Dangerous Waste Permit (DWP) Liner Heights in the Effluent Management Facility (EMF)

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Author(s): Elaine Tsai

Checked by: Bryant Leung

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Approved by: Youssef Mohammad-Zadeh

Approver's position: Engineering Group Supervisor

Approver's signature: _____ *Signature* 10/24/16 *Date*

Contents of this document are Dangerous Waste Permit Affecting.

River Protection Project
Waste Treatment Plant
2435 Stevens Center Place
Richland, WA 99354
United States of America
Tel: 509 371 2000

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History Sheet

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Acronyms

AEA	Atomic Energy Act of 1954
DOE	Department of Energy
DWP	Dangerous Waste Permit
EMF	Effluent Management Facility
WAC	Washington Administrative Code

1 Summary

The required and design liner heights for each room in the EMF containing dangerous waste are listed below. The liner heights are from the high point of the sloped floor.

Area	Room	Required Height	Design Height
Low Point Drain Vessel Area	ED-B001	4 ft 2 inches	5 ft
Evaporator Feed Vessel Area	E-0105	5 ft 2 inches	7 ft 6 inches
Process Condensate Lag Storage Vessel Area	E-0106	6 ft 10 inches	8 ft 4 inches
West Evaporator Process Area	E-0103	3 ft 5 inches	4 ft 6 inches
East Evaporator Process Area	E-0102	4 ft 6 inches	5 ft 10 inches

The liner heights were calculated by taking the total accumulated liquid volume, including the total volume of a single largest vessel in the room and rainfall or fire water, as applicable, dividing that by the net room area and adding a foot to account for the volume of miscellaneous equipment and components that may be within the containment area. For each area, it was determined whether a leak from another area could spill into the specified area. If a potential for leaking from another area existed, the most bounding scenario was used to determine the liner height.

Design heights were taken from the Architectural Room Finish Schedule (Ref. A-6.5).

2 Introduction

The regulatory codes for the secondary containment areas are contained in the Washington Administrative Code, WAC 173-303-640(4)(e)(i). The regulatory requirement states that external liner systems must be:

> "(A) Designed or operated to contain one hundred percent capacity of the largest tank within its boundary;
> (B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a twenty-five year, twenty-four hour rainfall event…" [WAC 173-303-640(4)(e)(i)] (Applicable Documents 3.1)

The calculated liner heights for indoor areas must also be able to contain the volume from 20 minutes of fire suppression water as required by the Basis of Design (Ref. A-6.2) in addition to the volume of the dangerous waste. This report assesses the liner heights required to contain dangerous waste, rainfall, and fire water in the Effluent Management Facility (EMF).

3 Applicable Documents

3.1 Washington Administrative Code, December 18, 2014, Title 173 Chapter 303 Section 640

3.2 NFPA 13, *Standard for Installation of Sprinkler Systems*, 1999

4 Description

There are five areas in the EMF that are considered dangerous waste permit affecting. The five areas are the Low Point Drain Vessel Area, Evaporator Feed Vessel Area, Process Condensate Lag Storage Vessel Area, West Evaporator Process Area, and East Evaporator Process Area. Vessel and pump suction line failures are evaluated for each area to determine the required liner height that will contain the total accumulated liquid volume of dangerous waste and rainfall or fire water, as applicable.

For indoor areas, it is assumed (Assumption A-3.5 and A-3.11) that the area will contain automatic sprinklers and there will be no accumulation from precipitation. Therefore, the liner must be sized to contain:

- The larger of 110% of volume up to the overflow line of the largest vessel (i.e. maximum operating volume), used as a conservative criteria per Basis of Design requirement 11.3.5.1 (Ref. A-6.2), or 100% of the capacity of the largest vessel/tank within the secondary containment boundary per WAC 173-303-640[4][e][i][A] (Applicable Documents 3.1) and
- Accumulation of 20 minutes of fire water from automatic sprinkler discharge in accordance with Basis of Design requirement 14.10.1.2.1 (Ref. A-6.2) with 10% added overage to account for hydraulic overages (Assumption A-3.10)

For outdoor areas, it is assumed (Assumption A-3.5 and A-3.11) that the area will not contain automatic sprinklers and there will be accumulation from precipitation. Therefore, the liner must be sized to contain:

- The larger of 110% of volume up to the overflow of the largest vessel (i.e. maximum operating volume), used as a conservative criteria per Basis of Design requirement 11.3.5.1 (Ref. A-6.2), or 100% of the capacity of the largest vessel/tank within the secondary containment boundary per WAC 173-303-640[4][e][i][A] (Applicable Documents 3.1) and
- Precipitation from a twenty-five-year, twenty-four-hour rainfall event per WAC 173-303-640[4][e][i][B] (Applicable Documents 3.1)

4.1 Low Point Drain Vessel Area (ED-B001)

Room ED-B001, the Low Point Drain Vessel Area, is an area located below grade in the Law Effluent Drain Tank Building at the (-) 39 ft. elevation. It contains one vessel, the Low Point Drain Vessel (DEP-VSL-00001).

In the event of a vessel failure, leakage and spillage could occur. Since the room is indoors, it could also accumulate fire water from the automatic sprinkler system in the event of a fire.

The Low Point Drain Vessel Area is not adjacent to other areas containing pumps and vessels; therefore, spillage and leakage from another areas is not of concern and a scenario assuming discharge of the total volume of liquid contained in the Low Point Drain Vessel (DEP-VSL-00001) and 20 minutes of fire water is evaluated as the most conservative scenario.

The total Low Point Drain Vessel volume of 18,000 gal (2,406 ft^3) is greater than 110% of the maximum operating volume (15,180 gal); therefore, 18,000 gal (2,406 ft^3) is used as the controlling vessel volume in this scenario. 462 ft^3 of fire water (20 minutes of sprinkler discharge with a 10% margin for overage) is added to the total vessel volume to determine the total accumulated liquid volume. The total accumulated liquid volume that must be contained by the liner in the room = 2,406 ft^3 + 462 ft^3 = 2,868 ft^3.

The room slopes to a single sump (DEP-SUMP-00001). To simplify the calculation, the available room volume below the high point of the sloped floor is omitted. This approach is conservative because assuming the floor to be flat and neglecting the sloped area leads to a taller liner height.

The liner height is measured from the high point of the sloped floor. The required liner height above the high point is equal to the total volume of 2,868 ft^3 divided by the net room area (924 ft^2) of the room, which is the cross-sectional area of the room minus the footprints of non-failed vessels within the room, plus 1 ft to account for miscellaneous equipment and components within the area, which is equal to 4.10 ft = 4 ft 2 in (rounded to the next inch).

The design liner height is 5 ft (Ref. A-6.5), therefore the liner is sufficient for the scenario. The detailed calculation for the required liner height is provided in Appendix A.

4.2 Evaporator Feed Vessel Area (Room E-0105)

Room E-0105, Evaporator Feed Vessel Area, is an area located in the northwest side of EMF at the 0 ft. elevation. It contains the following four vessels:

- Evaporator Feed Vessel DEP-VSL-00002
- Evaporator Concentrate Vessel DEP-VSL-00003A
- Evaporator Concentrate Vessel DEP-VSL-00003B
- Evaporator Concentrate Vessel DEP-VSL-00003C

In the event of a vessel failure, leakage and spillage could occur. Since the room is outdoors, it could also accumulate rainfall.

The wall shared between the Evaporator Feed Vessel Area and the Process Condensate Lag Storage Vessel Area does not contain any penetrations; therefore, there is no potential for accumulated liquid in the Process Condensate Lag Storage Vessel Area to leak into the Evaporator Feed Vessel Area. The penetrations into the building are welded; therefore, no accumulated liquid from within the building will have the potential of leaking outdoors. To calculate the required height of the liner in this area, a scenario assuming discharge of the total volume of liquid from the single largest vessel in the room, the Evaporator Feed Vessel (DEP-VSL-00002), and accumulation of rainfall is evaluated as the most conservative scenario.

The total Evaporator Feed Vessel volume of 42,300 gal (5,655 ft^3) is greater than 110% of the maximum operating volume (41,800 gal); therefore, 42,300 gal (5,655 ft^3) is used as the controlling volume. 1.56 inches of rainfall, which equates to 231 ft^3 of rainfall for the cross-sectional area (1,774 ft^2) of the room is added to the vessel volume to determine the total accumulated liquid volume. The total accumulated liquid volume that must be contained by the liner in the room = 5,655 ft^3 + 231 ft^3 = 5,886 ft^3.

The room slopes down to two sumps (DEP-SUMP-00004A/B). To simplify the calculation, the available room volume below the high point of the sloped floor is omitted. This approach is conservative because assuming the floor to be flat and neglecting the sloped area leads to a taller liner height.

The liner height is measured from the high point of the sloped floor. The required liner height above the high point is equal to the total volume of 5,886 ft^3 divided by the net room area (1,430 ft^2) of the room, which is the cross-sectional area of the room minus the footprints of non-failed vessels within the room,

plus 1 ft to account for miscellaneous equipment and components within the area, which is equal to 5.12 ft = 5 ft 2 in (rounded to the next inch).

The design liner height is 7 ft 6 in (Ref. A-6.5), therefore the liner is sufficient for the scenario. The detailed calculation for the required liner height is provided in Appendix A.

4.3 Process Condensate Lag Storage Vessel Area (E-0106)

Room E-0106, Process Condensate Lag Storage Area, is an area located in the north side of EMF at the 0 ft. elevation. It contains the following four vessels:

- Overhead Sampling Vessel DEP-VSL-00004A
- Overhead Sampling Vessel DEP-VSL-00004B
- Process Condensate Lag Storage Vessel DEP-VSL-00005A
- Process Condensate Lag Storage Vessel DEP-VSL-00005B

In the event of a vessel failure, leakage and spillage could occur. Since the room is outdoors, it could also accumulate rainfall.

The wall shared between the Process Condensate Lag Storage Vessel Area and the Evaporator Feed Vessel Area does not contain any penetrations; therefore, there is no potential for accumulated liquid in the Evaporator Feed Vessel Area to leak into the Process Condensate Lag Storage Vessel Area. The penetrations into the building are welded; therefore, no accumulated liquid from within the building will have the potential of leaking outdoors. To calculate the required height of the liner in this area, a scenario assuming discharge of the total volume of liquid from the single largest vessel in the room, one of the Process Condensate Lag Storage Vessels (DEP-VSL-00005A or DEP-VSL-00005B), and accumulation of rainfall is evaluated as the most conservative scenario.

The total Process Condensate Lag Storage Vessel volume of 127,260 gal (17,012 ft^3) is greater than 110% of the maximum operating volume (122,937 gal); therefore, 127,260 gal (17,012 ft^3) is the controlling volume. 1.56 inches of rainfall, which equates to 499 ft^3 of rainfall for the cross-sectional floor area (3,837 ft^2) of the room is added to the vessel volume to determine the total accumulated liquid volume. The total accumulated liquid volume that must be contained by the liner in the room = 17,012 ft^3 + 499 ft^3 = 17,511 ft^3.

The room slopes down to two sumps (DEP-SUMP-00005A/B). To simplify the calculation, the available room volume below the high point of the sloped floor is omitted. This approach is conservative because assuming the floor to be flat and neglecting the sloped area leads to a taller liner height.

The liner height is measured from the high point of the sloped floor. The required liner height above the high point is equal to the total volume of 17,511 ft^3 divided by the net room area (3,031 ft^2) of the room, which is the cross-sectional area of the room minus the footprints of non-failed vessels within the room, plus 1 ft to account for miscellaneous equipment and components within the area, which is equal to 6.77 ft = 6 ft 10 in (rounded to the next inch).

The design liner height is 8 ft 4 in (Ref. A-6.5), therefore the liner is sufficient for the scenario. The detailed calculation for the required liner height is provided in Appendix A.

4.4 West (E-0103) and East (E-0102) Evaporator Process Areas

Room E-0103, West Evaporator Process Area, is an area located in the southwest side of EMF at 0 ft. elevation. The room contains the discharge pumps (DEP-PMP-00002A/B and DEP-PMP-00012A/B/C) from the Evaporator Feed Vessel (DEP-VSL-00002) and discharge pumps (DEP-PMP-00003A/B) from the Evaporator Concentrate Vessels (DEP-VSL-00003A/B/C). The room also contains miscellaneous vessels such as the Evaporator Separator (DEP-EVAP-00001), the Evaporator Reboiler (DEP-RBLR-00001), and the Evaporator Concentrate/Feed LAW Effluent Cooler (DEP-HX-00001).

Room E-0102, East Evaporator Process Area, is an area located in the southeast side of EMF at 0 ft. elevation. The room contains the discharge pumps (DEP-PMP-00004A/B/C) of the Overhead Sampling Vessels (DEP-VSL-00004A/B) and discharge pumps (DEP-PMP-000015A/B/C and DEP-PMP-00005A/B) of the Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B). The room also contains miscellaneous vessels such as the three Evaporator Condensers (DEP-COND-00001/2/3), Reboiler Condensate Collection Vessel (DEP-VSL-00008), and the Steam Condensate Water Blowdown Vessel (SCW-VSL-00054).

In the event that a pump suction line fails, the entire volume of the connected vessel could discharge into the room. Since the rooms are indoor, they could also accumulate fire water from the automatic sprinkler system. The door between the two process areas cannot be credited as a seal; therefore, accumulated liquid in one area can leak into the other. In order to determine the appropriate liner height, two scenarios for each area are considered.

4.4.1 Scenario One for West Evaporator Process Area (E-0103)

The first scenario to be evaluated for the West Evaporator Process Area is the ability to contain the total volume of the single largest vessel connected to the pumps housed in the area and accumulation of fire water. Since the West Evaporator Process Area houses the discharge pumps for the Evaporator Feed and Evaporator Concentrate Vessels, the single largest vessel connected to the pumps in the area is the Evaporator Feed Vessel (DEP-VSL-00002).

Per Section 4.2, the controlling volume for the Evaporator Feed Vessel is 42,300 gal (5,655 ft^3). 1,751 ft^3 of fire water (20 minutes of sprinkler discharge with a 10% margin for overage) is added to the vessel volume to determine the total accumulated liquid volume. The total accumulated liquid volume that must be contained by the liner in the room = 5,655 ft^3 + 1,751 ft^3 = 7,406 ft^3.

The room slopes down to two sumps (DEP-SUMP-00002A/B). To simplify the calculation, the available room volume below the high point of the sloped floor is omitted. This approach is conservative because assuming the floor to be flat and neglecting the sloped area leads to a taller liner height.

The liner height is measured from the high point of the sloped floor. The required liner height above the high point is equal to the total volume of 7,406 ft^3 divided by the net room area (3,393 ft^2) of the room, which is the cross-sectional area of the room minus the footprints of non-failed vessels within the room, plus 1 ft to account for miscellaneous equipment and components within the area, which is equal to 3.18 ft = 3 ft 3 in (rounded to the next inch).

The design liner height is 4 ft 6 in (Ref. A-6.5), therefore the liner is sufficient for the scenario. The detailed calculation for the required liner height is provided in Appendix A.

4.4.2 Scenario One for East Evaporator Process Area (E-0102)

The first scenario to be evaluated for the East Evaporator Process Area is the ability to contain the total volume of the single largest vessel connected to the pumps housed in the area and accumulation of fire water. Since the East Evaporator Process Area houses the discharge pumps for the Overhead Sampling and Process Condensate Lag Storage Vessels, the single largest vessel connected to the pumps in the area is one of the Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B).

Per Section 4.3, the controlling volume for the Process Condensate Lag Storage Vessel is 127,260 gal (17,012 ft^3). 2,929 ft^3 of fire water (20 minutes of sprinkler discharge with a 10% margin for overage) is added to the vessel volume to determine the total accumulated liquid volume. The total accumulated liquid volume that must be contained by the liner in the room = 17,012 ft^3 + 2,929 ft^3 = 19,941 ft^3.

The room slopes down to two sumps (DEP-SUMP-00003A/B). To simplify the calculation, the available room volume below the high point of the sloped floor is omitted. This approach is conservative because assuming the floor to be flat and neglecting the sloped area leads to a taller liner height.

The liner height is measured from the high point of the sloped floor. The required liner height above the high point is equal to the total volume of 19,941 ft^3 divided by the net room area (5,727 ft^2) of the room, which is the cross-sectional area of the room minus the footprints of non-failed vessels within the room, plus 1 ft to account for miscellaneous equipment and components within the area, which is equal to 4.48 ft = 4 ft 6 in (rounded to the next inch).

The design liner height is 5 ft 10 in (Ref. A-6.5), therefore the liner is sufficient for the scenario. The detailed calculation for the required liner height is provided in Appendix A.

4.4.3 Scenario Two for West and East Evaporator Process Areas

The second scenario to be evaluated for both Evaporator Process Areas is to consider the ability to contain the total normalized accumulated liquid in both areas. This scenario considers the pump suction line for the single largest vessel associated with pumps in either process area to fail, therefore, the total accumulated liquid would contain the total vessel volume of a single Process Condensate Lag Storage Vessel (DEP-VSL-00005A/B) and the accumulation of fire water across both areas.

Per Section 4.3, the controlling volume for Process Condensate Lag Storage Vessel is 127,260 gal (17,012 ft^3). 4,681 ft^3 of fire water (20 minutes of sprinkler discharge with a 10% margin for overage) is added to the vessel volume to determine the total accumulated liquid volume. The total accumulated liquid volume that must be contained by the liner in the West and East Evaporator Process Areas = 17,012 ft^3 + 4,681 ft^3 = 21,693 ft^3.

The liner height is measured from the high point of the sloped floor, which is conservative because neglecting the volume under the sloped area leads to a taller liner height. The required liner height above the high point is equal to the total volume of 21,693 ft^3 divided by the net room area (9,120 ft^2) of the room, which is the cross-sectional area of both process areas minus the footprints of non-failed vessels in both areas, plus 1 ft to account for miscellaneous equipment and components within the area, which is equal to 3.38 ft = 3 ft 5 in (rounded to the next inch). The detailed calculation for the required liner height is provided in Appendix A.

Based on evaluation of the two scenarios for both Evaporator Process Areas, the required liner height determined in scenario two (Section 4.4.3) is greater than the required liner height determined in scenario one (Section 4.4.1) for the West Evaporator Process Area, but smaller than the required liner height determined in scenario one (Section 4.4.2) for the East Evaporator Process Area. Therefore, 3 ft 5 inches will be the required liner height for the West Evaporator Process Area and 4 ft 6 inches will be the required liner height for the East Evaporator Process Area. The design liner height for West and East Evaporator Process Areas are 4 ft 6 inches and 5 ft 10 inches (Ref. A-6.5), respectively, therefore, the liner heights are sufficient.

Appendix A
Calculation of Accumulated Liquid Volumes and Liner Heights

Appendix A: Calculation of Accumulated Liquid Volumes and Required Liner Heights

A-1 Purpose

The purpose of this calculation is to size the required liner heights for the dangerous waste containment areas of the Effluent Management Facility at elevation -39 ft and elevation 0 ft. The Low Point Drain Vessel Area is at the -39 ft elevation and the Evaporator Feed Vessel Area, Process Condensate Lag Storage Vessel Area, West Evaporator Process Area, and East Evaporator Process Area are located at the 0 ft elevation as shown on the Effluent Management Facility General Arrangement Drawing (Ref. A-6.1).

A-2 Criteria and Design Inputs

A-2.1 Secondary containment for indoor storage areas shall be designed to contain a spill from the largest vessel plus the design flow volume of fire-protection water calculated to discharge from the fire-extinguishing system over the area of the room for a period of 20 minutes (Ref. A-6.2 Sec. 14.10.1.2.1).

A-2.2 Secondary containment external liners shall be designed to contain one hundred percent of the capacity of the largest tank within its boundary as well as precipitation from a twenty-five year, twenty-four hour rainfall event (Applicable Documents 3.1 WAC 173-303-640[4][e][i][A], WAC 173-303-640[4][e][i][B], and Ref. A-6.2 Sec. 14.10.1.2.1).

A-2.3 The twenty-five-year, twenty-four-hour rainfall event for the Hanford Site is 1.56 inches (Ref. A-6.4 Table 61).

A-2.4 The liners are designed to contain one hundred percent of the largest tank within its boundary, or one hundred ten percent of the volume up to the overflow (i.e., maximum operating volume) of the largest tank within its boundary (Applicable Documents 3.1 WAC 173-303-640[4][e][i][B] and Reference A-6.2 Section 11.3.5.1).

A-3 Assumptions

A-3.1 To evaluate the worst case scenario, the volume of the vessel is assumed to leak completely onto the floor until it reaches equilibrium with the surrounding liquid level.

A-3.2 The calculation for net room area assumes that the area beneath non-failed vessels or tanks do not contain any spilled liquids.

A-3.3 In a fire event, it is assumed that the fire water will remain in the containment area with no credit given to the operation of area sump pump(s).

A-3.4 Room dimensions used in calculating area and volumes are assumed to be the following:

Room	Area	Dimensions (Ref. A-6.3)		
		Length	Width	Area (ft^2)
ED-B001	Low Point Drain Vessel Area	28’	33’	924
E-0105	Evaporator Feed Vessel Area	45’6”	39’	1,774
E-0106	Process Condensate Lag Storage Vessel Area	45’6”	84’4”	3,837
E-0103	West Evaporator Process Area	62’	56’6”	3,503
E-0102	East Evaporator Process Area	62’	94’6”	5,859

A-3.5 All inside areas are assumed to have a fire sprinkler system. All outside areas are assumed not to have a fire sprinkler system.

A-3.6 The following vessels are contained within each listed room as shown on the general arrangement drawing (Ref. A-6.1) and assumed to have the diameters and volumes below (Ref. A-6.3):

Room	Vessel	Elevation	Vessel Diameter	Total Vessel Volume (gal)	Maximum Operating Volume (gal)
ED-B001	Low Point Drain Vessel (DEP-VSL-00001)	- 39 ft	14 ft 1 in	18,000	13,800
E-0105	Evaporator Feed Vessel (DEP-VSL-00002)	0 ft	14 ft 1 in	42,300	38,000
	Evaporator Concentrate Vessels (DEP-VSL-00003A/B/C)	0 ft	12 ft 1 in	14,805	11,703
E-0106	Overhead Sampling Vessels (DEP-VSL-00004A/B)	0 ft	14 ft 1in	40,800	36,600
	Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B)	0 ft	25 ft 1 in	127,260	111,761

A-3.7 Miscellaneous vessels in the West and East Evaporator Process Areas are assumed to have the following dimensions and footprints (Ref. A-6.3):

Room	Equipment	Dimensions	Footprint
E-0103	DEP-EVAP-00001	10’ D x 23’ H	79 ft^2
E-0103	DEP-RBLR-00001	6’ L x 4’ W x 14’ H	24 ft^2
E-0103	DEP-HX-00001	2’6” L x 2’6” W 6’8” H	7 ft^2
E-0102	SCW-VSL-00054	4’ D x 9’ H	13 ft^2
E-0102	DEP-VSL-00008	4’ D x 3’ T-T	13 ft^2

E-0102	DEP-COND-00001	21' L x 4' W x 10' H	84 ft^2
E-0102	DEP-COND-00002	8' L x 2' W x 2' H	16 ft^2
E-0102	DEP-COND-00003	6' L x 1' W x 2' H	6 ft^2

A-3.8 The Evaporator Separator (DEP-EVAP-00001), Evaporator Condensers (DEP-COND-00001/2/3), Evaporator Reboiler (DEP-RBLR-00001), Reboiler Condensate Collection Vessel (DEP-VSL-00008), Steam Condensate Water Blowdown Vessel (SCW-VSL-00054), and the Evaporator Concentrate/Feed LAW Effluent Cooler (DEP-HX-00001) are not considered in determining the single largest vessel in each area because their capacities are expected to be significantly smaller than the process vessel volumes that are considered.

A-3.9 One (1) ft is added to the secondary containment height to account for the volume of miscellaneous equipment and components that may be within the containment area. The volume of miscellaneous equipment and components is not expected to challenge the volume from one foot of height in the containment area.

A-3.10 An automatic sprinkler system design density is assumed to be 0.17 gpm/ft^2 with 10 percent added to account for hydraulic overages (Applicable Documents 3.2 and Ref. A-6.6).

A-3.11 Precipitation will only accumulate in the outdoor areas.

A-4 Methodology

To determine the required liner height for the worst case scenario in each containment area, the vessels are considered to be completely filled and sitting on the floor and the largest vessel is expected to leak completely into the room. In addition, for the Evaporator Process Areas, it is also assumed that the leak has the capability of spilling between areas and normalizing within the combined area because doors/walls in the area cannot be credited as seals. Therefore, each containment area must be evaluated for the leaking of the total volume of the largest vessel in the area or 110% of the maximum operating volume, whichever is larger, as well as leaking from adjacent areas and rainfall or fire water, as applicable.

A-4.1 Conversion

Volume (ft^3) = $Volume\ (gal) \times 0.13368 \frac{ft^3}{gal}$ (Equation 1)

A-4.2 Vessel

A_{vessel} (ft^2) = Vessel Footprint Area = $\frac{\pi d^2}{4}$ (Equation 2)

Where $\pi = 3.14$
d (ft) = Vessel Diameter

A-4.3 Room Dimensions and Equations

A_{room} (ft^2) = Area of a Rectangular Room = L x W (Equation 3)

V_{room} (ft^3) = Volume of a Rectangular Room = L x W x H (Equation 4)

Where L (ft) = Length of room
W (ft) = Width of room
H (ft) = Height of room

$$A_{net}(ft^2) = Net\ Room\ Area = A_{room} - \sum A_{vessel}\ (non - failed)$$ (Equation 5)

A-4.4 Fire Water Discharge Volume for Automatic Fire Suppression Systems

V_F (ft^3) = Volume of Fire Water = $A_{room} \times \rho_{sprinkler} \times T \times 1.1$ (Equation 6)

Where A_{room} (ft^2) = Area of a Rectangular Room
$\rho_{sprinkler}$ $(gal/min/ft^2)$= Sprinkler Discharge Density (0.17 gal/min/ft^2) (Assumption A-3.10)
T (min) = Sprinkler Discharge Time (20 minutes) (Input A-2.1)
1.1 = 10% Margin for Hydraulic Overages (Assumption A-3.10)

A-4.5 Rainfall Volume

V_R (ft^3) = Volume of Rainfall = $A_{room} \times \left(H_r \times \frac{1\ ft}{12\ in}\right)$ (Equation 7)

Where A_{room} (ft^2) = Area of a Rectangular Room
H_r (in) = Height of Rainfall from a Twenty-Five-Year, Twenty-Four-Hour Rainfall Event
= 1.56 inches (Input A-2.3)

A-4.6 Accumulated Liquid Volume and Required Liner Height

V_T = Total Accumulated Liquid Volume
= V_V + (V_F or V_R), whichever is applicable (Equation 8)

Where V_V = 100% Total Vessel Volume or 110% of the Maximum Operating Volume, whichever is larger
V_F = Volume of Fire Water
V_R = Volume of Rainfall

H_L (ft) = Required Liner Height = $\frac{V_T}{A_{net}}$ +1 ft (Equation 9)

Where V_T (ft^3) = Total Accumulated Liquid Volume
A_{net} (ft^2) = Net Room Area
1 ft = Volume of Miscellaneous Equipment and Components (Assumption A-3.9)

A-5 Calculations

A-5.1 **Required Liner Height for Low Point Drain Vessel Area, Room ED-B001, Elevation -39 ft**

Scenario: Failure of the Low Point Drain Vessel (DEP-VSL-00001) and accumulation of fire water from automatic fire suppression system discharge (Assumption A-3.5). No rainfall will accumulate (A-3.11)

The total vessel volume is compared to 110% of the maximum operating volume of the vessel to determine the controlling volume:

$$Total\ Vessel\ Volume = 18{,}000\ gal \text{ (Assumption A-3.6)}$$
$$110\%\ Maximum\ Operating\ Volume = 1.10 \times\ 13{,}800\ gal = 15{,}180\ gal \text{ (Assumption A-3.6)}$$
$$18{,}000\ gal > 15{,}180\ gal\ \ \therefore \text{ Total Vessel Volume is the Controlling Volume}$$

The total accumulated liquid volume for the Low Point Drain Vessel Area is calculated using the following equation:

$$V_T = V_V + V_F (Equation\ 8)$$

Where

$V_V(gal) = Controlling\ Volume =\ 18{,}000\ gal\ (Total\ Vessel\ Volume)$(Assumption A-3.6)

$$V_V(ft^3) = 18{,}000\ gal \times 0.13368\ \frac{ft^3}{gal} \cong 2{,}406\ ft^3 (Equation\ 1)$$

$$V_F = A_{room} \times \rho_{sprinkler} \times T \times 1.1\ (Equation\ 6)$$

$A_{room} = 924\ ft^2$ (Assumption A-3.4)

$$V_F\ (gal) = 924\ ft^2 \times 0.17\ gal/min/ft^2 \times 20\ min \times 1.1 = 3{,}455.76\ gal$$
$$V_F(ft^3) = 3{,}455.76\ gal \times 0.13368 \frac{ft^3}{gal} \cong 462\ ft^3 (Equation\ 1)$$

Therefore,

$$V_T(ft^3) = 2{,}406 ft^3 + 462 ft^3 = 2{,}868 ft^3$$

$$V_T(gal) = 18{,}000\ gal + 3455.76\ gal \cong 21{,}456\ gal$$

The required liner height for the room is calculated using the following equation:

H_L = Required Liner Height = $\frac{V_T}{A_{net}} + 1\ ft$ (Equation 9)

The net room area (A_{net}) is the combined footprint from the non-failed vessels in the room subtracted from the room area. There are no other vessels in the Low Point Drain Vessel Area.

$$A_{net} = A_{room} - \sum A_{vessel}\ (non - failed) \qquad \text{(Equation 5)}$$

$$\sum A_{vessel}\ (non - failed) = 0\ ft^2 \text{ (Equation 2)}$$

A_{net} = 924 ft^2 – 0 ft^2 = 924 ft^2

Therefore,

$$H_L = \frac{2{,}868 ft^3}{924 ft^2} + 1\ ft = 4.10 ft \cong 4\ ft\ 2\ inches\ (rounded\ up\ to\ the\ next\ inch)$$

A-5.2 **Required Liner Height for Evaporator Feed Vessel Area, Room E-0105, Elevation 0 ft**

Scenario: Leakage and spillage of the single largest vessel in area, Evaporator Feed Vessel (DEP-VSL-00002) (Assumption A-3.6) and accumulation of rainfall (Assumption A-3.11). No accumulation of fire water from automatic fire suppression system discharge (Assumption A-3.5).

The total vessel volume is compared to 110% of the maximum operating volume of the vessel to determine the controlling volume:

$$Total\ Vessel\ Volume = 42{,}300\ gal \text{ (Assumption A-3.6)}$$
$$110\%\ Maximum\ Operating\ Volume = 1.10 \times\ 38{,}000\ gal = 41{,}800\ gal \text{ (Assumption A-3.6)}$$
$$42{,}300\ gal > 41{,}800\ gal\ \ \therefore \text{ Total Vessel Volume is the Controlling Volume}$$

The total accumulated liquid volume for the Evaporator Feed Vessel area is calculated using the following equation:

$$V_T = V_V + V_R (Equation\ 8)$$

Where

$V_V(gal) = Controlling\ Volume =\ 42{,}300\ gal\ (Total\ Vessel\ Volume)$ (Assumption A-3.6)

$$V_V(ft^3) = 42{,}300 gal \times 0.13368 \frac{ft^3}{gal} \cong 5{,}655\ ft^3 (Equation\ 1)$$

V_R = Volume of Rainfall = $A_{room} \times \left(H_r \times \frac{1\ ft}{12\ in}\right)$ (Equation 7)

$A_{room} = 1{,}774\ ft^2$ (Assumption A-3.4)

$$V_R(ft^3) = 1{,}774\ ft^2 \times \left(1.56\ in\ \times \frac{1 ft}{12 in}\right) \cong 231\ ft^3$$

$$V_R\ (gal) = 231\ ft^3 \times \frac{1\ gal}{0.13368\ ft^3} \cong 1{,}728\ gal\ (Equation\ 1)$$

Therefore,

$$V_T(ft^3) = 5{,}655\ ft^3 + 231\ ft^3 = 5{,}886\ ft^3$$

$$V_T\ (gal) = 42{,}300\ gal + 1{,}728\ gal = 44{,}028\ gal$$

The required liner height for the room is calculated using the following equation:

$$H_L = \text{Required Liner Height} = \frac{V_T}{A_{net}} + 1\ ft \text{ (Equation 9)}$$

The net room area (A_{net}) is the combined footprint from the non-failed vessels in the room subtracted from the room area. The non-failed vessels are all three Evaporator Concentrate Vessels (DEP-VSL-00003A/B/C).

$$A_{net} = A_{room} - \sum A_{vessel}\ (non - failed) \qquad \text{(Equation 5)}$$

$$\sum A_{vessel}\ (non - failed) = 3\left(\frac{\pi d_{conc}^2}{4}\right) \text{ (Equation 2)}$$

d_{conc}= Diameter of Concentrate Vessel = 12 ft 1 in (Assumption A-3.6)

$$\sum A_{vessel}\ (non - failed) = 3\left(\frac{\pi\left[12\ ft + \left(1\ in \times \frac{1ft}{12in}\right)\right]^2}{4}\right) = 344\ ft^2$$

$$A_{net}\ =\ 1{,}774\ ft^2 - 344\ ft^2\ =\ 1{,}430\ ft^2$$

Therefore,

$$H_L = \frac{5{,}886 ft^3}{1{,}430 ft^2} + 1ft = 5.12ft \cong 5\ ft\ 2\ inches\ (rounded\ up\ to\ the\ next\ inch)$$

A-5.3 Required Liner Height for Process Condensate Lag Storage Vessel Area, Room E-0106, Elevation 0 ft

Scenario: Leakage and spillage of the single largest vessel in the area, one of the Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B) and accumulation of rainfall (Assumption A-3.11). No accumulation of fire water from automatic fire suppression system discharge (Assumption A-3.5).

The total vessel volume is compared to 110% of the maximum operating volume of the vessel to determine the controlling volume:

$$Total\ Vessel\ Volume = 127{,}260\ gal \text{ (Assumption A-3.6)}$$
$$110\%\ Maximum\ Operating\ Volume = 1.10 \times\ 111{,}761\ gal = 122{,}937\ gal \text{ (Assumption A-3.6)}$$
$$127{,}260\ gal > 122{,}937\ gal\ \ \therefore \text{ Total Vessel Volume is the Controlling Volume}$$

The total accumulated liquid volume for the Process Condensate Lag Storage Vessel Area is calculated using the following equation:

$$V_T = V_V + V_R (Equation\ 8)$$

Where

$V_V(gal) = Controlling\ Volume =\ 127{,}260\ gal\ (Total\ Vessel\ Volume)$ (Assumption A-3.6)

$$V_V(ft^3) = 127{,}260\ gal \times 0.13368 \frac{ft^3}{gal} \cong 17{,}012\ ft^3 (Equation\ 1)$$

V_R (ft^3) = Volume of Rainfall = $A_{room} \times \left(H_r \times \frac{1\ ft}{12\ in}\right)$ (Equation 7)

$A_{room} = 3{,}837\ ft^2$ (Assumption A-3.4)

$$V_R(ft^3) = 3{,}837\ ft^2 \times \left(1.56\ in\ \times \frac{1ft}{12in}\right) \cong 499\ ft^3$$

$$V_R\ (gal) = 499\ ft^3 \times \frac{1\ gal}{0.13368\ ft^3} \cong 3733\ gal\ (Equation\ 1)$$

Therefore,

$$V_T(ft^3) = 17{,}012\ ft^3 + 499\ ft^3 = 17{,}511\ ft^3$$

$$V_T\ (gal) = 127{,}260\ gal + 3{,}733\ gal = 130{,}993\ gal$$

The required liner height for the room is calculated using the following equation:

H_L (ft) = Required Liner Height = $\frac{V_T}{A_{net}}$ + 1 ft (Equation 9)

The net room area (A_{net}) is the combined footprint from the non-failed vessels in the room subtracted from the room area. The non-failed vessels are one of the Process Condensate Lag Storage Vessel (DEP-VSL-00005A/B) and both of the Overhead Sampling Vessels (DEP-VSL-00004A/B).

$A_{net} = A_{room} - \sum A_{vessel}\ (non - failed)$ (Equation 5)

$\sum A_{vessel}\ (non - failed) = \left(\frac{\pi d_{lag}^2}{4}\right) + 2\left(\frac{\pi d_{overhead}^2}{4}\right)$ (Equation 2)

d_{lag} = Diameter of Lag Storage Vessel = 25 ft 1 in (Assumption A-3.6)

$d_{overhead}$ = Diameter of Overhead Sampling Vessel = 14 ft 1 in (Assumption A-3.6)

$$\sum A_{vessel}\ (non - failed) = \left(\frac{\pi\left(\left[25ft + \left(1\ in \times \frac{1ft}{12in}\right)\right]^2\right)}{4}\right) + 2\left(\frac{\pi\left[14ft + \left(1\ in \times \frac{1ft}{12in}\right)\right]^2}{4}\right)$$

$$= 806\ ft^2$$

$$A_{net} = 3{,}837\ ft^2 - 806\ ft^2 = 3{,}031\ ft^2$$

Therefore,

$$H_L = \frac{17{,}511 ft^3}{3{,}031 ft^2} + 1ft = 6.78\ ft \cong 6\ ft\ 10\ inch\ (rounded\ up\ to\ the\ next\ inch)$$

A-5.4 Required Liner Heights for the West (E-0103) and East (E-0102) Evaporator Process Areas, Elevation 0 ft

Two scenarios are evaluated for West and East Evaporator Process Areas to determine the most conservative liner heights.

A-5.4.1 Scenario One for West Evaporator Process Area (E-0103)

Scenario: Leakage and spillage of the full volume of the single largest vessel with pump suction line in the area, Evaporator Feed Vessel (DEP-VSL-00002), into the West Evaporator Process Area as a result of an Evaporator Feed Pump suction line failure and accumulation of fire water from automatic fire suppression system discharge (Assumption A-3.5). No accumulation from rainfall (Assumption A-3.11).

The total vessel volume is compared to 110% of the maximum operating volume of the vessel to determine the controlling volume:

$$Total\ Vessel\ Volume = 42{,}300\ gal \text{ (Assumption A-3.6)}$$
$$110\%\ Maximum\ Operating\ Volume = 1.10 \times\ 38{,}000\ gal = 41{,}800\ gal \text{ (Assumption A-3.6)}$$
$$42{,}300\ gal > 41{,}800\ gal\ \ \therefore \text{ Total Vessel Volume is the Controlling Volume}$$

The total accumulated liquid volume for the West Evaporator Process Area is calculated using the following equation:

$$V_T = V_V + V_F (Equation\ 8)$$

Where

$V_V(gal) = Controlling\ Volume = \ 42{,}300\ gal\ (Total\ Vessel\ Volume)$ (Assumption A-3.6)

$$V_V(ft^3) = 42{,}300\ gal \times 0.13368 \frac{ft^3}{gal} \cong 5{,}655\ ft^3 (Equation\ 1)$$

$$V_F = A_{room} \times \rho_{sprinkler} \times T \times 1.1\ (Equation\ 6)$$

$A_{room} = 3{,}503\ ft^2$ (Assumption A-3.4)

$$V_F(gal) = 3{,}503\ ft^2 \times 0.17 gal/min/ft^2 \times 20\ min \times 1.1 = 13101.22 gal$$
$$V_F(ft^3) = 13{,}101.22\ gal \times 0.13368 \frac{ft^3}{gal} \cong 1{,}751\ ft^3 (Equation\ 1)$$

Therefore,

$$V_T(ft^3) = 5{,}655 ft^3 + 1{,}751 ft^3 = 7{,}406\ ft^3$$

$$V_T(gal) = 42{,}300\ gal + 13{,}101.22\ gal \cong 55{,}401\ gal$$

The required liner height for the room is calculated using the following equation:

$$H_L = \text{Required Liner Height} = \frac{V_T}{A_{net}} + 1 \text{ ft} \qquad \text{(Equation 9)}$$

The net room area (A_{net}) is the combined footprint from the non-failed vessels in the room subtracted from the room area. The non-failed vessels are the Evaporator (DEP-EVAP-00001), the Evaporator Reboiler (DEP-RBLR-00001), and the Evaporator Concentrate/Feed LAW Effluent Cooler (DEP-HX-00001).

$$A_{net} = A_{room} - \sum A_{vessel}\ (non - failed) \qquad \text{(Equation 5)}$$

$$\sum A_{vessel}\ (non - failed) = A_{EVAP} + A_{RBLR} + A_{HX}$$
$$= 79ft^2 + 24ft^2 + 7ft^2 = 110ft^2 \text{ (Assumption A-3.7)}$$

$A_{net} = 3{,}503\ ft^2 - 110\ ft^2 = 3{,}393\ ft^2$

Therefore,

$$H_L = \frac{7{,}406ft^3}{3{,}393ft^2} + 1\ ft = 3.18ft \cong 3\ ft\ 3\ inches\ (rounded\ up\ to\ the\ next\ inch)$$

A-5.4.2 Scenario One for East Evaporator Process Area (E-0102)

Scenario: Leakage and spillage of the full volume of the single largest vessel with a pump suction line in the area, one of the Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B), into the East Evaporator Process Area as a result of a Process Condensate Lag Storage Vessel pump suction line failure and accumulation of fire water from automatic fire suppression system discharge (Assumption A-3.5). No accumulation from rainfall (Assumption A-3.11).

The total vessel volume is compared to 110% of the maximum operating volume of the vessel to determine the controlling volume:

$$Total\ Vessel\ Volume = 127{,}260\ gal \text{ (Assumption A-3.6)}$$
$$110\%\ Maximum\ Operating\ Volume = 1.10 \times\ 111{,}761\ gal = 122{,}937\ gal \text{ (Assumption A-3.6)}$$
$$127{,}260\ gal > 122{,}937\ gal\ \therefore \text{ Total Vessel Volume is the Controlling Volume}$$

The total accumulated liquid volume for the East Evaporator Process Area is calculated below:

$$V_T = V_V + V_F (Equation\ 8)$$

Where

$$V_V(gal) = Controlling\ Volume =\ 127{,}260\ gal\ (Total\ Vessel\ Volume) \text{ (Assumption A-3.6)}$$
$$V_V(ft^3) = 127{,}260\ gal \times 0.13368\frac{ft^3}{gal} \cong 17{,}012\ ft^3 (Equation\ 1)$$

$V_F = A_{room} \times \rho_{sprinkler} \times T \times 1.1$ $(Equation\ 6)$

$A_{room} = 5{,}859\ ft^2$ (Assumption A-3.4)

$V_F(gal) = 5{,}859\ ft^2 \times 0.17 gal/min/ft^2 \times 20\ min \times 1.1 = 21{,}912.66\ gal$

$V_F(ft^3) = 21{,}912.66\ gal \times 0.13368\ \frac{ft^3}{gal} \cong 2{,}929\ ft^3 (Equation\ 1)$

Therefore,

$V_T(ft^3) = 17{,}012\ ft^3 + 2{,}929\ ft^3 = 19{,}941\ ft^3$

$V_T(gal) = 127{,}260\ gal + 21{,}912.66\ gal \cong 149{,}173\ gal$

The required liner height for the room is calculated using the following equation:

H_L = Required Liner Height = $\frac{V_T}{A_{net}} + 1\ ft$ (Equation 9)

The net room area (A_{net}) is the combined footprint from the non-failed vessels in the room subtracted from the room area. The non-failed vessels are the Steam Condensate Water Blowdown Vessel (SCW-VSL-00054), Reboiler Condensate Collection Vessel (DEP-VSL-00008), and Evaporator Condensers (DEP-COND-00001/2/3).

$$A_{net} = A_{room} - \sum A_{vessel}\ (non - failed) \qquad \text{(Equation 5)}$$

$$\sum A_{vessel}\ (non - failed) = A_{SCW} + A_{VSL8} + A_{COND1} + A_{COND2} + A_{COND3}$$
$$= 13\ ft^2 + 13\ ft^2 + 84\ ft^2 + 16\ ft^2 + 6\ ft^2 = 132\ ft^2$$
(Assumption A-3.7)

$A_{net} = 5{,}859\ ft^2 - 132\ ft^2 = 5{,}727\ ft^2$

Therefore,

$$H_L = \frac{19{,}941 ft^3}{5{,}727 ft^2} + 1\ ft = 4.48\ ft \cong 4\ ft\ 6\ inches\ (rounded\ up\ to\ the\ next\ inch)$$

A-5.4.3 Scenario Two for West and East Evaporator Process Areas

Scenario: The full volume of the single largest vessel with a pump suction in either Evaporator Process Areas, one of the Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B) normalizing between the combined process areas. Additionally, fire water from automatic fire suppression system discharge is accumulated (Assumption A-3.5). No accumulation of rainfall (Assumption A-3.11)

The total accumulated liquid volume for the West and East evaporator process areas is calculated using the following equation:

$$V_T = V_V + V_F \ (Equation\ 8)$$

Where

$V_V(gal) = Controlling\ Volume = \ 127{,}260\ gal\ (Total\ Vessel\ Volume)$(Assumption A-3.6)

$V_V(ft^3) = 127{,}260\ gal \times 0.13368\ \frac{ft^3}{gal} \cong 17{,}012\ ft^3 (Equation\ 1)$

$V_F = A_{room} \times \rho_{sprinkler} \times T \times 1.1\ (Equation\ 6)$

$A_{room} = (3{,}503\ ft^2 + 5{,}859\ ft^2) = 9{,}362 ft^2$ (Assumption A-3.4)

$V_F(gal) = 9{,}362\ ft^2 \times 0.17\ gal/min/ft^2 \times 20\ min \times 1.1 = 35{,}013.88\ gal$

$V_F(ft^3) = 35{,}013.88\ gal \times 0.13368 \frac{ft^3}{gal} \cong 4{,}681 ft^3 (Equation\ 1)$

Therefore,

$V_T(ft^3) = 17{,}012\ ft^3 + 4{,}681\ ft^3 = 21{,}693\ ft^3$

$V_T(gal) = 127{,}260\ gal + 35{,}013.88\ gal \cong 162{,}274\ gal$

The required liner height for the room is calculated using the following equation:

H_L = Required Liner Height = $\frac{V_T}{A_{net}} + 1ft$ (Equation 9)

The net room area (A_{net}) is the combined footprint from the non-failed vessels in the room subtracted from the room area. The non-failed vessels are the Evaporator Separator (DEP-EVAP-00001), Evaporator Reboiler (DEP-RBLR-00001), Evaporator Concentrate/Feed LAW Effluent Cooler (DEP-HX-00001), Steam Condensate Water Blowdown Vessel (SCW-VSL-00054), Reboiler Condensate Collection Vessel (DEP-VSL-00008), and Evaporator Condensers (DEP-COND-00001/2/3).

$$A_{net} = A_{room} - \sum A_{vessel}\ (non - failed) \qquad \text{(Equation 5)}$$

$$\sum A_{vessel}(non - failed) = A_{EVAP} + A_{RBLR} + A_{HX} + A_{SCW} + A_{VSL8} + A_{COND1} + A_{COND2} + A_{COND3}$$

$$\sum A_{vessel}(non - failed) = 79ft^2 + 24ft^2 + 7ft^2 + 13\text{ft}^2 + 13\text{ft}^2 + 84\text{ft}^2 + 16\text{ft}^2 + 6\text{ft}^2$$
$$= 242\ ft^2 \text{ (Assumption A-3.7)}$$

A_{net} = 9,362 ft^2 – 242 ft^2 = 9120 ft^2

Therefore,

$$H_L = \frac{21{,}693 ft^3}{9{,}120 ft^2} + 1ft = 3.38\ ft \cong 3\ ft\ 5\ inches\ (rounded\ up\ to\ the\ next\ inch)$$

The required liner height for this scenario is greater than the required liner height calculated in Scenario 1 for the West Evaporator Process Area, but smaller than the required liner height calculated in Scenario 1 for the East Evaporator Process Area. Therefore, 3 ft 5 inches will be the required liner height for the West Evaporator Process Area and 4 ft 6 inches will be the required liner height for the East Evaporator Process Area.

A-5.5 Calculation Summary

Calculation Section Number	Elevation (ft)	Containment Area Room Number	Area of Room (ft^2)	Area of Non-Failed Vessels (ft^2)	Net Room Area (ft^2)	Total Volume of Largest Vessel (gal)	Total Volume of Largest Vessel (ft^3)	Fire Water Volume (gal)	Fire Water Volume (ft^3)	Rainfall Volume (gal)	Rainfall Volume (ft^3)	Total Accumulated Liquid Volume (gal)	Total Accumulated Liquid Volume (ft^3)	Required Liner Height (ft)
A-5.1	-39	ED-B001 (Low Point Drain Vessel Area)	924	0	924	18,000	2,406	3,456	462	Not Applicable. Rainfall is not accumulated in indoor areas.		21,456	2,868	4 ft 2 in
A-5.2	0	E-0105 (Evaporator Feed Vessel Area)	1,774	344	1,430	42,300	5,655	Not Applicable. Fire water is not accumulated in outdoor areas.		1,728	231	44,028	5,886	5 ft 2 in
A-5.3	0	E-0106 (Process Condensate Lag Storage Vessel Area)	3,837	806	3,031	127,260	17,012			3,733	499	130,993	17,511	6 ft 10 in
A-5.4.1	0	E-0103 (West Evaporator Process Area) Scenario 1	3,503	110	3,393	42,300	5,655	13,101	1,751	Not Applicable. Rainfall is not accumulated in indoor areas.		55,401	7,406	3 ft 3 in
A-5.4.2	0	E-0102 (East Evaporator Process Area) Scenario 1	5,859	132	5,727	127,260	17,012	21,913	2,929			149,173	19,941	4 ft 6 in
A-5.4.3	0	E-0102/E-0103 (West & East Evaporator Process Area) Scenario 2	9,362	242	9,120	127,260	17,012	35,014	4,681			162,274	21,693	3 ft 5 in

A-6 References

A-6.1 24590-BOF-P1-25-00001, Rev. 0, Balance of Facilities LAW Effluent Process Bldg & LAW Effluent Drain Tank Bldg General Arrangement Plan at Elev. 0'-0".

A-6.2 24590-WTP-DB-ENG-01-001, Rev. 3, Basis of Design

A-6.3 24590-BOF-M0C-DEP-00001, Rev. B, Liner Height Calculation in the EMF

A-6.4 PNL-4622 UC-11, June 1983, Climatological Summary for the Hanford Area

A-6.5 24590-BOF-A5-25-05200001, Rev. 0, LAW Effluent Process Bldg 25 & Drain Tank Bldg 25A Architectural Room Finish Schedule

A-6.6 24590-WTP-GPG-M-033, Rev. 4, Fire Water Floor Drain System