requirement of the cathodic protection system.

Several secondary pipes are surrounded by a layer of insulation (1 to 2 inches thick) and a protective polymer outer shell (e.g., secondary pipe from the DOE Tank Farm to the WTP PTF). Because of its isolation from the surrounding soil and groundwater intrusion, the secondary pipe does not need to be cathodically protected; however, it is connected to cathodically protected piping at both ends and therefore may receive some cathodic protection within those areas.

Primary transfer lines are flushed after each use to minimize the accumulation of waste material and prevent corrosion of the line. Flushing capabilities for removing leaks or accumulated liquid from the secondary containment pipe are also provided.

The leak detection system of the underground transfer pipes employs leak detection boxes at the low points of the pipes so that in the event that the primary pipe leaks, the leak is contained by the secondary pipe and drains into the leak detection boxes. In each of the leak detection boxes, there is a level switch to detect leaks. Once the sensing element of the switch detects a leak, the switch sends a signal to activate a leak detection alarm.

For leak detection boxes installed inside the PTF (PWD-LDB-00001 through PWD-LDB-00019), the box is a horizontal stainless steel pipe with capped ends, drain, overflow drain, and weir. The drain located between the weir and the closest end cap (which is called the containment side of the weir), is normally closed by a plug attached to a rod extending to an accessible area above the leak detection boxes. The overflow drain, located in the non-containment side of the weir, has a similar apparatus, but remains open. The level switch is located in the containment side of the weir. The design of the leak detection boxes is provided in 24590-WTP-PER-J-02-002 (Low-Point Leak Detection in Secondary Containment Systems Including Buried Co-Axial Transfer Lines) and 24590-BOF-CS-80-00102 (RAD Transfer Lines, Miscellaneous Details, Sheet 3).

The leak detection boxes located at the WTP boundary (RLD-LDB-00012 and RLD-LDB-00013) have a similar design as the leak detection boxes installed inside a building. However, the overflow drain remains closed and is opened only after the placement of an appropriate overflow containment receptacle.

Prior to installation in the leak detection boxes, the leak detection level switches are tested for functionality. The leak detection system is periodically self-tested in-situ, to facilitate continuous operability.

The underground transfer lines are covered with bedding and backfill materials consisting of granular material or controlled density fill as specified in 24590-BOF-3PS-CE01-T0001, *Engineering Specification for Excavation and Backfill.* The bedding material at the building interfaces consists of an expansion absorbing cushion made of mineral inorganic glass fiber material and a dry, free-flowing granular product formulated from select inert, inorganic materials as specified in 24590-BOF-3PS-C000-T0002, *Engineering Specification for Excavation and Backfill of Underground Radioactive Waste Transfer Lines.*

## 6.1 Design Standards

The primary containment pipe for the underground transfer lines between the WTP facilities is stainless steel 316L (UNS S31603). The secondary containment pipe is made of carbon steel. It has an epoxy-coating and cathodic protection system to be corrosion resistant during its 40-year design life. The pipes are designed in accordance with ASME B31.3-96, Process Piping.

The 3-inch-diameter nominal primary pipe has a wall thickness of 0.216 inch. The 6-inch-diameter nominal secondary pipe has a wall thickness of 0.280 inch. Corrosion and erosion allowance for the primary pipe from the DOE Tank Farm to the PTF is 0.0160 inch. Corrosion and erosion allowances for the primary pipe between the WTP facilities range from 0.0425 to 0.0937 inch. There are no corrosion

and erosion allowances specified for the secondary pipe because of the epoxy-coating, the cathodic protection system, and for some of the lines, the insulation and protective polymer outer shell around the pipe.

The likelihood of corrosion of the secondary containment pipe of the transfer lines due to liquid in the annular space is small because any leak from the primary pipe is quickly contained and directed to the leak detection boxes, reducing exposure time. In addition, corrosion of the secondary containment pipe is not expected to occur due to the epoxy coating and cathodic protection system. The use of the tertiary barrier (insulation and protective polymer outer shell) for some of the pipes also isolates the secondary containment pipe from external sources of moisture, which eliminates the occurrence of corrosion.

## 6.2 Characteristics of the Waste

The PTF receives LAW and HLW waste feeds from the DOE Tank Farms through three transfer lines. The LAW waste feed is approximately 63.7 wt% water, 35.5 wt% dissolved solids, and 0.78 wt% solids with a pH of 14. The HLW waste feed is approximately 70.9 wt% water, 16.5 wt% dissolved solids, and 12.7 wt% solids with a pH of 13 (24590-WTP-M4C-V11T-00010).

The PTF pretreats the feeds and transfers them to the LAW vitrification facility through three transfer lines or to the HLW vitrification facility through four transfer lines. The treated LAW feed is approximately 57.9 wt% water, 42.1 wt% dissolved solids, and 0 wt% solids with a pH of 14. The treated HLW feed is approximately 76.1 wt% water, 5.6 wt% dissolved solids, and 18.3 wt% solids with a pH of 13.7 (24590-WTP-M4C-V11T-00010).

Secondary waste from the analytical laboratory is transferred to the PTF for treatment and disposal through one transfer line. Waste includes contents of the hot cell drain collection vessel (RLD-VSL-00165) that are discharged to the PTF plant wash vessel (PWD-VSL-00044) described in Section 4.2.

Secondary waste from the LAW vitrification facility is returned to the PTF for treatment and disposal through four transfer lines. Waste includes contents of the LAW caustic collection tank (LVP-TK-00001), plant wash vessel (RLD-VSL-00003), and SBS condensate collection vessel (RLD-VSL-00005) described in Sections 5.5.1.2, 5.6.1.2, and 5.6.3.2.

Secondary waste from the HLW vitrification facility is returned to the PTF through four transfer lines. Waste includes contents of the acidic waste vessel (RLD-VSL-00007) and plant wash and drains vessel (RLD-VSL-00008). The acidic waste vessel receives waste that consists of SBS purge, WESP and HEME drainage, and neutralized canister decontamination waste. The blended contents are approximately 98.8 wt% water and 1.2 wt% solids. The plant wash and drains vessel receives various vessel, sump, and plant washes. The blended contents are approximately 99.97 wt% water and 0.03 wt% solids. The contents of both vessels are neutralized to a pH of 8 or greater before transferring to the PTF vessel PWD-VSL-00043 (24590-HLW-N1D-RLD-00006, 24590-HLW-3YD-RLD-00001).

Secondary waste generated within the PTF is transferred through two transfer lines to the LERF/ETF. Waste includes contents of the alkaline effluent vessels (RLD-VSL-00017A/B) and process condensate tanks (RLD-TK-00006A/B). Both vessels receive condensate/effluent that is 100 wt% water with a pH of 11.5 (24590-WTP-M4C-V11T-00010).

The materials of construction for the underground transfer lines are compatible with the waste carried by the lines. The transfer lines are considered to have no potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, corrosion prevention methods such as epoxy coating and cathodic protection system, and nature of the waste managed in the tank. The underground transfer lines are not accessible for inspection without excavation.

# 7 Assessment Approach and Schedule

This section presents the integrity assessment approach and schedule for the regulated plant items in the analytical laboratory, LAW vitrification facility, and for underground transfer lines.

## 7.1 Assessment Approach

This section presents information on the integrity assessments needed to assure regulated plant items retain their structural integrity. These activities and systems include routine inspections, operating history reviews, static liquid volume tests, NDEs, and visual examination. Closed-circuit television (CCTV) systems are placed for operational needs and to view certain equipment, but are not specifically placed to meet integrity assessment requirements. However, where CCTV views include regulated equipment, the CCTV system can be used as an integrity assessment tool.

### 7.1.1 Routine Inspections

Routine inspections (such as visual inspections, camera inspections, and instrumentation inspections) to check for leaks from tanks, miscellaneous units, sumps, and piping are performed and recorded where design features are provided for that purpose to ensure waste has not leaked from a tank, miscellaneous unit, sump or pipe. Routine inspections are a part of normal plant operations and contribute to an understanding of the current operating conditions. Routine inspections are performed in accordance with the requirements of Chapter 6.0 of the WTP DWP as specified in WTP DWP condition III.10.C.5.c, WAC 173-303-640(6) and WAC 173-303-680(3). The data from these routine inspections are considered in scheduling periodic assessments.

### 7.1.2 Integrity Assessments

Periodic integrity assessments will be performed over the life of the regulated plant items to assure they retain their structural integrity and will not collapse, rupture, or fail. All regulated plant items are categorized into different classes. The classification system allows extra assessment efforts to be focused on regulated plant items that may have the highest potential consequences if failure or loss of containment should occur.

Tanks, miscellaneous units, bulges, sumps, and piping with a design life of 40 years are adequately designed and fabricated to last for 40 years without in-service replacement in accordance with procedures and materials of construction described in Section 2 and the design standards described in Sections 4 through 6. For the purpose of scheduling periodic assessments, a regulated plant item is considered to have a lower potential for corrosion and erosion or a higher potential for corrosion and erosion on the basis of the materials of construction, corrosion and erosion allowances, and nature of the waste managed.

Most equipment is considered to have a lower potential for corrosion and erosion for assessment scheduling. Tanks for which erosion due to higher velocities may occur are considered to have a higher potential for corrosion and erosion. Specifically, tanks with mixers that result in higher velocities are considered to have a higher potential for corrosion and erosion for assessment purposes, even though they are designed with additional thickness to compensate for additional erosion.

The following provides the frequency of assessments for regulated plant items.

- **Frequency of Assessments for Equipment with Lower Potential for Corrosion and Erosion.** Assessment of equipment with lower potential for corrosion and erosion within accessible areas is made during routine or maintenance outages and within 10 years after start of hot commissioning at selected accessible points where baseline NDE measurements had been taken. Subsequent integrity assessments will be based on the results of previous integrity assessments, the age of the equipment, materials of construction, characteristics of the waste, and any other relevant factors, but will be no more than 10 years between integrity assessments. Ten years is considered long enough to detect anticipated normal corrosion and erosion, but short enough so that if there were significant unanticipated corrosion and erosion, adequate wall thickness would remain so that failure would be prevented and corrective actions can be taken, if required.
- **Frequency of Assessment for Equipment with Higher Potential for Corrosion and Erosion.** Assessment of equipment with higher potential for corrosion and erosion within accessible areas is made during routine or maintenance outages and within 7 years after start of hot commissioning at selected accessible points where baseline NDE measurements had been taken. Subsequent integrity assessments will be based on the results of previous integrity assessments, the age of the equipment, materials of construction, characteristics of the waste, and any other relevant factors, but will be no more than 7 years between integrity assessments. Because of the potential for increased corrosion and erosion, 7 years is considered long enough to detect anticipated normal corrosion and erosion, but short enough so that if there were significant unanticipated corrosion and erosion, adequate wall thickness would remain so that failure would be prevented and corrective actions can be taken, if required.

Vendor-provided weld and NDE inspection records and associated quality control documents are used to establish the baseline condition of equipment prior to start-up and operations. Where supplier documentation is not sufficient, additional NDE is conducted to establish a baseline prior to start of hazardous waste operations. Results of future integrity assessments will be compared to the baseline condition to evaluate the structural integrity of equipment and to determine whether the schedule of future assessments should be adjusted.

Where corrosion and/or erosion rates can be determined, the maximum assessment interval is the smaller of:

> Remaining Corrosion Allowance/2N years (where remaining corrosion allowance is the difference between the measured shell thickness and the minimum required thickness in mils, and N is the corrosion rate in mils per year);

or:

> Seven and 10 years, respectively, for equipment with higher or lower potential for corrosion and erosion.

### 7.1.3 Operating History Reviews

The operating and maintenance history of tanks, miscellaneous units, bulges, sumps, and piping are evaluated to verify that the regulated plant items have been operating within the process envelope used to determine the material of construction and corrosion and erosion allowances. This assessment includes reviewing the process chemistry and parameters such as pH, pressure and temperature, where available, over the period of assessment. Table 8 provides a summary of the process chemistry and parameters that are monitored and evaluated during the operating history reviews. A description of the detailed process chemistry sampling and analysis conducted on hazardous waste managed in the analytical laboratory and LAW vitrification facility is provided in 24590-WTP-RPT-ENV-01-0003, *Waste Treatment Plant Waste Analysis Plan*. For cases where the process conditions deviate from the design conditions, the data are evaluated to determine potential effects on the regulated plant item corrosion and erosion allowances.

These reviews of operating and maintenance conditions and process chemistry for tanks, miscellaneous units, bulges, sumps and piping are done at least every 2 years, or whenever operating parameters are known to have been outside of the process and operating limitations, or when the process chemistry data identified on the respective Corrosion Evaluation Reports/Material Selection Data Sheets, which were used for initial material selection, are revised to incorporate new process information.

Process monitoring is facilitated by a facility-wide autosampling system. The WTP Autosampling System consists of the following major components:

- Ten Autosampler Units - Two located in the LAW vitrification facility and the remaining units located in the PTF and HLW vitrification facility.
- Each sampler is connected to several components that require sampling of their contents. A list of the samplers, the components connected for sampling, and the source terms for fluids routed to each sampler are presented in Table 9. At each autosampler unit, sample bottles are received from a local carrier magazine, filled with a sample from the waste stream, and dispatched to the analytical laboratory.
- Carrier Posting Station - A stand-alone station located in the LAW vitrification facility for the manual introduction of carriers into the Pneumatic Transfer System. These carriers are dispatched to the LAW laboratory fume hood receipt station.
- Pneumatic Transfer System (PTS) -- A network of transport tubes, diverters, exhausters, HEPA filters, and controlled arrival facilities work concurrently to transfer the carriers and sample bottles for analytical laboratory receipt.
- Fumehood Receipt Station -- This is the analytical laboratory receipt station for LAW samples.
- Hot Cell Receipt Station -- This is the analytical laboratory receipt station for HLW vitrification facility and PTF samples.

Each autosampling unit consists of a main glovebox with a robotic arm, a carrier docking station, and a sample retrieval mechanism. A carrier magazine is positioned locally at each autosampler unit for dispatching new sample bottles and carriers in to the main glovebox. Table 9 provides a summary of the LAW tanks monitored by sampling and analysis.

The LAW melters and film coolers, which are designed to be replaced at the end of their 5-year design life, have replaceable melter components (e.g., bubblers, thermocouples, glass level detectors) that have a design life of 6 months or 12 months. Review of melter operations and maintenance records at the time of component replacements form the basis for the assessment for the melters.

Operating history reviews is the only assessment method suitable for use on underground transfer lines and the analytical laboratory imbedded coaxial lines. Records of leak detections and confirmation of process chemistry conditions assures the integrity of these lines.

### 7.1.4 Static Liquid Volume Tests

Static liquid volume leak tests are made periodically to ensure that there is no leakage by demonstrating that a tank can maintain its liquid level over a period of time when fluid flow into and out of the tank is stopped. Static liquid tests are performed in accordance with procedures described in API 334 or equivalent guidance documents for tanks. Static liquid volume tests are not performed on the analytical laboratory RLD vessels because these vessels receive waste from floor drains and are, therefore, difficult to isolate.

Static liquid volume tests are conducted as part of the integrity assessment of the tank. For tanks considered to have a lower potential for corrosion and erosion, these tests are performed during routine or maintenance outages, within 10 years after start of hot commissioning, and subsequently, every 10 years during the life of the tank, unless observed conditions indicate more frequent assessments should be implemented.

For tanks considered to have a higher potential for corrosion and erosion, the tests are made during routine or maintenance outages, within 7 years after start of hot commissioning, and subsequently, every 7 years during the life of the tank, unless observed conditions indicate more frequent assessments should be implemented.

### 7.1.5 Non-Destructive Examinations

Pre-operational baseline NDE measurements are performed on regulated plant items before the initial receipt of dangerous waste as described in Section 2.3. Subsequent NDE measurements are conducted as part of the integrity assessments. The objective of the NDE measurements is to determine the remaining corrosion and erosion allowances of regulated plant items. Results of NDE measurements collected during future integrity assessments will be compared to the baseline NDE measurements to evaluate the structural integrity of equipment and to determine whether the schedule of future assessments should be adjusted. Thickness measurements allow for confirmation that the expected corrosion and erosion rates at the designed operating conditions and erosive conditions have not been exceeded and that the equipment-specific corrosion/erosion allowances continue to be adequate to maintain structural integrity for the design life.

NDE measurements are to be conducted as part of the integrity assessments for tanks and other regulated plant items designed to pressure vessel standards, for other miscellaneous units, for piping connected to regulated plant items, and for in-line components. Bulges containment and sumps do not receive dangerous waste unless there is a leak from a tank, miscellaneous unit, piping, or in-line component. For bulges containment and sumps, NDE measurements are to be conducted as part of the integrity assessments only when the operating history reviews indicate that a leak had traveled to and entered these

plant items. Operating history reviews is the only assessment method suitable for use on underground transfer lines.

Since the location (C5 cell - room A-B004) of the hot cell drain collection vessel (RLD-VSL-00165) and the C5 cell sump (RLD-SUMP-00042) is inaccessible, the integrity assessment of this tank and its associated sump is limited to the review of operating history in the same manner as for tanks and sumps in black cells in the PTF and HLW vitrification facility. The laboratory area sink drain collection vessel (RLD-VSL-00164) and its associated sump (RLD-SUMP-00041) have the same material of construction and similar wastes as RLD-VSL-00165 and RLD-SUMP-00042, respectively. Therefore, NDE measurements of RLD-VSL-00164 and RLD-SUMP-00042 are used as surrogates for NDE measurements of RLD-VSL-00165 and RLD-SUMP-00041, respectively. For regulated equipment in black cells in the PTF and HLW vitrification facility, Table 10 provides a summary of LAW vitrification equipment that can be used as possible surrogates for NDE measurements. The document "Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Pretreatment Facility and High-Level Waste Vitrification Facility" (24590-WTP-PER-M-08-002) provides additional details of integrity assessment for tanks, miscellaneous units, and sumps in black cells.

The integrity assessment thickness measurements are to be conducted at the same locations as the pre-operational baseline thickness measurements. By taking repeated measurements at the same points, the expected remaining corrosion and erosion allowances of the regulated plant items can be more accurately calculated. NDE measurement locations for welds or wall thicknesses are illustrated in Appendix B. These illustrations are provided as information becomes available.

Similar to the baseline thickness measurements, integrity assessment thickness measurements are made in accordance with written procedures implementing the requirements of ASTM E 797, Standard Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method. Section 9 of ASTM E 797 provides the requirements for developing a detailed written procedure.

### 7.1.6 Visual Examinations

Visual examinations (conducted with or without the assistance of CCTV) are conducted in accordance with written procedures that conform to the requirements of ASME Section V, Article 9. Visual examinations include:

- Evidence of excessive or uneven settlement of the tank foundation such as distortion and cracks around anchor bolts attaching a tank to an underlying foundation
- Rust, pitting, and other visual evidence of corrosion on the exterior of metal tanks and ancillary equipment, especially at grade level and connections
- Evidence of deterioration of exterior coatings such as rust spots and blisters
- Damage to any insulation being used
- Evidence of possible leaks around the tank or ancillary equipment such as discoloration of coatings
- Cracks or evidence of leaks at joints and welds, especially at connections
- Apparent loss of metal thickness on the tank bottom and sides
- Condition of tank system coatings and linings including cracks, gaps, swelling, blistering, and crinkling

Visual examinations of accessible piping include:

- Sufficient materials and components, selected at random, to satisfy the examiner that they are free from defects
- At least 5% of welds
- Random examination of threaded, bolted or other joints

A process and mechanical handling monitoring CCTV system provides for remote viewing of equipment and operations within specified cave areas and where the radiation levels are too high for personnel access. Cameras are located to give optimum viewing angles and distance to suit the process where required. Although CCTV cameras are placed for operational needs rather than to meet integrity assessment requirements, cameras used to monitor process functions can be used to inspect some regulated plant items. CCTV systems are not required in the analytical laboratory because visual access is not restricted. Within the LAW vitrification facility, CCTV systems are installed in the LAW melter cave and melter wet process cells.

## 7.2 Assessment Schedule

This section presents the integrity assessment schedule for the regulated plant items in the analytical laboratory and LAW vitrification facility.

### 7.2.1 Frequency of Assessments for Equipment with Lower Potential for Corrosion and Erosion

Assessment of equipment considered to have a lower potential for corrosion and erosion is made during routine or maintenance outages and within 10 years after start of hot commissioning at selected accessible points where baseline NDE measurements had been taken. Subsequent integrity assessments will be based on the results of previous integrity assessments, the age of the equipment, materials of construction, characteristics of the waste, and any other relevant factors, but will be no more than 10 years between integrity assessments. Ten years is considered long enough to detect anticipated normal corrosion and erosion, but short enough so that if there were significant unanticipated corrosion and erosion, adequate wall thickness would remain so that failure would be prevented and corrective actions could be taken, if required. Table 7 presents the schedule for conducting periodic assessments of regulated plant items located in the analytical laboratory and LAW vitrification facility.

### 7.2.2 Frequency of Assessments for Equipment with Higher Potential for Corrosion and Erosion

Assessment of equipment considered to have a higher potential for corrosion and erosion is made during routine or maintenance outages and within 7 years after hot commissioning at selected accessible points where baseline NDE measurements had been taken. Subsequent integrity assessments will be based on the results of previous integrity assessments, the age of the tank and miscellaneous unit system, materials of construction, characteristics of the waste, and any other relevant factors, but will be no more than 7 years between integrity assessments. Because of the potential for increased corrosion and erosion, 7 years is considered long enough to detect anticipated normal corrosion and erosion, but short enough so that if

there were significant unanticipated corrosion and erosion, adequate wall thickness would remain so that failure would be prevented and corrective actions could be taken, if required. The schedule for conducting periodic assessments of regulated plant items located in the analytical laboratory and LAW vitrification facility is provided in Table 7.

### 7.2.3 Potential Access Impacts on the Assessment Schedule

The two analytical laboratory tanks and the LAW vitrification facility CRVs, MFPVs, MFVs, plant wash vessel, and SBS condensate vessels are located in cells that are designated R5/C5 areas (high radiation/high contamination). Personnel access is not normally permitted to R5/C5 areas. However, as conditions allow, and subject to an approval process, the process cells may be downposted to permit access for offnormal conditions and/or equipment maintenance, or for integrity assessments. For example, for the LAW vitrification facility CRVs, downposting occurs after source term reduction by emptying and flushing the tanks and after contamination reduction in the cell.

## 7.3 Adjustment of Periods Between Assessments

Subsequent assessment intervals may be reduced based on abnormal events (e.g., seismic event resulting in the category III loads [as defined in Section 5 of 24590-WTP-3PS-FB01-T0001] and the design basis events for the analytical laboratory and LAW vitrification facility described in 24590-LAB-RPT-ENS-04-001 and 24590-LAW-RPT-ENS-03-001, respectively), process conditions, operating histories, routine inspection results, and expected remaining corrosion and erosion allowances of the regulated plant item. Adjustment of the period between assessments may be partially or wholly based on the inspection interval calculation(s) described in the last paragraph of Section 7.1.2 above.

## 7.4 Reporting

Upon completion of a periodic integrity assessment, a report of assessment results is prepared. The report of assessment results is reviewed and certified. The certification includes the following statement from WAC 173-303-810(13)(a): "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

The report of assessment results includes: an introduction describing the scope and objectives of the assessment; the methods used to conduct the assessment; the results of the assessment; and conclusions including recommendations regarding the time interval before the next integrity assessment.

Reports of the results of operating history reviews include the following information:

- Date of the examination
- Procedure and revision used
- Technique used
- Results of the examination

  - minimum
  - maximum
  - average
  - standard deviation
- Examination personnel identity and qualifications

The reports of results of static liquid volume tests include:

- Date of the examination
- Procedure and revision used
- Technique used
- Results of the examination
  - minimum
  - maximum
  - average
  - standard deviation
- Examination personnel identity and qualifications

Reports of the results of ultrasonic thickness testing include the following information:

- Date of the examination
- Examination procedure
- Type of instrument
- Standardization blocks, size and material type
- Size, frequency and type of search unit
- Scanning method
- Results
- Maximum and minimum thickness measurements
- Location of measurements
- Personnel data, certification level

The reports of results of visual (conducted with or without use of CCTV) examinations include:

- Date of the examination
- Procedure and revision used
- Technique used
- Results of the examination
- Examination personnel identity and qualifications

### 7.5 Contingency Action

If the integrity assessment program detects problems with a regulated plant item, the contingency plan will be followed. The contingency plan provides a detailed description of procedures that will be implemented for compliance with WAC 173-303-640(7) as required by Dangerous Waste Permit Condition III.10.C.6.b.

# 8 References for Applicable Codes and Regulations

10 CFR 835, Occupational Radiation Protection, Code of Federal Regulations, as amended

American Bearing Manufacturers Association (ABMA) Standard 7 - Shaft and Housing Fits for Metric Radial Ball and Roller Bearings

ABMA Standard 9 - Load Ratings and Fatigue Life for Ball Bearings

ABMA Standard 20 - Radial Bearings of Ball, Cylindrical Roller, and Spherical Roller Types Metric Design

American Institute of Steel Construction, Inc. (AISC) M016-89, Manual of Steel Construction

Air Movement and Control Association (AMCA) 201, Fans and Systems

AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

AMCA 300, Reverberant Room Methods for Sound Testing of Fans

American Petroleum Institute (API) 334, A Guide to Leak Detection for Aboveground Storage Tanks

API 610, Centrifugal Pumps for General Refinery Service

API 650, Welded Steel Tanks for Oil Storage

American Society of Mechanical Engineers (ASME) AG-1, Code on Nuclear Air and Gas Treatment

ASME B31.3-96, Process Piping

ASME B73.1, Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process

ASME B73.2, Specifications for Vertical In-Line Centrifugal Pumps for Chemical Process

ASME Section V, Nondestructive Examination

ASME Section VIII, Division 1, Pressure Vessels

ASME Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

ASME/American National Standards Institute (ANSI) Y14.5M, Dimensioning and Tolerancing

American Society for Nondestructive Testing, Inc. (SNT), Recommended Practice No. SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing

American Society for Testing and Materials (ASTM) A 276, Specification for Stainless Steel Bars and Shapes

ASTM A 802, Standard Practice for Steel Castings, Surface Acceptance Standards, Visual Examination

ASTM E 797, Standard Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method

Hydraulic Institute Standards (HI) 2.6, American National Standard for Vertical Pump Tests

National Electrical Manufacturers Association (NEMA) MG-1, Motors and Generators

Washington Administrative Code (WAC) 173-303, Dangerous Waste Regulations, as amended

**Table 1 Summary of Design Codes**

| Plant Item Name | Plant Item Number | Design Code |
|---|---|---|
| **Analytical Laboratory Tanks** | | |
| Laboratory Area Sink Drain Collection Vessel | RLD-VSL-00164 | ASME Section VIII Division 1 |
| Hot Cell Drain Collection Vessel | RLD-VSL-00165 | ASME Section VIII Division 1 |
| **Analytical Laboratory Sumps and Piping** | | |
| Sumps | RLD-SUMP-00041<br>RLD-SUMP-00042<br>RLD-SUMP-00043A/B<br>RLD-SUMP-00044<br>RLD-SUMP-00045 | AISC M016-89 |
| Piping | NA | ASME B31.3-96 |
| **Analytical Laboratory Pumps** | | |
| Pumps | RLD-PMP-00182A/B<br>RLD-PMP-00183A/B | ASME B73.1, B73.2 |
| **LAW Tanks** | | |
| Melter 1 Concentrate Receipt Vessel | LCP-VSL-00001 | ASME Section VIII Division 1 |
| Melter 2 Concentrate Receipt Vessel | LCP-VSL-00002 | ASME Section VIII Division 1 |
| Melter 1 Feed Preparation Vessel | LFP-VSL-00001 | ASME Section VIII Division 1 |
| Melter 1 Feed Vessel | LFP-VSL-00002 | ASME Section VIII Division 1 |
| Melter 2 Feed Preparation Vessel | LFP-VSL-00003 | ASME Section VIII Division 1 |
| Melter 2 Feed Vessel | LFP-VSL-00004 | ASME Section VIII Division 1 |
| Melter 1 SBS Condensate Vessel | LOP-VSL-00001 | ASME Section VIII Division 1 |
| Melter 2 SBS Condensate Vessel | LOP-VSL-00002 | ASME Section VIII Division 1 |
| LAW Caustic Collection Tank | LVP-TK-00001 | API 650 Appendices J and S (commercial grade) |
| Plant Wash Vessel | RLD-VSL-00003 | ASME Section VIII Division 1 |
| LAW C3/C5 Drains/Sump Collection Vessel | RLD-VSL-00004 | ASME Section VIII Division 1 |
| SBS Condensate Collection Vessel | RLD-VSL-00005 | ASME Section VIII Division 1 |
| **LAW Miscellaneous Units** | | |
| LAW Melter 1 | LMP-MLTR-00001 | NA |
| LAW Melter 2 | LMP-MLTR-00002 | NA |
| Melter 1 Primary Film Cooler | LOP-FCLR-00001 | ASME B31.3-96 |
| Melter 1 Secondary Film Cooler | LOP-FCLR-00002 | ASME B31.3-96 |
| Melter 2 Primary Film Cooler | LOP-FCLR-00003 | ASME B31.3-96 |
| Melter 2 Secondary Film Cooler | LOP-FCLR-00004 | ASME B31.3-96 |
| Melter 1 Submerged Bed Scrubber | LOP-SCB-00001 | ASME Section VIII Division 1 |
| Melter 2 Submerged Bed Scrubber | LOP-SCB-00002 | ASME Section VIII Division 1 |
| Melter 1 Wet Electrostatic Precipitator | LOP-WESP-00001 | ASME Section VIII Division 1 |
| Melter 2 Wet Electrostatic Precipitator | LOP-WESP-00002 | ASME Section VIII Division 1 |
| LAW Melter Offgas Caustic Scrubber | LVP-SCB-00001 | ASME Section VIII Division 1 |
| HEPA Filters | LVP-HEPA-00001A/B<br>LVP-HEPA-00002A/B<br>LVP-HEPA-00003A | ASME AG-1 |
| Selective Catalytic Oxidizer | LVP-SCO-00001 | ASME Section VIII Division 1 |
| Selective Catalytic Reduction Unit | LVP-SCR-00001 | ASME Section VIII Division 1 |

| Plant Item Name | Plant Item Number | Design Code |
|---|---|---|
| Electric Heaters | LVP-HTR-00001A/B<br>LVP-HTR-00002 | ASME Section VIII Division 1 |
| Heat Exchanger | LVP-HX-00001 | ASME Section VIII Division 1 |
| Offgas Mercury Adsorbers | LVP-ADBR-00001A/B | ASME AG-1<br>ASME Section VIII Division 1<br>(Housing) |
| Melter Offgas Exhausters | LVP-EXHR-00001A/B/C | ASME Section VIII Division 1 |
| **LAW Bulges, Sumps, and Piping** | | |
| Bulges | LCP-BULGE-00001<br>LCP-BULGE-00002<br>LCP-BULGE-00003<br>LFP-BULGE-00001<br>LFP-BULGE-00002<br>LOP-BULGE-00001<br>LOP-BULGE-00002<br>RLD-BULGE-00001<br>RLD-BULGE-00002<br>RLD-BULGE-00003<br>RLD-BULGE-00004 | AISC M016-89 |
| Sumps | RLD-SUMP-00028<br>RLD-SUMP-00029<br>RLD-SUMP-00030<br>RLD-SUMP-00031<br>RLD-SUMP-00032<br>RLD-SUMP-00035<br>RLD-SUMP-00036 | AISC M016-89 |
| Piping | NA | ASME B31.3-96 |
| **LAW Pumps** | | |
| Semi-Remote, Self-Priming Pumps | LCP-PMP-00001A/B<br>LCP-PMP-00002A/B | ASME Section IX<br>ABMA Std. 7, 9, and 20<br>ASME/ANSI Y14.5M<br>ASTM A 276 and A 802<br>HI 2.6, 2000<br>NEMA MG-1<br>(and other requirements specified in 24590-WTP-3PS-MPC0-T0008) |
| Semi-Remote, Cantilever Pumps | LFP-PMP-00001A/B<br>LFP-PMP-00002<br>LFP-PMP-00003A/B<br>LFP-PMP-00004<br>LOP-PMP-00001<br>LOP-PMP-00002<br>LOP-PMP-00004<br>LOP-PMP-00005<br>RLD-PMP-00001A/B<br>RLD-PMP-00003A/B | ASME Section IX<br>ABMA Std. 7, 9, and 20<br>ASME/ANSI Y14.5M<br>ASTM A 276 and A 802<br>HI 2.6, 2000<br>NEMA MG-1<br>(and other requirements specified in 24590-WTP-3PS-MPC0-T0008) |
| Centrifugal Pumps | RLD-PMP-00002A/B | API 610, 8th Edition |

| Plant Item Name | Plant Item Number | Design Code |
|---|---|---|
| Centrifugal Pumps | LOP-PMP-00003A/B<br>LOP-PMP-00006A/B<br>LVP-PMP-00002A/B<br>LVP-PMP-00003A/B | ASME B73.1, B73.2 |
| Submersible Pumps | RLD-PMP-00004<br>RLD-PMP-00025<br>RLD-PMP-00026<br>RLD-PMP-00027<br>RLD-PMP-00028 | manufacturer standard |

Acronyms:

ABMA – American Bearing Manufacturers Association
AISC – American Institute of Steel Construction, Inc.
ANSI – American National Standards Institute
API - American Petroleum Institute
ASME - American Society of Mechanical Engineers
ASTM – American Society for Testing and Materials
HEPA - high efficiency particulate air
HI – Hydraulic Institute Standards
LAW – low-activity waste
NA – not applicable
NEMA – National Electrical Manufacturers Association
SBS - submerged bed scrubber

**Table 2 Summary of Materials of Construction and Corrosion Allowances**

| Plant Item Number | Contents | Materials of Construction (UNS Number) | Corrosion and Erosion Allowances[1] |
|---|---|---|---|
| **Analytical Laboratory Tanks** | | | |
| RLD-VSL-00164 | radioactive liquid | 6% Mo alloy (N08367 or N08926) | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |
| RLD-VSL-00165 | radioactive liquid | 6% Mo alloy (N08367, N08925, or N08926) or better | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |
| **Analytical Laboratory Sumps** | | | |
| RLD-SUMP-00041<br>RLD-SUMP-00042 | radioactive liquid | 6% Mo alloy (N08367) | 0.040 inch |
| RLD-SUMP-00043A/B<br>RLD-SUMP-00044<br>RLD-SUMP-00045 | radioactive liquid | 304L (S30403) or higher (max 0.030% C; dual certified) | 0.040 inch |
| **Analytical Laboratory Piping** | | | |
| Systems with highly corrosive fluids in high active cells | radioactive liquid | 6% Mo alloy (N08367) | 0.0425 inch |
| Systems with less than 2% solids | radioactive liquid | 316L (S31603) | 0.040 inch |
| Coaxial piping carrier piping | radioactive liquid | Alloy C-22 (N06022) | 0.040 inch |
| **Analytical Laboratory Pumps** | | | |
| RLD-PMP-00182A/B<br>RLD-PMP-00183A/B | radioactive liquid | 316L (S31603) (max 0.030% C; dual certified[2]) | 0.040 inch (includes corrosion and erosion allowances) |
| **LAW Tanks** | | | |
| LCP-VSL-00001<br>LCP-VSL-00002 | LAW concentrate feed | 316L (S31603) | 0.040 inch (includes 0.024 inch corrosion allowance and 0.016 inch erosion allowance) |
| LFP-VSL-00001<br>LFP-VSL-00002<br>LFP-VSL-00003<br>LFP-VSL-00004 | LAW melter feed | vessel: 316L (S31603) (max 0.030% C; dual certified)<br>agitator: Stellite 712, or equivalent | 0.040 inch (no erosion allowance specified); 0.125 inch required on bottom head and shell (includes erosion and corrosion allowances) |
| LOP-VSL-00001<br>LOP-VSL-00002 | SBS condensate | Alloy C-22 (N06022) | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |
| LVP-TK-00001 | scrubber solution (caustic) | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |
| RLD-VSL-00003 | wash/drain effluent | body: 6% Mo alloy (N08367/N08926)<br>top head: 316 (max 0.030% C; dual certified) | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |

| Plant Item Number | Contents | Materials of Construction (UNS Number) | Corrosion and Erosion Allowances[1] |
|---|---|---|---|
| RLD-VSL-00004 | radioactive liquid | 316L (S31603) (max 0.030% C; dual certified); bottom head clad with 0.1 in of Inconel 625 (N06625) or better | 0.040 inch (includes 0.024 inch corrosion allowance and 0.016 inch erosion allowance) |
| RLD-VSL-00005 | SBS condensate | body: 6% Mo alloy (N08367/N08926)<br>top head: 316 (max 0.030% C; dual certified) | 0.040 inch |
| **LAW Miscellaneous Units** | | | |
| LMP-MLTR-00001<br>LMP-MLTR-00002 | pretreated low-activity waste concentrate combined with glass formers and sucrose | glass pool: Monofrax refractory bricks: 30% chrome oxide/60% alumina and 80% chrome oxide<br>plenum: Monofrax refractory bricks: approximately 100% alumina<br>outer wall: alumina-zirconia-silica bonded brick | refractory corrosion rates, based on pilot melter and lab-scale testing, are accounted for in the melter designs |
| LOP-FCLR-00001<br>LOP-FCLR-00002<br>LOP-FCLR-00003<br>LOP-FCLR-00004 | LAW melter offgas | Inconel 690 (N06690) | none required |
| LOP-SCB-00001<br>LOP-SCB-00002 | radioactive liquid | Hastelloy C-22 (N06022) or equivalent; packing is ceramic | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |
| LOP-WESP-00001<br>LOP-WESP-00002 | LAW melter offgas (post SCB) | 6% Mo alloy (N08367) | 0.040 inch |
| LVP-SCB-00001 | LAW melter offgas (post SCO, SCR) | 316L (S31603) (max 0.030% C; dual certified)<br>Nozzles: N01 - Hastelloy C-276 (N10276) or Hastelloy C-22 (N06022) or 316L clad internally with Hastelloy C-276 or Hastelloy C-22<br>N06/N07 - Hastelloy C-276 or Hastelloy C-22 unless replaceable<br>Interior, including nozzles (and any associated internal pipe): Hastelloy C-276 or Hastelloy C-22 or clad with Hastelloy C-276 or Hastelloy C-22 where temperatures are in excess of 200°F. | 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance) |
| LVP-HEPA-00001A/B<br>LVP-HEPA-00002A/B<br>LVP-HEPA-00003A | LAW melter primary offgas | vendor package; 316L (S31603) for housing | NA |
| LVP-SCO-00001 | LAW melter offgas (post | platinum-based material deposited on a metal monolith | 0.010 inch |

| Plant Item Number | Contents | Materials of Construction (UNS Number) | Corrosion and Erosion Allowances[1] |
|---|---|---|---|
| | ADBR) | Housing: 316L (S31603) | |
| LVP-SCR-00001 | LAW melter offgas (post ADBR) | titanium oxide-based material deposited on a metal monolith<br>Fluid side shell components; ammonia piping and spray: 316L (S31603) (max 0.030% C; dual certified)<br>Frame and instrument housings: 347 (S34700) or Inconel 960 (N06690)<br>Structural support not in contact with offgas stream: 304L (S30403) (max 0.030% C; dual certified) | 0.010 inch |
| LVP-HTR-00001A/B | LAW melter primary offgas | 316L (S31603) (max 0.030% C; dual certified) | none required |
| LVP-HTR-00002 | LAW melter offgas (post ADBR) | Housing: 316L (S31603) (max 0.030% C; dual certified)<br>Heating elements and enclosure: Incoloy 800/825 (N08800/N08825)<br>Hi-temp surfaces: 347 (S34700) or Inconel 600/690 (N06600/N06900) | 0.010 inch |
| LVP-HX-00001 | LAW melter offgas (post ADBR) | hot side components and plates: 347 (S34700) or heat-resistant nickel-base alloy<br>cold-side components and enclosure: 316L (S31603) (max 0.030% C; dual certified) | 0.010 inch (not required for plates) |
| LVP-ADBR-00001A/B | LAW melter offgas (post HTR, HEPA, EXHR) | 316L (S31603) (max 0.030% C; dual certified) | none required |
| LVP-EXHR-00001A/B/C | LAW melter primary offgas | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| **LAW Bulges** | | | |
| LCP-BULGE-00001<br>LCP-BULGE-00002<br>LCP-BULGE-00003 | LAW concentrate feed | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| LFP-BULGE-00001<br>LFP-BULGE-00002 | LAW melter feed | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| LOP-BULGE-00001<br>LOP-BULGE-00002 | scrubber solution (caustic) | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| RLD-BULGE-00001<br>RLD-BULGE-00002<br>RLD-BULGE-00003<br>RLD-BULGE-00004 | radioactive liquid | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |

| Plant Item Number | Contents | Materials of Construction (UNS Number) | Corrosion and Erosion Allowances[1] |
|---|---|---|---|
| **LAW Sumps** | | | |
| RLD-SUMP-00028 | radioactive liquid | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| RLD-SUMP-00029<br>RLD-SUMP-00030<br>RLD-SUMP-00031<br>RLD-SUMP-00032<br>RLD-SUMP-00035<br>RLD-SUMP-00036 | radioactive liquid | 6% Mo alloy (N08367) | 0.040 inch |
| **LAW Piping** | | | |
| Systems with less than 2% solids | LAW condensate | Alloy C-22 (N06022) | 0.040 inch |
| Systems with less than 2% solids | scrubber solution (caustic) | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| Systems with less than 2% solids | wash/drain effluent | 6% Mo alloy (N08367/N08926) | 0.040 inch |
| Systems with less than 2% solids | radioactive liquid | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| Systems with more than 2% solids | LAW concentrate feed | 316L (S31603) | 0.0937 inch |
| Systems with glass formers | LAW melter feed | 316L (S31603) | 0.125 inch |
| LOP off-gas piping (downstream of film coolers to SBS) | LAW melter off-gas | Piping: Alloy 625 (N06625) or Alloy 690 (N06690)<br>Bellows: Alloy 635LCF | none required |
| **LAW Pumps** | | | |
| LCP-PMP-00001A/B<br>LCP-PMP-00002A/B | LAW concentrate feed | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| LFP-PMP-00001A/B<br>LFP-PMP-00002<br>LFP-PMP-00003A/B<br>LFP-PMP-00004 | LAW melter feed | 316L (S31603) (max 0.030% C; dual certified) | 0.040 inch |
| LOP-PMP-00001<br>LOP-PMP-00002<br>LOP-PMP-00004<br>LOP-PMP-00005 | SBS condensate | 6% Mo alloy (N08367) | 0.040 inch |
| LOP-PMP-00003A/B<br>LOP-PMP-00006A/B | SBS solution | 6% Mo alloy (N08367) | 0.040 inch |
| LVP-PMP-00002A/B<br>LVP-PMP-00003A/B | caustic scrubbing solution | 316L (S31603) | 0.040 inch |
| RLD-PMP-00001A/B<br>RLD-PMP-00002A/B<br>RLD-PMP-00003A/B | radioactive liquid | 6% Mo alloy (N08367) | 0.040 inch |

| Plant Item Number | Contents | Materials of Construction (UNS Number) | Corrosion and Erosion Allowances[1] |
|---|---|---|---|
| RLD-PMP-00004<br>RLD-PMP-00025<br>RLD-PMP-00026<br>RLD-PMP-00027<br>RLD-PMP-00028 | radioactive liquid | 316L (S31603) | manufacturer standard |

Notes:

[1] See Appendix A for list of applicable Corrosion Evaluation Reports/Material Selection Data Sheets for DWP-regulated plant items. The corrosion allowance listed includes the erosion allowance.

[2] dual certified = meets the mechanical and chemical requirements of more than one type of steel; e.g., has chemical and mechanical properties complying with both Type 316 and Type 316L, or both Type 304 and Type 304L, specifications. This ensures higher strength material with the chemical composition of the low carbon levels.

Acronyms:

ADBR - offgas mercury adsorbers
C - carbon
°F - degrees Fahrenheit
HEPA - high efficiency particulate air
HTR - heater
EXHR - exhauster
LAW – low-activity waste
Mo - molybdenum
% - percent
SBS - submerged bed scrubber
SCB - scrubber
SCO - selective catalytic oxidizer
SCR - selective catalytic reducer
UNS - unified numbering system

**Table 3 Materials of Construction Specification and Corrosion Potentials**

| Material | UNS Number Specification | Corrosion Potential | Applicable Plant Item Number |
|---|---|---|---|
| **Metals** | | | |
| Stainless steel 304L | S30403 | more resistant to corrosion in nitric acid, if no chlorides are present, than 316L and less prone to stress corrosion cracking than its higher carbon version (stainless steel 304) | LVP-SCR-00001 (structural support not in contact with offgas stream)<br>RLD-SUMP-00043A/B<br>RLD-SUMP-00044<br>RLD-SUMP-00045 |
| Stainless steel 316L | S31603 | more resistant to pitting corrosion, stress corrosion cracking, and crevice corrosion than its higher carbon version (stainless steel 316) | General piping<br>RLD-PMP-00182A/B<br>RLD-PMP-00183A/B<br>LCP-VSL-00001<br>LCP-VSL-00002<br>LFP-VSL-00001<br>LFP-VSL-00002<br>LFP-VSL-00003<br>LFP-VSL-00004<br>LVP-TK-00001<br>RLD-VSL-00004<br>LVP-SCB-00001<br>LVP-HTR-00001A/B<br>LVP-HTR-00002<br>LVP-HX-00001<br>LVP-ADBR-00001A/B<br>LVP-SCO-00001 (housing)<br>LVP-SCR-00001 (fluid side shell components; ammonia piping and spray)<br>LVP-EXHR-00001A/B/C<br>LVP-HEPA-00001A/B, 00002A/B, 00003A (housing only)<br>RLD-SUMP-00028<br>Bulges<br>LCP-PMP-00001A/B<br>LCP-PMP-00002A/B<br>LFP-PMP-00001A/B<br>LFP-PMP-00002<br>LFP-PMP-00003A/B<br>LFP-PMP-00004<br>LVP-PMP-00002A/B<br>LVP-PMP-00003A/B<br>RLD-PMP-00004<br>RLD-PMP-00025<br>RLD-PMP-00026<br>RLD-PMP-00027<br>RLD-PMP-00028 |

| Material | UNS Number Specification | Corrosion Potential | Applicable Plant Item Number |
|---|---|---|---|
| Stainless steel 347 | S34700 | suitable for high temperature applications where 316L is precluded and dry-air conditions are not conducive to general corrosion | LVP-SCR-00001 (frame and instrument housings)<br>LVP-HX-00001 (high temperature surfaces) |
| 6% Mo alloy | N08367<br>N08925<br>N08926 | more resistant to acids and chlorides than the 300 series stainless steels | Piping for highly corrosive fluids<br>RLD-VSL-00164<br>RLD-VSL-00165<br>RLD-VSL-00003<br>RLD-VSL-00005<br>LOP-WESP-00001<br>LOP-WESP-00002<br>RLD-SUMP-00029<br>RLD-SUMP-00030<br>RLD-SUMP-00031<br>RLD-SUMP-00032<br>RLD-SUMP-00035<br>RLD-SUMP-00036<br>RLD-SUMP-00041<br>RLD-SUMP-00042<br>LOP-PMP-00001<br>LOP-PMP-00002<br>LOP-PMP-00004<br>LOP-PMP-00005<br>LOP-PMP-00003A/B<br>LOP-PMP-00006A/B<br>RLD-PMP-00001A/B<br>RLD-PMP-00002A/B<br>RLD-PMP-00003A/B |
| Alloy 22 or Hastelloy C-22 – Ni-Cr-Mo alloy | N06022 | more resistant to acids and chlorides than the 300 series stainless steels or 6% Mo alloy | LOP-VSL-00001<br>LOP-VSL-00002<br>LOP-SCB-00001<br>LOP-SCB-00002 |
| Hastelloy C-276 or equivalent – Ni-Mo-Cr-W alloy | N10276 | more resistant to acids and chlorides than the 300 series stainless steels | LVP-SCB-00001 (interior and nozzles) |
| Incoloy 800 – Ni-Cr alloy | N08800 | excellent resistance to oxidation and carburization; maintains stable structure during exposure to high temperatures; good corrosion resistance to many acidic environments | LVP-HTR-00002 (heating elements) |
| Incoloy 825 – Ni-Fe-Cr with additions of Mo, Cu, and Ti | N08825 | exceptional resistance to many aggressive corrosion environments | LVP-HTR-00002 (heating elements) |

| Material | UNS Number Specification | Corrosion Potential | Applicable Plant Item Number |
|---|---|---|---|
| Inconel 600 (Alloy 600) – Ni-Cr-Fe alloy | N06600 | good oxidation resistance at high temperatures and resistance to chloride ion stress corrosion cracking, corrosion by high-purity water, and caustic corrosion | LVP-HTR-00002 (hi-temp surfaces) |
| Inconel 690 (Alloy 690) – Ni-Cr alloy | N06900 | very resistant to attack from oxidizing chemicals or hot gases | LOP piping between film coolers and SBSs<br>LVP-SCR-00001 (frame and instrument housings)<br>LVP-HTR-00002 (high temperature surfaces)<br>LOP piping between film coolers and SBSs |
| Inconel 625 – Ni-Cr-Mo alloy | N06625 | excellent corrosion resistance to many acids and resists intergranular attack and stress corrosion cracking | LOP-FCLR-00001<br>LOP-FCLR-00002<br>LOP-FCLR-00003<br>LOP-FCLR-00004<br>LOP piping between film coolers and SBSs |
| Stellite 712 – cobalt-based alloy | None available | high corrosion resistance in reducing environments, as well as enhanced wear resistance | LFP-AGT-00001<br>LFP-AGT-00002<br>LFP-AGT-00003<br>LFP-AGT-00004 |

Acronyms:

Cr - chromium
Cu - copper
°F - degrees Fahrenheit
Fe - iron
Mo - molybdenum
Ni - nickel
% - percent
SBS - submerged bed scrubber
Ti - titanium
UNS - unified numbering system
W - tungsten

**Table 4 Radiological Area Classification Based on Dose Rate**

| Classification | Target Dose Equivalent Rate (mrem/hr) for Wide-Spread and Static Radiation Fields (Note 1) | Maximum Dose Equivalent Rate (mrem/hr) (see Notes 2 and 3) | Type of Access Control |
|---|---|---|---|
| R1 Radiological Controlled Area | 0.025 | 0.050 | General Employee Radiological Training (GERT) required to access. |
| R2 Radiological Buffer Area | 0.250 | 0.500 | No limit on occupancy for general employees. A TLD and Rad Worker I training required for entry. |
| R3 (Average Radiation Area) | See Note 1 | 10 | Entry only to carry out prescribed tasks in accordance with normal procedures and a Radiation Work Permit. TLD and Rad Worker I training required for entry into Radiation Areas. |
| R4 (Maximum Radiation Area) | See Note 1 | 100 | Entry only to carry out prescribed tasks in accordance with normal procedures and a Radiation Work Permit. TLD and Rad Worker I training required for entry into Radiation Areas. |
| R5 (High and Very High Radiation Area) | See Note 4 | no specific limit | Normally locked. Entry is unusual and requires management approval. Supplemental dosimetry, a specific RWP, and approved procedures are also required. |

Notes:

1. Occupational doses, and therefore, selection of an appropriate dose rate criterion is very sensitive to occupancy in R3, R4, and R5 areas. Hence, rather than set a specific dose rate target for any of these classifications, the appropriate value should be derived for each individual area by considering the respective contributions to the workers' annual doses and applying the ALARA principle. At early design stages, when insufficient information is available regarding worker occupancy, initial target radiation levels of 2.5 mrem/hr and 25 mrem/hr are to be used for the R3 and R4 classifications, respectively. However, these initial values should be reviewed and adjusted as appropriate, when sufficient occupancy data is available.
2. These maximum dose equivalent rate limits are set based on static whole-body radiation fields. Higher dose equivalent rates may be accepted for transient radiation fields (such as source movements), and for localized radiation fields (such as beams) that are unlikely to produce whole-body exposure, subject to an appropriate justification of the effect on annual dose and ALARA.
3. Notwithstanding the above dose rate equivalent targets and maximums, all radiation levels shall be within prescribed limits and ALARA.
4. When entry to an area that has been classified R5 is intended or anticipated by the design (frequency > 0.1[yr-1]), the design process is obligated to identify the means by which the dose rates in the affected area may be reduced to levels that are R3/R4 (less than 100 mrem/hr) prior to the entry. In any case, entry to all radiation areas is ALARA.

Acronyms:

ALARA - as low as reasonably achievable
mrem/hr - millirems per hour
RWP - radiological work permit
TLD - thermoluminescent dosimetry

**Table 5 Radiological Area Classification Based on Contamination**

| Classification | Typical Type of Control (see Note 1) | Surface Contamination Limit (dpm/100 cm2) (see Note 2) β/γ | Mean Airborne Contamination (Fraction of Exposure Standard; see Note 3) | Description |
|---|---|---|---|---|
| Cl Radiological Controlled Area | GERT | <1,000 | N/A | The C1 area means any area to which access is managed by or for DOE to protect individuals from exposure to radiation and/or radioactive material. For the WTP project, this includes all areas within the site security fence not assigned a higher radiological classification. The C1 area has low potential to be contaminated because there are no direct interfaces with contaminated areas. C1 areas are typically administrative offices, control rooms, conference rooms, locker rooms, restrooms, equipment rooms, truck bays, and non-contiguous support facilities. |
| C2 Radiological Buffer Area | Equipment and personnel are confirmed to be uncontaminated before exit to the uncontrolled C1 area is permitted. C2 areas may not be ventilated directly to the atmosphere. A TLD and Rad Worker I training are required for entry. | <1,000 | N/A | C2 areas are operating areas of the process buildings. C2 areas have direct interfaces with contaminated areas, and have the potential to be contaminated.<br><br>C2 contamination surveys are performed regularly with frequencies as determined by facility trends. |
| C3 Contamination Area | Work in a contaminated area requires protective clothing, a single set of coveralls, canvas booties, rubber shoe covers, appropriate gloves, and head covering. A TLD and Radworker II training are both required for entry. Respiratory protection may, on occasion, be required for specific tasks, but would not normally exceed the requirements for a full-face | ≥ 1,000 but <100,000 | < 40 DAC - hr year | C3 areas are the process areas where the potential for direct contact with radioactive material, contaminated systems and components, or both, exists.<br><br>These areas include the following: |

| Classification | Typical Type of Control (see Note 1) | Surface Contamination Limit (dpm/100 cm2) (see Note 2) β/γ | Mean Airborne Contamination (Fraction of Exposure Standard; see Note 3) | Description |
|---|---|---|---|---|
| | particulate respirator. The interface between a contamination area and the surrounding buffer area is typically a physical barrier; however, there will be maintenance evolutions requiring the temporary posting of contamination areas without the presence of a physical barrier (e.g., areas surrounding filter housings during filter changeout). | | | • maintenance shops<br>• laboratory fume hoods<br>• Cask handling areas<br>• sampling suites<br>• Contact areas where breaking of containment is possible |
| C4 High Contamination Area (Note 4, Note 5) | Work in high contamination areas may require a double set of protective clothing and a multiple step-off pad exit configuration. Table 3-1 of 24590-WTP-MN-ESH-01-001, Waste Treatment Plant Radiological Control Manual, provides guidelines for selecting protective clothing and indicates double sets of protective clothing are selected based on the contamination level in the work area, the anticipated work activity, worker health considerations, and regard for nonradiological hazards that may be present. As indicated in Table 3-1, routine work in high contamination areas may not warrant a double set of protective clothing. Respiratory protection may be required on occasion for specific tasks, but would not normally exceed the requirements for a full-face particulate respirator. High contamination areas should be controlled through use of physical barriers, engineering controls, and/or containment devices, as appropriate, in accordance with Article 337 of 24590-WTP-MN-ESH-01-001, Waste Treatment Plant Radiological Control Manual. | ≥ 100,000 but < ≈ 500,000 | > 40 DAC-hr year but < 12 DAC-hr week or < 1 DAC | C4 areas are highly contaminated as a result of the breaching large, highly contaminated systems or components when use of a glove bag is impractical. |

| Classification | Typical Type of Control (see Note 1) | Surface Contamination Limit (dpm/100 cm2) (see Note 2) β/γ | Mean Airborne Contamination (Fraction of Exposure Standard; see Note 3) | Description |
|---|---|---|---|---|
| C5 Airborne Radioactivity Area | Access to C5 areas is not normally permitted. When access is required, protective clothing for these areas includes high-integrity clothing (plastic suit), and supplied air respirators.<br><br>Exiting into a contaminated area (C5 → C4, C3) requires removing the outer layer of protective clothing.<br><br>ARAs are normally accessed through a permanent or temporary containment structure (tent) provided with its own filtered exhaust. Because entry to an ARA requires the use of respirators, no personnel may perform routine or periodic work within an ARA. | ≥ ≈ 500,000 | >12 DAC-hr week<br>or<br>> 1 DAC | C5 areas are highly contaminated areas that require total enclosure to ensure contamination control. |

Notes:

1. The type of control listed in this column is subject to local variation and is defined by 24590-WTP-MN-ESH-01-001, Waste Treatment Plant Radiological Control Manual, and specified on the RWP. Control regimes shown are expected to be typical.
2. Values shown are for β/γ contamination only. Additional, radionuclide specific limits are provided in Appendix D to 10 CFR 835, Occupational Radiation Protection.
3. Exposure standards are those of Safety Criterion 2.0-1 of 24590-WTP-SRD-ESH-01-001-02 to the worker for normal events. The breathing zone levels of airborne contamination are order-of-magnitude estimates of long-term requirements. Maximum transient values of airborne contamination may be higher.
4. Use of additional controls and respiratory protection must be evaluated when working in areas or on equipment with removable contamination levels greater than 100,000 dpm/100 $cm^2$.
5. The C4 designation is not used at WTP.

Acronyms:

ALARA - as low as reasonably achievable
ARA - Airborne Radioactivity Area
β - beta
CFR – Code of Federal Regulations
cm - centimeter
DAC - derived air concentration
DOE – United States Department of Energy
dpm – disintegrations per minute
γ - gamma
GERT - General Employee Radiological Training
hr - hour
mrem/hr - millirems per hour
N/A – not applicable
RWP - radiological work permit
TLD - thermoluminescent dosimetry
WTP - Hanford Tank Waste Treatment and Immobilization Plant

**Table 6 Summary of Radiological Area Classifications**

| Plant Item Name | Plant Item Number | Radiological Area Classification[1] |
|---|---|---|
| **Analytical Laboratory Tanks** | | |
| Laboratory Area Sink Drain Collection Vessel | RLD-VSL-00164 | R4/C5 |
| Hot Cell Drain Collection Vessel | RLD-VSL-00165 | R5/C5 |
| **Analytical Laboratory Sumps** | | |
| C3 Cell Sump | RLD-SUMP-00041 | R4/C5 |
| C5 Cell Sump | RLD-SUMP-00042 | R5/C5 |
| C5 Pump Pit Pumps and Sumps | RLD-PMP-00183A/B<br>RLD-SUMP-00043A/B | R3/R4/C3 |
| C5 Piping Pit Sump | RLD-SUMP-00044 | R3/R4/C3 |
| C3 Pump Pit Pumps and Sump | RLD-PMP-00182A/B<br>RLD-SUMP-00045 | R3/C3 |
| **LAW Tanks** | | |
| Melter 1 Concentrate Receipt Vessel | LCP-VSL-00001 | R5/C5 |
| Melter 2 Concentrate Receipt Vessel | LCP-VSL-00002 | R5/C5 |
| Melter 1 Feed Preparation Vessel | LFP-VSL-00001 | R5/C5 |
| Melter 1 Feed Vessel | LFP-VSL-00002 | R5/C5 |
| Melter 2 Feed Preparation Vessel | LFP-VSL-00003 | R5/C5 |
| Melter 2 Feed Vessel | LFP-VSL-00004 | R5/C5 |
| Melter 1 SBS Condensate Vessel | LOP-VSL-00001 | R5/C5 |
| Melter 2 SBS Condensate Vessel | LOP-VSL-00002 | R5/C5 |
| LAW Caustic Collection Tank | LVP-TK-00001 | R2/C2 |
| Plant Wash Vessel | RLD-VSL-00003 | R5/C5 |
| LAW C3/C5 Drains/Sump Collection Vessel | RLD-VSL-00004 | R3/C5 |
| SBS Condensate Collection Vessel | RLD-VSL-00005 | R5/C5 |
| **LAW Miscellaneous Units** | | |
| LAW Melter 1 | LMP-MLTR-00001 | R3/C3/C2 |
| LAW Melter 2 | LMP-MLTR-00002 | R3/C3/C2 |
| Melter 1 Primary Film Cooler | LOP-FCLR-00001 | R3/C3/C2 |
| Melter 1 Secondary Film Cooler | LOP-FCLR-00002 | R3/C3/C2 |
| Melter 2 Primary Film Cooler | LOP-FCLR-00003 | R3/C3/C2 |
| Melter 2 Secondary Film Cooler | LOP-FCLR-00004 | R3/C3/C2 |
| Melter 1 Submerged Bed Scrubber | LOP-SCB-00001 | R5/C5 |
| Melter 2 Submerged Bed Scrubber | LOP-SCB-00002 | R5/C5 |
| Melter 1 Wet Electrostatic Precipitator | LOP-WESP-00001 | R5/C5 |
| Melter 2 Wet Electrostatic Precipitator | LOP-WESP-00002 | R5/C5 |
| LAW Melter Offgas Caustic Scrubber | LVP-SCB-00001 | R3/C3 |
| HEPA Filters | LVP-HEPA-00001A/B<br>LVP-HEPA-00002A/B<br>LVP-HEPA-00003A | R3/C3 |
| Selective Catalytic Oxidizer | LVP-SCO-00001 | R3/C3 |
| Selective Catalytic Reduction Unit | LVP-SCR-00001 | R3/C3 |
| Electric Heaters | LVP-HTR-00001A/B<br>LVP-HTR-00002 | R3/C3 |
| Heat Exchanger | LVP-HX-00001 | R3/C3 |
| Offgas Mercury Adsorbers | LVP-ADBR-00001A/B | R3/C3 |
| Melter Offgas Exhausters | LVP-EXHR-00001A/B/C | R3/C3 |

| Plant Item Name | Plant Item Number | Radiological Area Classification[1] |
|---|---|---|
| **LAW Process Pumps** | | |
| Concentrate Receipt Vessel Pumps | LCP-PMP-00001A/B<br>LCP-PMP-00002A/B | R5/C5 |
| Melter Feed Preparation Vessel Pumps | LFP-PMP-00001A/B<br>LFP-PMP-00003A/B | R5/C5 |
| Melter Feed Vessel Pumps | LFP-PMP-00002<br>LFP-PMP-00004 | R5/C5 |
| Melter SBS Water Purge Pumps | LOP-PMP-00003A/B<br>LOP-PMP-00006A/B | R5/C5 |
| Melter SBS Condensate Purge Pumps | LOP-PMP-00001<br>LOP-PMP-00002<br>LOP-PMP-00004<br>LOP-PMP-00005 | R5/C5 |
| Caustic Blowdown Transfer Pump<br>Caustic Scrubbing Solution Recirculation Pump | LVP-PMP-00002A/B<br>LVP-PMP-00003A/B | R2/C2 |
| Plant Wash Discharge Pumps | RLD-PMP-00001A/B | R5/C5 |
| C3/C5 Drains/Sump Collection Transfer Pumps | RLD-PMP-00002A/B | R3/C3 |
| SBS Condensate Collection Discharge Pumps | RLD-PMP-00003A/B | R5/C5 |
| **LAW Bulges and Sumps** | | |
| Concentrate Receipt Valve Bulges | LCP-BULGE-00001<br>LCP-BULGE-00002<br>LCP-BULGE-00003 | R3/C3 |
| Melters 1 and 2 Feed/Preparation Valve Bulges | LFP-BULGE-00001<br>LFP-BULGE-00002 | R3/C3 |
| Melters 1 and 2 Valve Bulges | LOP-BULGE-00001<br>LOP-BULGE-00002 | R3/C3 |
| C3/C5 Pump Bulge | RLD-BULGE-00001 | R3/C3 |
| Plant Wash/SBS Condensate Collection Vessel Valve Bulge | RLD-BULGE-00004 | R3/C3 |
| Melter 1 Process Cell Pumps and Sumps | RLD-PMP-00025<br>RLD-PMP-00026<br>RLD-SUMP-00029<br>RLD-SUMP-00030 | R5/C5 |
| Melter 2 Process Cell Pumps and Sumps | RLD-PMP-00027<br>RLD-PMP-00028<br>RLD-SUMP-00031<br>RLD-SUMP-00032 | R5/C5 |
| Effluent Cell Pumps and Sumps | RLD-PMP-00031<br>RLD-PMP-00032<br>RLD-SUMP-00035<br>RLD-SUMP-00036 | R5/C5 |
| C3/C5 Drains Collection Cell Pump and Sump | RLD-PMP-00004<br>RLD-SUMP-00028 | R3/C5 |

Note:

[1] Regulated plant items are accessible except for the hot cell drain collection vessel (RLD-VSL-00165) and sump (RLD-SUMP-00042) in the analytical laboratory.

Acronyms:

HEPA - high efficiency particulate air
LAW – low-activity waste
SBS - submerged bed scrubber

**Table 7 Assessment Schedule**

| Plant Item Name | Plant Item Number | Lower Potential for Corrosion and Erosion | Higher Potential for Corrosion and Erosion | Assessment Schedule[1] |
|---|---|---|---|---|
| **Analytical Laboratory Tanks** | | | | |
| Laboratory Area Sink Drain Collection Vessel | RLD-VSL-00164 | X | | 10 years[2] |
| Hot Cell Drain Collection Vessel[3] | RLD-VSL-00165 | X | | 10 years[2] |
| **Analytical Laboratory Sumps** | | | | |
| C3 Cell Sump | RLD-SUMP-00041 | X | | 10 years[2] |
| C5 Cell Sump[4] | RLD-SUMP-00042 | X | | 10 years[2] |
| C5 Pump Pit Sumps | RLD-SUMP-00043A/B | X | | 10 years[2] |
| C5 Piping Pit Sump | RLD-SUMP-00044 | X | | 10 years[2] |
| C3 Pump Pit Sump | RLD-SUMP-00045 | X | | 10 years[2] |
| **LAW Tanks** | | | | |
| Melter 1 Concentrate Receipt Vessel | LCP-VSL-00001 | | X | 7 years[5] |
| Melter 2 Concentrate Receipt Vessel | LCP-VSL-00002 | | X | 7 years[5] |
| Melter 1 Feed Preparation Vessel | LFP-VSL-00001 | | X | 7 years[5] |
| Melter 1 Feed Vessel | LFP-VSL-00002 | | X | 7 years[5] |
| Melter 2 Feed Preparation Vessel | LFP-VSL-00003 | | X | 7 years[4] |
| Melter 2 Feed Vessel | LFP-VSL-00004 | | X | 7 years[5] |
| Melter 1 SBS Condensate Vessel | LOP-VSL-00001 | X | | 7 years[5,6] |
| Melter 2 SBS Condensate Vessel | LOP-VSL-00002 | X | | 7 years[5,6] |
| LAW Caustic Collection Tank | LVP-TK-00001 | X | | 7 years[5,6] |
| Plant Wash Vessel | RLD-VSL-00003 | X | | 10 years[2] |
| LAW C3/C5 Drains/Sump Collection Vessel | RLD-VSL-00004 | X | | 7 years[5,6] |
| SBS Condensate Collection Vessel | RLD-VSL-00005 | X | | 7 years[5,6] |
| **LAW Miscellaneous Units** | | | | |
| LAW Melter 1 | LMP-MLTR-00001 | NA | NA | NA[7] |
| LAW Melter 2 | LMP-MLTR-00002 | NA | NA | NA[7] |
| Melter 1 Primary Film Cooler | LOP-FCLR-00001 | NA | NA | NA[7] |
| Melter 1 Secondary Film Cooler | LOP-FCLR-00002 | NA | NA | NA[7] |
| Melter 2 Primary Film Cooler | LOP-FCLR-00003 | NA | NA | NA[7] |
| Melter 2 Secondary Film Cooler | LOP-FCLR-00004 | NA | NA | NA[7] |
| Melter 1 Submerged Bed Scrubber | LOP-SCB-00001 | X | | 10 years[2] |

| Plant Item Name | Plant Item Number | Lower Potential for Corrosion and Erosion | Higher Potential for Corrosion and Erosion | Assessment Schedule[1] |
|---|---|---|---|---|
| Melter 2 Submerged Bed Scrubber | LOP-SCB-00002 | X | | 10 years[2] |
| Melter 1 Wet Electrostatic Precipitator | LOP-WESP-00001 | X | | Housing: 10 years[2] |
| Melter 2 Wet Electrostatic Precipitator | LOP-WESP-00002 | X | | Housing: 10 years[2] |
| LAW Melter Offgas Caustic Scrubber | LVP-SCB-00001 | X | | 10 years[2] |
| HEPA Filters | LVP-HEPA-00001A/B<br>LVP-HEPA-00002A/B<br>LVP-HEPA-00003A | X | | 5-year design life for filters; Housing: 10 years[2] |
| Selective Catalytic Oxidizer | LVP-SCO-00001 | X | | Housing: 10 years[2] |
| Selective Catalytic Reduction Unit | LVP-SCR-00001 | X | | Housing: 10 years[2] |
| Electric Heaters | LVP-HTR-00001A/B<br>LVP-HTR-00002 | X | | Housing: 10 years[2] |
| Heat Exchanger | LVP-HX-00001 | X | | Housing: 10 years[2] |
| Offgas Mercury Adsorbers | LVP-ADBR-00001A/B | X | | Housing: 10 years[2] |
| Melter Offgas Exhausters | LVP-EXHR-00001A/B/C | X | | Housing: 10 years[2] |
| **LAW Bulges and Sumps** | | | | |
| Concentrate Receipt Valve Bulges | LCP-BULGE-00001<br>LCP-BULGE-00002<br>LCP-BULGE-00003 | | X | 7 years[5] |
| Melters 1 and 2 Feed/Preparation Valve Bulges | LFP-BULGE-00001<br>LFP-BULGE-00002 | | X | 7 years[5] |
| Melters 1 and 2 Valve Bulges | LOP-BULGE-00001<br>LOP-BULGE-00002 | X | | 10 years[2] |
| C3/C5 Pump Bulge | RLD-BULGE-00001 | X | | 10 years[2] |
| Plant Wash/SBS Condensate Collection Vessel Valve Bulge | RLD-BULGE-00004 | X | | 10 years[2] |
| Melter 1 Process Cell Sumps | RLD-SUMP-00029<br>RLD-SUMP-00030 | X | | 7 years[5,6] |
| Melter 2 Process Cell Sumps | RLD-SUMP-00031<br>RLD-SUMP-00032 | X | | 7 years[5,6] |
| Effluent Cell Sumps | RLD-SUMP-00035<br>RLD-SUMP-00036 | X | | 7 years[5,6] |
| C3/C5 Drains Collection Cell Sump | RLD-SUMP-000028 | X | | 7 years[5,6] |

Notes:

[1] Includes piping associated with the regulated plant item.

[2] Frequency of subsequent integrity assessments will be based on the results of the current and previous integrity assessments; age of the tank, miscellaneous unit, bulge, or sump; materials of construction; characteristics of the waste; and any other relevant factors, but will be no more than 10 years between integrity assessments.

[3] The hot cell drain collection vessel (RLD-VSL-00165) was designed to the same criteria as tanks located in black cells in the PTF and HLW vitrification facility. Since the location of this tank is inaccessible, integrity assessment is limited to the review of operating history in the same manner as for tanks in black cells. The document "Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Pretreatment Facility and High-Level Waste Vitrification Facility" (24590-WTP-PER-M-08-002) provides details of integrity assessment for tanks in black cells. As described in Section 7.1.5, laboratory area sink drain collection vessel (RLD-VSL-00164) will be used as a surrogate for the inaccessible RLD-VSL-00165, such that the results of NDE measurements for RLD-VSL-00164 will also represent conditions for RLD-VSL-00165.

[4] The C5 cell sump (RLD-SUMP-00042) is inaccessible; therefore, integrity assessment is limited to the review of operating history in the same manner as for sumps in black cells. The document "Integrity Assessment Program and Schedule for DWP Regulated Equipment in the Pretreatment Facility and High-Level Waste Vitrification Facility" (24590-WTP-PER-M-08-002) provides details of integrity assessment for sumps in black cells. As described in Section 7.1.5, C3 cell sump (RLD-SUMP-00041) will be used as a surrogate for the inaccessible RLD-SUMP-00042, such that the results of NDE measurements for RLD-SUMP-00041 will also represent conditions for RLD-SUMP-00042.

[5] Frequency of subsequent integrity assessments will be based on the results of the current and previous integrity assessments; age of the tank, bulge, or sump; materials of construction; characteristics of the waste; and any other relevant factors, but will be no more than 7 years between integrity assessments.

[6] This accessible regulated plant item is used as a surrogate for inaccessible equipment in the PTF or HLW vitrification facility. Therefore, the frequency of the integrity assessment is consistent with the frequency of the integrity assessment for the inaccessible equipment. See Table 10 for a list of surrogate equipment in the LAW vitrification facility.

[7] Design life is 5 years. Assessment, other than review of operation and maintenance records on annual or semiannual basis, is not required if melter and melter coolers are replaced within less than 7 years. Otherwise, the initial integrity assessment will be conducted within 7 years after start of hot commissioning; frequency of subsequent integrity assessments will be based on the results of the current and previous integrity assessments, age of the miscellaneous unit system, materials of construction, characteristics of the waste, and any other relevant factors, but will be no more than 7 years between integrity assessments.

Acronyms:

HEPA - high efficiency particulate air
HLW – high-level waste
LAW – low-activity waste
NDE – non-destructive examination
PTF – pretreatment facility
SBS - submerged bed scrubber

**Table 8 Process Chemistry and Parameters Monitored for Operating History Reviews**

| | Aluminum | Chloride | Fluoride | Iron | Nitrate | Nitrite | Phosphate | Sulfate | Mercury | Carbonate | Undissolved solids | Lead | pH | Temperature | Bromide | Hydroxide | Total organic carbon | Particle size/hardness | Dose rate, α, β/γ (inside) | Time of exposure |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analytical Laboratory** | | | | | | | | | | | | | | | | | | | | |
| RLD-VSL-00164 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | | ■ | |
| RLD-VSL-00165 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | | | |
| **LAW Vitrification Facility** | | | | | | | | | | | | | | | | | | | | |
| LCP-VSL-00001<br>LCP-VSL-00002 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| LFP-VSL-00001<br>LFP-VSL-00003 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| LFP-VSL-00002<br>LFP-VSL-00004 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| LOP-VSL-00001<br>LOP-VSL-00002 | ■ | ■ | ■ | ■ | ■ | | | | ■ | | ■ | ■ | ■ | ■ | | | | | | |
| LVP-TK-00001 | | ■ | ■ | | ■ | | | | | | | | ■ | ■ | | | | | | |
| RLD-VSL-00003 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| RLD-VSL-00004 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| RLD-VSL-00005 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |

Note:

Shaded cells indicate parameter considered in corrosion and erosion evaluation. See Appendix A for list of applicable Corrosion Evaluation Reports/Material Selection Data Sheets.

**Table 9 Summary of Tanks Monitored by the Sampling System**

| Tank Name | Plant Item Number | Comments |
|---|---|---|
| **LAW Vitrification Facility** | | |
| Concentrate Receipt Vessels | LCP-VSL-00001<br>LCP-VSL-00002 | These are tanks considered to have a higher potential for corrosion and erosion. To monitor process operating conditions, tank contents are pumped from the tanks using LCP-PMP-00001A/B and LCP-PMP-00002A/B, respectively, and routed to an autosampler. The sampling device is located outside the process cell in a shielded but accessible location on the 48-foot elevation level. |
| Melter Feed Preparation Vessels | LFP-VSL-00001<br>LFP-VSL-00003 | These are tanks considered to have a higher potential for corrosion and erosion. To monitor process operating conditions, tank contents are pumped from the tanks using LFP-PMP-00001A/B and LFP-PMP-00003A/B, respectively, and routed to an autosampler. The sampling device is located outside the process cell in a shielded but accessible location on the 48-foot elevation level. |
| Melter Feed Vessels | LFP-VSL-00002<br>LFP-VSL-00004 | These are tanks considered to have a higher potential for corrosion and erosion. To monitor process operating conditions, tank contents are pumped from the tanks using LFP-PMP-00002 and LFP-PMP-00004, respectively, and routed to an autosampler. The sampling device is located outside the process cell in a shielded but accessible location on the 48-foot elevation level. |
| Plant Wash Vessel | RLD-VSL-00003 | This tank is considered to have a lower potential for corrosion and erosion. To monitor process operating conditions, tank contents are pumped from the tank using RLD-PMP-00001A/B and routed to an autosampler. The sampling device is located outside the effluent cell area in a shielded but accessible location on the 48-foot elevation level. |

| Tank Name | Plant Item Number | Comments |
|---|---|---|
| LAW C3/C5 Drains/Sump Collection Vessel | RLD-VSL-00004 | This tank is considered to have a lower potential for corrosion and erosion. To monitor process operating conditions, tank contents are pumped from the tank using RLD-PMP-00002A/B and routed to an autosampler. The sampling device is located outside the C3/C5 cell area in a shielded but accessible location on the 48-foot elevation level. |
| SBS Condensate Collection Vessel | RLD-VSL-00005 | This tank is considered to have a lower potential for corrosion and erosion. To monitor process operating conditions, tank contents are pumped from the tank using RLD-PMP-00003A/B and routed to an autosampler. The sampling device is located outside the effluent cell area in a shielded but accessible location on the 48-foot elevation level. |

Acronyms:

LAW – low-activity waste
SBS – submerged bed scrubber

**Table 10 Accessible LAW Vitrification Facility DWP-Regulated Equipment as Possible Surrogates for NDE Measurements of Regulated Equipment in Hard-to-Reach Areas and Black Cells**

| Plant Item Number | Attributes | Candidate PTF/HLW Vitrification Facility Equipment | | |
|---|---|---|---|---|
| | | Direct Correspondence[1] | Similar Attributes[2] | Limited Similarity[3] – Use High Potential Scenario |
| **LAW Tanks** | | | | |
| LCP-VSL-00001<br>LCP-VSL-00002 | 316L (S31603), receives concentrated LAW, corrosion/erosion allowance specified[4] | PTF<br>TCP-VSL-00001 | PTF<br>CXP-VSL-00001<br>CXP-VSL-00026A/B/C<br>UFP-VSL-00062A/B/C | |
| LFP-VSL-00001<br>LFP-VSL-00002<br>LFP-VSL-00003<br>LFP-VSL-00004 | 316L (S31603), receives concentrated LAW plus glass formers, increased bottom head and shell thickness to provide erosion allowance<br>Represents highest potential scenario for erosion due to contents and from mixing process | | | PTF<br>FEP-VSL-00017A/B<br>FRP-VSL-00002A/B/C/D<br>HLP-VSL-00022<br>HLP-VSL-00027A/B<br>HLP-VSL-00028<br>PWD-VSL-00015<br>PWD-VSL-00016<br>PWD-VSL-00033<br>PWD-VSL-00043<br>RDP-VSL-00002A/B/C<br>UFP-VSL-00001A/B<br>UFP-VSL-00002A/B |
| LOP-VSL-00001<br>LOP-VSL-00002 | Alloy C-22 (N06022), receives SBS condensate, corrosion/erosion allowance specified | HLW<br>HOP-VSL-00903<br>HOP-VSL-00904 | PTF<br>CNP-EVAP-00001<br>HLP-BRKPT-00004<br>HLP-BRKPT-00006 | |
| LVP-TK-00001 | 316L (S31603), receives caustic solution, corrosion/erosion allowance specified | | PTF<br>CNP-VSL-00003<br>CXP-VSL-00004 | |

| Plant Item Number | Attributes | Candidate PTF/HLW Vitrification Facility Equipment | | |
|---|---|---|---|---|
| | | Direct Correspondence[1] | Similar Attributes[2] | Limited Similarity[3] – Use High Potential Scenario |
| RLD-VSL-00004 | 316L (S31603), receives radioactive drains, no corrosion/erosion allowance specified | | PTF<br>PWD-VSL-00044<br>PWD-BRKPT-00007<br>PWD-BRKPT-00008<br>PWD-BRKPT-00009<br>PWD-BRKPT-00010<br><br>HLW<br>RLD-VSL-00002<br>RLD-VSL-00008<br>RLD-BRKPT-00007<br>RLD-BRKPT-00009 | PTF<br>UFP-BRKPT-00001A/B |
| RLD-VSL-00005 | 6% Mo alloy (N08367/N08926), receives LAW SBS condensate, possible strongly acidic waste, standard corrosion allowance | PTF<br>TLP-VSL-00009A/B | HLW<br>RLD-VSL-00007 | |
| **LAW Miscellaneous Units** | | | | |
| LVP-SCB-00001 | 316L (S31603), receives and scrubs vessel vent gases, corrosion/erosion allowance specified | PTF<br>PVP-SCB-00002 | | |
| LOP-WESP-00001<br>LOP-WESP-00002 | 6% Mo alloy (N08367), receive LAW melter offgas (post-scrubber) | HLW<br>HOP-WESP-00001<br>HOP-WESP-00002 | | |
| **LAW Sumps** | | | | |
| RLD-SUMP-00028 | 316L (S31603), receives radioactive liquid | | PTF<br>PWD-SUMP-00026<br>PWD-SUMP-00028<br>PWD-SUMP-00029<br>PWD-SUMP-00032<br>PWD-SUMP-00033 | |

| Plant Item Number | Attributes | Candidate PTF/HLW Vitrification Facility Equipment | | |
|---|---|---|---|---|
| | | Direct Correspondence[1] | Similar Attributes[2] | Limited Similarity[3] – Use High Potential Scenario |
| RLD-SUMP-00029<br>RLD-SUMP-00030<br>RLD-SUMP-00031<br>RLD-SUMP-00032<br>RLD-SUMP-00035<br>RLD-SUMP-00036 | 6% Mo alloy (N08367/N08926), receive radioactive drains, standard corrosion allowance | PTF<br>PWD-SUMP-00040<br><br>HLW<br>HOP-SUMP-00003<br>HOP-SUMP-00008<br>RLD-SUMP-00001<br>HCP-SUMP-00001 | | |

Notes:

[1] Same materials of construction, same waste stream, same corrosion/erosion potential.

[2] Same materials of construction, similar waste stream, similar corrosion/erosion potential.

[3] Same materials of construction, waste streams different but similar high potential for corrosion/erosion potential based on similar pH conditions or mixing process.

[4] In addition to standard 0.040-inch corrosion allowance, corrosion evaluation identified tank-specific corrosion/erosion allowances.

Acronyms:

HLW – high-level waste
LAW – low-activity waste
Mo - molybdenum
NDE – non-destructive examination
% - percent
PTF – pretreatment facility
SBS - submerged bed scrubber

# Appendix A

# Applicable Design Documents

# Appendix A
# Applicable Design Documents

24590-101-TSA-W000-0010-409-881, *Final - 100% Design - LAW Melter ADS Pump Operation and Maintenance Manual*

24590-BOF-3PS-C000-T0002, *Engineering Specification for Excavation and Backfill of Underground Radioactive Waste Transfer Lines*

24590-BOF-3PS-CE01-T0001, *Engineering Specification for Excavation and Backfill*

24590-BOF-CS-80-00102, *RAD Transfer Lines, Miscellaneous Details, Sheet 3*

24590-CM-POA-MVA0-00002-03-04, *Drawing – General Arrangement –Melter1 Feed Vessel*

24590-CM-POA-MVA0-00002-03-42, *Drawing – General Arrangement –Melter2 Feed Vessel*

24590-CM-POA-MVA0-00002-03-11, *Drawing – General Arrangement –Melter2 Feed Preparation Vessel*

24590-CM-POA-MVA0-00002-03-22, *Drawing – General Arrangement –Melter1 Feed Preparation Vessel*

24590-CM-POA-MVA0-00002-03-53, *Drawing – General Arrangement – Concentrate Receipt Vessel*

24590-CM-POA-MVA0-00002-03-64, *Drawing – General Arrangement – Concentrate Receipt Vessel*

24590-LAB-3YD-AHL-00001, *System Description for the Analytical Hotcell Laboratory Equipment (AHL)*

24590-LAB-3YD-ARL-00001, *System Description for the Analytical Radiological Laboratory Equipment (ARL)*

24590-LAB-3YD-RLD-00001, *System Description for the Radioactive Liquid Waste Disposal System for the Analytical Laboratory*

24590-LAB-M0C-60-00008, *Estimation of Chemical Usage in the WTP Laboratory*

24590-LAB-M6-RLD-P0001, *P&ID – Lab Radioactive Liquid Waste Disposal System – C5 Collection & Transfer*

24590-LAB-M6-RLD-P0002, *P&ID – Lab Radioactive Liquid Waste Disposal System – C3 Collection & Transfer*

24590-LAB-M6C-RLD-00016, *DWP Change Submittal Data & Flooding Calculation for LAB below-grade cells*

24590-LAB-MPD-RLD-00001, *24590-LAB-RLD-PMP-00183A and B – Self-Priming, Mag-Drive, Horizontal Centrifugal Pump*

24590-LAB-MPD-RLD-00002, *24590-LAB-RLD-PMP-00182A and B – Self-Priming, Mag-Drive, Horizontal Centrifugal Pump*

24590-LAB-MVC-RLD-00002, *Process and Materials Selection Data for Laboratory Area Sink Drain Collection Vessel (RLD-VSL-00164)*

24590-LAB-MVC-RLD-00003, *Process and Materials Selection Data for Hot Cell Drain Collection Vessel (RLD-VSL-00165)*

24590-LAB-MVD-RLD-P0164, *Mechanical Data Sheet: 24590-LAB-MV-RLD-VSL-00164 – Lab Area Sink Drain Collection Vessel*

24590-LAB-MVD-RLD-P0165, *Mechanical Data Sheet: 24590-LAB-MV-RLD-VSL-00165 – Hot Cell Drain Collection Vessel*

24590-LAB-MV-RLD-P0001, *Equipment Assembly Lab Area Sink Drain Collection Vessel RLD-VSL-00164*

24590-LAB-MV-RLD-P0003, *Equipment Assembly Hot Cell Drain Collection Vessel RLD-VSL-00165*

24590-LAB-N1D-RLD-00004, *RLD-SUMP-00182A/B (LAB) – Lab Area Sink Drain Collection Vessel Pump with Bowl Drain*

24590-LAB-N1D-RLD-00005, *RLD-SUMP-00183A/B (LAB) – Hot Cell Drain Collection Vessel Pump with Bowl Drain*

24590-LAB-N1D-RLD-P0002, *Plant Item Material Selection Data Sheet: RLD-VSL-00164 (LAB) - Lab Area Sink Drain Collection Vessel (RLD C3 Vessel)*

24590-LAB-N1D-RLD-P0003, *Plant Item Material Selection Data Sheet: RLD-VSL-00165 (LAB) – Hot Cell Drain Collection Vessel (RLD C5 Vessel)*

24590-LAB-P1-60-00007, *Analytical Laboratory General Arrangement Plan at El (-) 19 ft – 2 in Sections E-E, F-F & G-G*

24590-LAB-PER-J-03-001, *System Logic Description for Analytical Laboratory – Radioactive Liquid Waste System (RLD)*

24590-LAB-PER-M-02-002, *Sump Data for LAB facility*

24590-LAB-RPT-ENS-04-001, *Analytical Laboratory Design Basis Event Selection Report*

24590-LAW-3YD-LCP-00001, *System Description for LAW Concentrate Receipt Process (LCP)*

24590-LAW-3YD-LFP-00001, *System Description for Low-Activity Waste Melter Feed Process System (LFP)*

24590-LAW-3YD-LMP-00001, *System Description for LAW Melter Process System (LMP)*

24590-LAW-3YD-LOP-00001, *System Description for LAW Primary Offgas Process (LOP) and LAW Secondary Offgas/Vessel Vent Process (LVP) Systems*

24590-LAW-3YD-RLD-00001, *System Description for LAW Radioactive Liquid Waste Disposal (RLD) System*

24590-LAW-IBCE-AR-03-001, *International Building Code Evaluation for Low-Activity Waste Vitrification Building (LAW)*

24590-LAW-J0-PTJ-00002, *LAW Vitrification System PTJ, Supplemental Instrument Diagram, CCTV Equipment Plan at El 3 ft - 0 in*

24590-LAW-M6-LVP-P0001, *P&ID – LAW Secondary Offgas/Vessel Vent Process System Melters Secondary Offgas*

24590-LAW-M6-LVP-P0002, *P&ID – LAW Secondary Offgas/Vessel Vent Process System and Stack Discharge Monitoring System*

24590-LAW-M6-LVP-P0003, *P&ID - LAW Secondary Offgas/Vessel Vent Process System Equipment Vents*

24590-LAW-M6-LVP-P0004, *P&ID – LAW Melters Secondary Offgas/Vessel Vent Process System Mercury Mitigation Equipment*

24590-LAW-M6-LVP-P0005, *P&ID - LAW Melters Secondary Offgas/Vessel Vent Process System SCR, VOC & Ammonia Dilution Packages*

24590-LAW-M6-RLD-P0001, *P&ID - LAW Radioactive Liquid Waste Disposal System Plant Wash & SBS Condensate Collection*

24590-LAW-M6-RLD-P0002, *P&ID - LAW Radioactive Liquid Waste Disposal System C3/C5 Drains/Sump Collection*

24590-LAW-MKD-LVP-00012, *24590-LAW-MX-LVP-SKID-00002, 24590-LAW-MX-LVP-00003 - LAW Catalytic Oxidizer/Reducer*

24590-LAW-MPD-LCP-00001, *LCP-PMP-00001A/B – Melter 1 Concentrate Receipt Pumps*

24590-LAW-MPD-LCP-00003, *LCP-PMP-00003A/B – Melter 2 Concentrate Receipt Pumps*

24590-LAW-MPD-LFP-00001, *LFP-PMP-00001A/B – Melter 1 Feed Preparation Vessel Pumps*

24590-LAW-MPD-LFP-00003, *LFP-PMP-00002 – Melter 1 Feed Vessel Pump*

24590-LAW-MPD-LFP-00004, *LFP-PMP-00003A/B – Melter 2 Feed Preparation Vessel Pumps*

24590-LAW-MPD-LFP-00006, *LFP-PMP-00004 – Melter 2 Feed Vessel Pump*

24590-LAW-MPD-LOP-00001, *LOP-PMP-00003A/B – SBS Water Purge Pumps*

24590-LAW-MPD-LOP-00003, *LOP-PMP-00006A/B – SBS Water Purge Pumps*

24590-LAW-MPD-LOP-00007, *24590-LAW-MP-LOP-PMP-00001 24590-LAW-MP-LOP-PMP-00002 24590-LAW-MP-LOP-PMP-00004, 24590-LAW-MP-LOP-PMP-00005 - Melter 1 and 2 SBS Condensate Purge Pumps*

24590-LAW-MPD-LVP-00004, *24590-LAW-MP-LVP-PMP-00002A/B - Caustic Blowdown Transfer Pump*

24590-LAW-MPD-LVP-00006, *24590-LAW-MP-LVP-PMP-00003A/B – Offgas Caustic Scrubber Recirculation Pump*

24590-LAW-MPD-RLD-00001, *24590-LAW-MP-RLD-PMP-00002-A – Centrifugal Pump Data Sheet*

24590-LAW-MPD-RLD-00003, *RLD-PMP-00001A/B – Plant Wash Vessel Discharge Pumps*

24590-LAW-MPD-RLD-00005, *RLD-PMP-00003A/B – SBS Condensate Collection Vessel Discharge Pumps*

24590-LAW-MPD-RLD-00026, *RLD-PMP-00016, 00025, 00026, 00027, 00028, 00031, 00032 – Permanently Installed and Portable (RLD-PMP-00016) Electric Submersible Sump Pumps Transferring Liquid Deposited in Various Sumps to RLD-VSL-00003 and RLD-VSL-00004*

24590-LAW-MPD-RLD-00033, *RLD-PMP-00004 - Permanently Installed Electric Submersible Sump Pump Transferring Liquid Deposited in the C3/C5 Drains/Sumps Collection Vessel Cell Sump to Plant Wash Vessel RLD-VSL-00003*

24590-LAW-MVC-LCP-00002, *LAW Concentrate Receipt Process System (LCP) Data*

24590-LAW-MVD-LVP-00003, *24590-LAW-MV-LVP-ADBR-00001A, 24590-LAW-MV-LVP-ADBR-00001B – Activated Carbon Adsorber for Mercury Abatement (LVP-SKID-00001)*

24590-LAW-MV-LCP-P0001, *Equipment Assembly Concentrate Receipt Collection Vessel LCP-VSL-00001*

24590-LAW-MV-LCP-P0002, *Equipment Assembly Concentrate Receipt Collection Vessel LCP-VSL-00002*

24590-LAW-MV-LOP-P0001, *Equipment Assembly LAW Melter 1 SBS Condensate Vessel LOP-VSL-00001*

24590-LAW-MV-LOP-P0002, *Equipment Assembly LAW Melter 2 SBS Condensate Vessel LOP-VSL-00002*

24590-LAW-MV-RLD-P0001, *Equipment Assembly C3/C5 Drains/Sump Collection Vessel RLD-VSL-00004*

24590-LAW-MV-RLD-P0002, *Equipment Assembly Plant Wash Vessel RLD-VSL-00003*

24590-LAW-MV-RLD-P0003, *Equipment Assembly SBS Condensate Collection Vessel RLD-VSL-00005*

24590-LAW-MXD-LCP-00001, *LCP-Bulge-00001 - Concentrate Receipt Valve Bulge*

24590-LAW-MXD-LCP-00002, *LCP-Bulge-00002 - Concentrate Receipt Valve Bulge*

24590-LAW-MXD-LCP-00003, *LCP-Bulge-00003 - Concentrate Receipt Valve Bulge*

24590-LAW-MXD-LFP-00001, *LFP-BULGE-00001 - Melter 1 Feed/Prep Valve Bulge*

24590-LAW-MXD-LFP-00002, *LFP-BULGE-00002 - Melter 2 Feed / Preparation Valve Bulge*

24590-LAW-MXD-LOP-00001, *LOP-BULGE-00001 - Melter 1 Valve Bulge Mechanical Systems Data Sheet: Process Bulge*

24590-LAW-MXD-LOP-00001, *LOP-BULGE-00002 - Melter 2 Valve Bulge*

24590-LAW-MXD-RLD-00002, *RLD-BULGE-00001 - LAW RLD C3/C5 Pump Bulge*

24590-LAW-MXD-RLD-00002, *RLD-BULGE-00004 – Plant Wash/SBS Condensate Collection Vessel Valve Bulge Mechanical Systems Data Sheet: Process Bulge*

24590-LAW-N1D-LCP-00002, *Corrosion Evaluation: LCP-PMP-00001A/B and LCP-PMP-00002A/B LAW Concentrate Pump*

24590-LAW-N1D-LCP-P0001, *Plant Item Material Selection Data Sheet: LCP-VSL-00001 & LCP-VSL-00002 (LAW) – LAW Concentrate Receipt Vessel*

24590-LAW-N1D-LFP-00006, *Corrosion Evaluation LFP-VSL-00004 Melter 1 & 2 Feed Vessels*

24590-LAW-N1D-LFP-P0004; *Plant Item Material Selection Data Sheet: LFP-VSL-00001, LFP-VSL-00002, LFP-VSL-00003, LFP-VSL-00004*

24590-LAW-N1D-LOP-00006, *LOP-PMP-00001 and 2 and 4 and 5 LAW Melter 1 and 2 SBS Condensate Purge Pumps*

4590-LAW-N1D-LOP-00007, *LOP-PMP-00003A/B & LOP-PMP-00006A/B LAW Melter 1 & 2 SBS Water Purge Pump – Primary & Standby*

24590-LAW-N1D-LOP-P0001, *LOP-SCB-00001 & LOP-SCB-00002 (LAW) Melter 1 and Melter 2 Submerged Bed Scrubbers (SBS)*

24590-LAW-N1D-LOP-P0002, *LOP-VSL-00001 & LOP-VSL-00002 (LAW) Melter 1 & Melter 2 SBS Condensate Vessel*

24590-LAW-N1D-LOP-P0003, *LOP-WESP-00001 & LOP-WESP-00002 (LAW) Melter 1 and Melter 2 Wet Electrostatic Precipitator (WESP)*

24590-LAW-N1D-LOP-P0004, *Plant Item Material Selection Data Sheet LOP Off-gas Piping*

24590-LAW-N1D-LVP- 00001, *LVP-SCB-00001 - Corrosion Evaluation*

24590-LAW-N1D-LVP-P0002, *LVP-TK-00001 (LAW)*

24590-LAW-N1D-LVP-00003, *LVP-EXHR-00001A/B/C (LAW) - Melter Offgas Exhauster*

24590-LAW-N1D-LVP-00004, *LVP-ADBR-00001A/B (LAW) - Offgas Mercury Adsorber*

24590-LAW-N1D-LVP-00005, *LVP-HX-00001 (LAW) - Catalytic Oxidizer Heat Recovery Exchanger*

24590-LAW-N1D-LVP-00006, *LVP-HTR-00002 (LAW) – Catalytic Oxidizer Electric Heater*

24590-LAW-N1D-LVP-00007, *LVP-SCO-00001(LAW) - Thermal Catalytic Oxidizer*

24590-LAW-N1D-LVP-00008, *LVP-SCR-00001 (LAW) - $NO_x$ Selective Catalytic Reducer*

24590-LAW-N1D-LVP-00009, *LVP-HTR-00001A&B (LAW) Melters Offgas HEPA Preheater – Corrosion Evaluation*

24590-LAW-N1D-RLD-00001, *RLD-VSL-00004 (LAW) C3/C5 Drains/Sump Collection Vessel*

24590-LAW-N1D-RLD-00002, *RLD-VSL-00005 (LAW) SBS Condensate Collection Vessel*

24590-LAW-N1D-RLD-00004, *Corrosion Evaluation RLD-PMP-00001A-B LAW*

24590-LAW-N1D-RLD-00005, *RLD-VSL-00003 (LAW) Plant Wash Vessel*

24590-LAW-N1D-RLD-00006, *RLD-SUMP-00029 – RLD-SUMP-00036 (LAW) Process/Effluent Cell Sumps*

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Analytical Laboratory Fact Sheet dated January 2008

Dangerous Waste Permit WA7890008967, Part III, Operating Unit 10, Waste Treatment and Immobilization Plant, dated September 2007

# Appendix B

# NDE Measurement Locations

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[Drawings to be added following installation of regulated plant items]