



**Department of Energy**  
Richland Operations Office  
P.O. Box 550  
Richland, Washington 99352

14-AMRP-0075

JAN 14 2014

Ms. J. A. Hedges, Program Manager  
Nuclear Waste Program  
State of Washington  
Department of Ecology  
3100 Port of Benton  
Richland, Washington 99354

Dear Ms. Hedges:

**PROPOSED CLASS 2 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)  
PERMIT MODIFICATIONS AT THE HANFORD FACILITY LIQUID EFFLUENT  
RETENTION FACILITY AND 200 AREA EFFLUENT TREATMENT FACILITY  
(LERF/ETF) AND TEMPORARY AUTHORIZATION REQUEST**

The U.S. Department of Energy Richland Operations Office (RL) as owner/operator and CH2M HILL Plateau Remediation Company (CHPRC) as the co-operator (hereinafter referred to as the Permittees) are proposing Class 2 modifications to unit specific addendums of the LERF/ETF permit.

The Permittees are requesting Class 2 modifications per WAC 173-303-830(4)(b) for the following LERF/ETF permit addendums:

- Addendum C, Process Information
- Addendum F, Preparedness and Prevention
- Addendum I, Inspection Requirements

This modification request proposes to revise three addenda of the LERF/ETF Hanford Facility RCRA Permit by updating the frequency at which specified alarms, leak detectors, and level/pressure indicators are monitored. In addition, modifications are proposed that allow for an additional leachate monitoring method to be used to calculate the action leakage rate. A detailed summary table of the proposed LERF/ETF RCRA modifications is attached to this request that identifies the specific modifications requested, and also provides the justifications for the various changes from WAC 173-303-830 Appendix I. A red-line strikeout of the previous versions of these attachments outlining the proposed changes is also submitted with this request.

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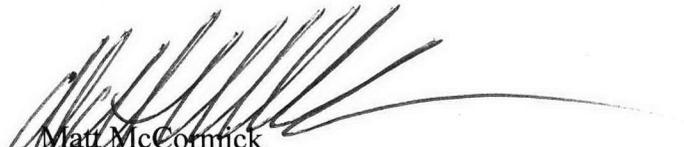
JAN 14 2014

The Permittees are requesting a temporary authorization (TA) that meets the criteria of WAC 173-303-830(4)(e)(iii)(B)(III) to prevent disruption of ongoing waste management activities. A temporary authorization to implement the requested Class 2 modifications to the Permit will allow the reduction from daily monitoring to proceed when no aqueous waste transfers or ETF processing operations are occurring. This will allow personnel to focus on more critical environmental and operational activities during the planned facility downtime in February thru April 2014, specifically to focus on the LERF cover cleanup effort. A temporary authorization request that provides additional information and justification for this TA is attached to this permit modification request. In the change summary table, the changes that are requested for a TA are identified; only those changes are requested for the TA.

The notice required by the Permittees in WAC 173-303-830(4)(e)(ii)(C) will be included in the appropriate Hanford Federal Facility Agreement and Consent Order publication or list server, as described in Hanford Facility RCRA Permit Condition I.C.3.

If you have any questions, please contact me, or your staff may contact Ray Corey, Assistant Manager for the River and Plateau, on (509) 373-9971.

Sincerely,



Matt McCormick  
Manager

AMRP:MSC

Attachments

cc: See Page 3

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cc w/attachs:

D. B. Bartus, EPA  
G. Bohnee, NPT  
F. W. Bond, Ecology  
R. Buck, Wanapum  
S. L. Dahl-Crumpler, Ecology  
D. A. Faulk, EPA  
S. Harris, CTUIR  
R. Jim, YN  
S. Hudson, HAB  
K. Niles, ODOE  
D. Rowland, YN  
E. R. Skinnerland, Ecology  
Administrative Record (LERF/ETF, TSD: S-2-8)  
Environmental Portal  
Ecology Library

cc w/o attachs:

L. M. Dittmer, CHPRC  
R. H. Engelmann, CHPRC  
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T. W. Noland, MSA  
R. E. Piippo, MSA  
J. R. Seaver, CHPRC

# Summary of Proposed LERF/ETF RCRA Mods - Addendum C, Addendum F, and Addendum I

Section	Page #	Modified Requirement/Text	Justification	Requested for Temporary Authorization?
C.2.1 (load-in) in last paragraph	C.3	Any leaks at the Load-in Station drain to the sump. A leak detector in the sump alarms locally and in the 200 Area ETF control room. <b>Alarms are monitored continuously during Load-in Station transfers and at least daily at other times.</b> Alternatively, leaks can be visually detected.	Class 2 justification: App. I Modification A.4.b*. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.2.5.1, Monitor & Control System	C.7	The operation of the 200 Area ETF is monitored and controlled by a centralized computer system (i.e., monitor and control system or MCS). The MCS continuously monitors data from various field indicators, such as pH, flow, tank level, temperature, pressure, conductivity, alarm status, and valve switch positions. Data gathered by the MCS enable operations and engineering personnel to document and adjust the operation of the ETF. <b>Emergency communications equipment and warning systems are included in Addendum J, Contingency Plan. These do not rely upon continuous control room monitoring.</b>	Class 1 justification: App. I Modification A.1. Administrative and informational changes. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.4.3.1.2, load-in tank secondary containment, end of 1st paragraph	C.19	Leaks are detected by a leak detector that alarms locally, in the 200 Area ETF control room, and by visual inspection of the secondary containment. <b>Alarms are monitored continuously during Load-in Station transfers and at least daily at other times.</b>	Class 2 justification: App. I Modification A.4.b*. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.4.3.1.2, surge tank secondary containment	C.19	Leaks into the secondary containment are detected by level instrumentation in the sump, <del>which alarms in the 200 Area ETF control room,</del> and/or by routine visual inspections. <b>Sump alarms are monitored continuously during ETF processing operations and at least daily at other times.</b>	Class 2 justification: App. I Modification A.4.b*. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.4.3.1.2, sump tank secondary containment	C.20	The sump tank levels are monitored by remote level indicators or through visual inspections from the sump covers. These indicators are connected to high- and low-level alarms that are monitored <del>in the control room</del> <b>during ETF processing operations and at least daily at other times.</b>	Class 2 justification: App. I Modification A.4.b*. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.4.3.1.2, verification tank secondary containment	C.20	Leaks into the secondary containment are detected by level instrumentation in the sump <del>that alarms in the control room,</del> and/or by routine visual inspections. <b>Sump alarms are monitored continuously during ETF processing operations and at least daily at other times.</b>	Class 2 justification: App. I Modification A.4.b*. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES

## Summary of Proposed LERF/ETF RCRA Mods - Addendum C, Addendum F, and Addendum I

Section	Page #	Modified Requirement/Text	Justification	Requested for Temporary Authorization?
C.4.3.2.1, double-walled (sump) tanks	C.21	The sump tanks are equipped with a leak detector between the walls of the tanks that provide continuous monitoring for leaks. <del>The leak detector provides immediate notification through an alarm in the control room.</del> <b>Sump tank alarms are monitored continuously during ETF processing operations and at least daily at other times.</b>	Class 2 justification: App. I Modification A.4.b*. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.4.3.2.2, (LERF-to-ETF) transfer piping and pipe trenches, 2nd para	C.21	<del>The alarms on the leak detection system are monitored in the control room. Alarms are monitored continuously during aqueous waste transfers between LERF and the ETF surge tank and at least daily at other times.</del>	Class 2 justification: App. I Modification A.4.b*. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.5.2, 242-A to LERF PL leak detection system	C.35	If a leak develops in the carrier pipe...As moisture contacts a sensor unit, an general alarm sounds in the 242-A Evaporator and 200 Area ETF control rooms and the zone of the sensor unit causing the alarm can be determined using the 242-A Evaporator leak detection monitoring panel. <del>at ETF. ETF troubleshoots the alarm and, upon verification of a leak, requests that the pump located in the 242-A Evaporator be shut down, to stopping the flow of aqueous waste through the transfer line.</del>	Class 1 justification: App. I Modification A.1. Administrative and informational changes. Removal of 242-A Evaporator functions is necessary to distinguish ETF vs 242-A Evaporator facility responsibilities.	NO
C.5.2, 242-A to LERF PL leak detection system	C.35	The catch basins have conductivity leak detectors <del>that alarm in the 242-A Evaporator and 200 Area ETF control rooms. Leak detector alarms are monitored continuously during aqueous waste transfers and at least daily at other times.</del>	Class 1 justification: App. I Modification A.1. Administrative and informational changes. & Class 2 justification: App. I Modification A.4.b*. Removal of 242-A Evaporator is necessary to distinguish ETF vs 242-A Evaporator facility responsibilities. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
C.5.6, (LERF leachate) leak detection, next-to-last para	C.36	<del>Automated controls maintain</del> The fluid level in each leachate sump is <b>maintained</b> below 33 centimeters to prevent significant liquid backup into the drainage layer. The leachate pump is activated when the liquid level in the sump reaches about 28 centimeters, and is shut off when the sump liquid level reaches about 18 centimeters. This operation <b>may be done either manually or automatically, prevents the leachate pump from cycling with no fluid, which could damage the pump.</b>	Class 2 justification: App. I Modification A.4.b* Historical data show extremely low leachate leak rates relative to the action leakage rate in C.5.8 (page 37). Therefore manual controls are not necessary and either automatic or manual pumping is acceptable.	NO

# Summary of Proposed LERF/ETF RCRA Mods - Addendum C, Addendum F, and Addendum I

Section	Page #	Modified Requirement/Text	Justification	Requested for Temporary Authorization?
C.5.6, (LERF leachate) leak detection, next-to-last para	C.36	A flow meter/totalizer on the leachate return pipe measures fluid volumes pumped and pumping rate from the leachate collection sumps, and indicates volume and flow rate on local readouts. <b>In addition, a timer on the leachate pump tracks the cumulative pump operating hours.</b>	Class 2 justification: App. I Modification A.4.b*. Historical data have shown that these two leachate data collection methods are comparable	NO
C.5.6, (LERF leachate) leak detection, next-to-last paragraph	C.36	Other instrumentation provided is real-time continuous level monitoring with readout at the catch basin <del>and the 242-A Evaporator control room</del> . <b>Leachate levels are monitored at least weekly.</b>	Class 1 justification: App. I Modification A.1, Administrative and Informational changes & Class 2 justification: App. I Modification A.4.b*. Removal of 242-A Evaporator is necessary to distinguish ETF vs 242-A Evaporator facility responsibilities. Leachate level monitoring from Table I-1 is added for informational purposes.	NO
C.5.6, (LERF leachate) leak detection, next-to-last paragraph	C.36	<del>Leak detection is provided through inspections of</del> <b>The leak rate through the primary liner is calculated using the leachate flow meter/totalizer readings or pump operating hours readings along with the pump flow rate. Calculations using either method are sufficient for compliance.</b>	Class 2 justification: App. I Modification A.4.b*. Historical data have shown that these two leachate data collection methods are comparable	NO
C.5.8 (Proposed Action Leakage Rate & Response Action Plan)	C.37	An action leakage rate (also called the rapid or large leak rate) of 20,000 liters per hectare per day <b>(2,100 gallons/acre/day)</b> was calculated for each basin (WVC 1992b).	Class 1 justification: App. I Modification A.1, Administrative and Informational changes: unit conversion provided	NO
F.2.3, Water Supplies, in 1st paragraph	F.3	The LERF is monitored <del>eleseely</del> <b>continuously during aqueous waste transfers and at least daily</b> during operation to detect abnormal conditions (e.g., leaks), and regularly inspected to detect equipment and structural deteriorations that could allow possible water supply contamination.	Class 2 justification: App. I Modification A.4.b*. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
F.2.3, Water Supplies, in 2nd paragraph	F.3	The 200 Area ETF is monitored during ETF <b>processing</b> operations to detect abnormal conditions, and is inspected regularly to detect equipment and structural deteriorations that could allow spills to the environment. Areas in contact with dangerous and/or mixed waste are monitored continuously during <b>Load-in Station and/or ETF processing</b> operations through a series of level and pressure indicators, leak detection alarms, equipment failure alarms, and control panel readouts.	Class 1 justification: App. I Modification A.1, Administrative and informational changes: clarified meaning of "operations"	YES

# Summary of Proposed LERF/ETF RCRA Mods - Addendum C, Addendum F, and Addendum I

Section	Page #	Modified Requirement/Text	Justification	Requested for Temporary Authorization?
I.1.2.2.1, Overfill Protection	I.2	Tanks that have the possibility of being overfilled have level instrumentation that alarms before the tanks reach overflow. High tank level alarms annunciate <del>in the control room</del> , allowing personnel to take immediate action to stop the vessels from overflowing. These alarms are monitored continuously <del>in the control room</del> during solution transfers.	Class 2 justification: App. I Modification A.4.b* Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room.	NO
I.1.2.2.3, Secondary Containment Leak Detectors	I.2	Surge and VT secondary containment systems have sloped floors that drain solutions to sumps equipped with leak detectors <del>that alarm in the control room</del> . These alarms are monitored continuously <del>in the control room</del> during ETF processing operations and at least daily at other times.	Class 2 justification: App. I Modification A.4.b*. Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.	YES
I.1.2.3.3, Leak Detection, first paragraph	I.3	The leachate detection, collection, and removal system is described in Addendum C. The leachate collection sump pump is <del>automatically</del> activated when the liquid level in the leachate sump reaches a preset level. A flow meter <del>and</del> /totalizer measures the amount of leachate removed. <del>In addition, the timer on the leachate pump tracks the cumulative pump run hours. The leak rate through the primary liner is calculated weekly using the leachate flow meter/totalizer readings or pump operating hours readings. Calculations using either method are sufficient for compliance. An inspection is performed weekly where the totalizer reading and basin level reading are used to determine the leak rate per wetted surface area. The leak rate is compared to previous rates to see if leakage has increased. If either the flow meter/totalizer or pump operating hours system is not functioning, this is identified as an abnormal condition (see I.1).</del>	Class 2 justification: App. I Modification A.4.b*. Historical data show extremely low leachate leak rates relative to the action leakage rate in C.5.8 (page 37). Therefore manual controls are not necessary and either automatic or manual pumping is acceptable. Clarification of the weekly calculation process is also provided.	NO
I.1.2.3.3, Leak Detection, third paragraph	I.3	The buried pipelines normally are continuously monitored during transfers by a leak detection system (Addendum C). <del>The alarms on the leak detection system are monitored in the 200 Area ETF control room.</del>	Class 2 justification: App. I Modification A.4.b* Alarms can be monitored from other locations throughout the facility and are not limited to monitoring from the control room.	NO
Table I.1, Visual Inspection Schedule for the LERF and 200 Area ETF	I.5 & I.6	<del>Stated inspection frequency to be performed only when system is in service during 200 area ETF operations.</del>	Class 2 justification: App. I Modification A.4.b*. The previously footnoted daily inspections will be performed daily regardless of ETF processing operations	NO

# Summary of Proposed LERF/ETF RCRA Mods - Addendum C, Addendum F, and Addendum I

Section	Page #	Modified Requirement/Text	Justification	Requested for Temporary Authorization?
Table I.2, Inspection Plan for Instrumentation Monitoring	1.7	<p>Added asterick and footnote: <b>Frequency of "continuously" applies during ETF processing and/or Load-in Station transfers. Data from MCS alarms, leak detectors, and level transmitters are monitored at least daily at other times, even though many of these instruments record continuously (see C.2.5.1). Emergency communications equipment and warning systems are included in Addendum J, Contingency Plan. These do not rely upon continuous control room monitoring.</b></p>	<p>Class 2 Justification: App. I Modification A.4.b*. Emergency response alarms can be heard throughout the facility and do not depend upon control room monitoring. This modification does not result in additional risk to personnel.</p>	YES

\*changes in frequency of or procedures for monitoring, reporting, sampling, or maintenance activities by the permittee

~~purple-strikeout~~ = permit text deleted in this modification

**red bold text** = text added in this modification

	<b>Addendum C</b>	<b>Process Information</b>
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## C. PROCESS INFORMATION

This addendum provides a detailed discussion of the LERF and 200 Area ETF processes and equipment. The LERF and 200 Area ETF comprise an aqueous waste treatment system located in the 200 East Area that provides storage and treatment for a variety of aqueous mixed waste. This aqueous waste includes process condensate from the 242-A Evaporator and other aqueous waste generated from onsite remediation and waste management activities.

The LERF consists of three lined surface impoundments, or basins. Aqueous waste from LERF is pumped to the 200 Area ETF for treatment in a series of process units, or systems, that remove or destroy essentially all of the dangerous waste constituents. The treated effluent is discharged to a State-Approved Land Disposal Site (SALDS) north of the 200 West Area, under the authority of a Washington State Waste Discharge Permit (Ecology 2000) and the Final Delisting ([40 CFR 261](#), Appendix IX, Table 2).

### C.1 LIQUID EFFLUENT RETENTION FACILITY PROCESS DESCRIPTION

Each of the three LERF basins has an operating capacity of 29.5-million liters. The LERF receives aqueous waste through several inlets including the following:

- A pipeline that connects LERF with the 242-A Evaporator
- A pipeline from the 200 West Area
- A pipeline that connects LERF to the Load-In Station at the 200 Area ETF
- A series of sample ports located at each basin.

Figure C.1 presents a general layout of LERF and associated pipelines. Aqueous waste from LERF is pumped to the 200 Area ETF through one of two double-walled fiberglass transfer pipelines. Effluent from the 200 Area ETF also can be transferred back to the LERF through one of these transfer pipelines. These pipelines are equipped with leak detection located in the annulus between the inner and outer pipes. In the event that these leak detectors are not in service, the pipelines are visually inspected during transfers for leakage by opening the secondary containment drain lines located at the 200 Area ETF end of the transfer pipelines.

Each basin is equipped with six available sample risers constructed of 6-inch perforated pipe. A seventh sample riser in each basin is dedicated to influent aqueous waste receipt piping (except for aqueous waste received from the 242-A Evaporator), and an eighth riser in each basin contains liquid level instrumentation. Each riser extends along the sides of each basin from the top to the bottom of the basin and allows samples to be collected from any depth. Personnel access to these sample ports is from the perimeter area of the basins.

A catch basin is provided at the northwest corner of each LERF basin for aboveground piping and manifolds for transfer pumps. Aqueous waste from the 242-A Evaporator is transferred through piping which ties into piping at the catch basins. Under routine operations, a submersible pump is used to transfer aqueous waste from a LERF basin to the 200 Area ETF for processing or for basin-to-basin transfers. This pump is connected to a fixed manifold on one of four available risers.

Each basin consists of a multilayer liner system supported by a concrete anchor wall around the basin perimeter and a soil-bentonite clay underlayment. The multilayer liner system consists of a primary liner in contact with the aqueous waste, a layer of bentonite carpet, a geonet, a geotextile, a gravel layer, and a secondary liner that rests on the bentonite underlayment. Any aqueous waste leakage through the primary liner flows through the geonet and gravel to a leachate collection system. The leachate flows to a sump at the northwest corner of each basin, where the leachate is pumped up the side slope and back into the basin above the primary liner. Each liner is constructed of high-density polyethylene. A floating cover made of very low-density polyethylene is stretched over each basin above the primary liner. These covers serve to keep unwanted material from entering the basins, and to minimize evaporation of the liquid contents.

## 1 C.2 EFFLUENT TREATMENT FACILITY PROCESS DESCRIPTION

2 The 200 Area ETF is designed as a flexible treatment system that provides treatment for contaminants  
3 anticipated in process condensate and other onsite aqueous waste. The design influent flow rate into the  
4 200 Area ETF is approximately 570 liters per minute, with planned outages for activities such as  
5 maintenance on the 200 Area ETF systems. Maintenance outages typically are scheduled between  
6 treating a batch of aqueous waste, referred to as treatment campaigns. The effluent flow (or volume) is  
7 equivalent to the influent flow (or volume).

8 The 200 Area ETF generally receives aqueous waste directly from the LERF. However, aqueous waste  
9 also can be transferred from tanker trucks at the Load-In Station to the 200 Area ETF and from containers  
10 (e.g., carboys, drums) directly to ETF. Aqueous waste is treated and stored in the 200 Area ETF process  
11 areas in a series of tank systems, referred to as process units. Within the ETF, waste also is managed in  
12 containers through treatment and/or storage. Figure C.2 provides the relative locations of the process and  
13 container storage areas within the ETF.

14 The process units are grouped in either the primary or the secondary treatment train. The primary  
15 treatment train provides for the removal or destruction of contaminants. Typically, the secondary  
16 treatment train processes the waste by-products from the primary treatment train by reducing the volume  
17 of waste. In the secondary treatment train, contaminants are concentrated and dried to a powder. The  
18 liquid fraction is routed to the primary treatment train. Figure C.3 provides an overview of the layout of  
19 the ETF, 2025E Building). Figure C.4 presents the 200 Area ETF floor plan, the relative locations of the  
20 individual process units and associated tanks within the ETF, and the location of the Load-In Station.

21 The dry powder waste and maintenance and operations waste are containerized and stored or treated in  
22 the container storage areas or in collection or treatment areas within the Process Area. Secondary  
23 containment is provided for all containers and tank systems (including ancillary equipment) housed  
24 within the ETF. The trenches and floor of the 200 Area ETF comprise the secondary containment system.  
25 The floor includes approximately a 15.2-centimeter rise (berm) along the containing walls of the process  
26 and container storage areas. Any spilled or leaked material from within the process area or container  
27 storage area is collected into trenches that feed into either sump tank 1 or sump tank 2. From these sump  
28 tanks, the spilled or leaked material (i.e., waste) is fed to either the surge tank and processed in the  
29 primary treatment train or the secondary waste receiving tanks and processed in the secondary treatment  
30 train. All tank systems outside of the 200 Area ETF are provided with a secondary containment system,

31 In the following sections, several figures are provided that present general illustrations of the treatment  
32 units and the relation to the process.

### 33 C.2.1 Load-In Station

34 The 200 Area ETF receives aqueous waste from LERF or the Load-In Station. The 200 Area ETF Load-  
35 In Station, located due east of the surge tank and outside of the perimeter fence (Figure C.4), was  
36 designed and constructed to provide the capability to unload, store, and transfer aqueous waste to the  
37 LERF or 200 Area ETF from tanker trucks and other containers (such as drums). The Load-In Station  
38 consists of two truck bays equipped with load-in tanks, transfer pumps, filtration system, level  
39 instrumentation for tanker trucks, leak detection capabilities for the containment basin and transfer line,  
40 and an underground transfer line that connects to lines in the surge tank berm, allowing transfers to either  
41 the 200 Area ETF surge tank or LERF. The Load-In Station is covered with a steel building for weather  
42 protection. Tanker trucks and other containers are used to unload aqueous waste at the Load-In Station.  
43 To perform unloading, the tanker truck is positioned on a truck pad, a 'load-in' transfer line is connected  
44 to the truck, and the tanker contents are pumped into one of the Load-In Station tanks, the surge tank, or  
45 directly to the LERF. For container unloading, the container is placed on the truck pad and the container  
46 contents are pumped into one of the Load-In Station tanks, the surge tank, or directly to the LERF.

1 During unloading operations, solids may be removed from the waste by pumping the contents of the  
2 tanker truck or container through a filtration system. If solids removal is not needed, the filtration system  
3 is not used and the solution is transferred directly to the Load-In Station tanks, surge tank, or to LERF.

4 Any leaks at the Load-In Station drain to the sump. A leak detector in the sump alarms locally and in the  
5 200 Area ETF control room. Alarms are monitored continuously during Load-in Station transfers and at  
6 least daily at other times. Alternatively, leaks can be visually detected.

## 7 **C.2.2 Effluent Treatment Facility Operating Configuration**

8 Because the operating configuration of the 200 Area ETF can be adjusted or modified, most aqueous  
9 waste streams can be effectively treated to below Delisting and Discharge Permit limits. The operating  
10 configuration of the 200 Area ETF depends on the unique chemistry of an aqueous waste stream(s).  
11 Before an aqueous waste stream is accepted for treatment, the waste is characterized and evaluated.  
12 Information from the characterization is used to adjust the treatment process or change the configuration  
13 of the 200 Area ETF process units, as necessary, to optimize the treatment process for a particular  
14 aqueous waste stream.

15 Typically, an aqueous waste is processed first in the primary treatment train, where the 200 Area ETF is  
16 configured to process an aqueous waste through the UV/OX unit first, followed by the RO unit.  
17 However, under an alternate configuration, an aqueous waste could be processed in the RO unit first. For  
18 example, high concentrations of nitrates in an aqueous waste might interfere with the performance of the  
19 UV/OX. In this case, the 200 Area ETF could be configured to process the waste in the RO unit before  
20 the UV/OX unit.

21 The flexibility of the 200 Area ETF also allows some aqueous waste to be processed in the secondary  
22 treatment train first. For example, for small volume aqueous waste with high concentrations of some  
23 anions and metals, the approach could be to first process the waste stream in the secondary treatment  
24 train. This approach would prevent premature fouling or scaling of the RO unit. The liquid portion (i.e.,  
25 untreated overheads from the 200 Area ETF evaporator and thin film dryer) would be sent to the primary  
26 treatment train.

27 Figure C.5 and Figure C.6 provide example process flow diagrams for two different operating  
28 configurations.

## 29 **C.2.3 Primary Treatment Train**

30 The primary treatment train consists of the following processes:

- 31 • Influent Receipt/Surge tank - inlet, surge capacity
- 32 • Filtration - for suspended solids removal
- 33 • UV/OX - organic destruction
- 34 • pH adjustment - waste neutralization
- 35 • Hydrogen peroxide decomposition - removal of excess hydrogen peroxide
- 36 • Degasification - removal of carbon dioxide
- 37 • RO - removal of dissolved solids
- 38 • IX - removal of dissolved solids
- 39 • Verification - holding tanks during verification

40 **Influent Receipt/Surge Tank.** Depending on the configuration of the ETF, the surge tank is one inlet  
41 used to feed an aqueous waste into the 200 Area ETF for treatment. In Configuration 1 (Figure C.5), the  
42 surge tank is the first component downstream of the LERF. The surge tank provides a storage/surge  
43 volume for chemical pretreatment and controls feed flow rates from the LERF to the 200 Area ETF.  
44 However, in Configuration 2 (Figure C.6), aqueous waste from LERF is fed directly into the treatment  
45 units. In this configuration, the surge tank receives aqueous waste, which has been processed in the RO  
46 units, and provides the feed stream to the remaining downstream process units. In yet another  
47 configuration, some small volume aqueous waste could be received into the secondary treatment train  
48 first for processing. In this case, the aqueous waste would be received directly into the secondary waste

1 receiving tanks. Finally, the surge tank also receives waste extracted from various systems within the  
2 primary and secondary treatment train while in operation.

3 The surge tank is located outside the 200 Area ETF on the south side. In the surge tank (Figure C.7), the  
4 pH of an aqueous waste is adjusted using the metered addition of sulfuric acid and sodium hydroxide, as  
5 necessary, to prepare the waste for treatment in downstream processes. In addition, hydrogen peroxide or  
6 biocides could be added to control biological growth in the surge tank. A pump recirculates the contents  
7 in the surge tank, mixing the chemical reagents with the waste to a uniform pH.

8 **Filtration.** Two primary filter systems remove suspended particles in an aqueous waste: a rough filter  
9 removes the larger particulates, while a fine filter removes the smaller particulates. The location of these  
10 filters depends on the configuration of the primary treatment train. However, the filters normally are  
11 located upstream of the RO units.

12 The solids accumulating on these filter elements are backwashed to the secondary waste receiving tanks  
13 with pulses of compressed air and water, forcing water back through the filter. The backwash operation is  
14 initiated either automatically by a rise in differential pressure across the filter or manually by an operator.  
15 The filters are cleaned chemically when the backwashing process does not facilitate acceptable filter  
16 performance.

17 Auxiliary fine and rough filters (e.g., disposable filters) have been installed to provide additional filtration  
18 capabilities. Depending on the configuration of the ETF, the auxiliary filters are operated either in series  
19 with the primary filters to provide additional filtration or in parallel, instead of the primary fine and rough  
20 filters, to allow cleaning/maintenance of the primary fine and rough filters while the primary treatment  
21 train is in operation.

22 **Ultraviolet Light/Oxidation.** Organic compounds contained in an aqueous waste stream are destroyed  
23 in the UV/OX system (Figure C.8). Hydrogen peroxide is mixed with the waste. The UV/OX system  
24 uses the photochemical reaction of UV light on hydrogen peroxide to form hydroxyl radicals and other  
25 reactive species that oxidize the organic compounds. The final products of the complete reaction are  
26 carbon dioxide, water, and inorganic ions.

27 Organic destruction is accomplished in two UV/OX units operating in parallel. During the UV/OX  
28 process, the aqueous waste passes through reaction chambers where hydrogen peroxide is added. While  
29 in the UV/OX system, the temperature of an aqueous waste is monitored. Heat exchangers are used to  
30 reduce the temperature of the waste should the temperature of the waste approach the upper limits for the  
31 UV/OX or RO systems.

32 **pH Adjustment.** The pH of a waste stream is monitored and controlled at different points throughout the  
33 treatment process. Within the primary treatment train, the pH of a waste can be adjusted with sulfuric  
34 acid or sodium hydroxide to optimize operation of downstream treatment processes or adjusted before  
35 final discharge. For example, the pH of an aqueous waste would be adjusted in the pH adjustment tank  
36 after the UV/OX process and before the RO process. In this example, pH is adjusted to cause certain  
37 chemical species such as ammonia to form ammonium sulfate, thereby increasing the rejection rate of the  
38 RO.

39 **Hydrogen Peroxide Decomposition.** Typically, hydrogen peroxide added into the UV/OX system is not  
40 consumed completely by the system. Because hydrogen peroxide is a strong oxidizer, the residual  
41 hydrogen peroxide from the UV/OX system is removed to protect the downstream equipment. The  
42 hydrogen peroxide decomposer uses a catalyst to break down the hydrogen peroxide that is not consumed  
43 completely in the process of organic destruction. The aqueous waste is sent through a column that breaks  
44 down the hydrogen peroxide into water and oxygen. The gas generated by the decomposition of the  
45 hydrogen peroxide is vented to the vessel off gas system.

46 **Degasification.** The degasification column is used to purge dissolved carbon dioxide from the aqueous  
47 waste to reduce the carbonate loading to downstream dissolved solids removal processes within the  
48 200 Area ETF primary treatment train. The purged carbon dioxide is vented to the vessel off gas system.

1 **Reverse Osmosis.** The RO system (Figure C.9) uses pressure to force clean water molecules through  
2 semi-permeable membranes while keeping the larger molecule contaminants, such as dissolved solids,  
3 and large molecular weight organic materials, in the membrane. The RO process uses a staged  
4 configuration to maximize water recovery. The process produces two separate streams, including a clean  
5 'permeate' and a concentrate (or retentate), which are concentrated as much as possible to minimize the  
6 amount of secondary waste produced.

7 The RO process is divided into first and second stages. Aqueous waste is fed to the first RO stage from  
8 the RO feed tank. The secondary waste receiving tanks of the secondary treatment train receive the  
9 retentate removed from the first RO stage, while the second RO stage receives the permeate (i.e., 'treated'  
10 aqueous waste from the first RO stage). In the second RO stage, the retentate is sent to the first stage RO  
11 feed tank while the permeate is sent to the IX system or to the surge tank, depending on the configuration  
12 of the ETF.

13 Two support systems facilitate this process. An anti-scale system injects scale inhibitors as needed into  
14 the feed waste to prevent scale from forming on the membrane surface. A clean-in-place system using  
15 cleaning agents, such as descalants and surfactants, cleans the membrane pores of surface and subsurface  
16 deposits that have fouled the membranes.

17 **Ion Exchange.** Because the RO process removes most of the dissolved solids in an aqueous waste, the  
18 IX process (Figure C.10) acts as a polishing unit. The IX system consists of three columns containing  
19 beds of cation and/or anion resins. This system is designed to allow for regeneration of resins and  
20 maintenance of one column while the other two are in operation. Though the two columns generally are  
21 operated in series, the two columns also can be operated in parallel or individually.

22 Typically, the two columns in operation are arranged in a primary/secondary (lead/lag) configuration, and  
23 the third (regenerated) column is maintained in standby. When dissolved solids breakthrough the first  
24 IX column and are detected by a conductivity sensor, this column is removed from service for  
25 regeneration, and the second column replaces the first column and the third column is placed into service.  
26 The column normally is regenerated using sulfuric acid and sodium hydroxide. The resulting  
27 regeneration waste is collected in the secondary waste receiving tanks.

28 Spent resins are transferred into a disposal container should regeneration of the IX resins become  
29 inefficient. Free water is removed from the container and returned to the surge tank. Dewatered resins are  
30 transferred to a final storage/disposal point.

31 **Verification.** The three verification tanks (Figure C.11) are used to hold the treated effluent while a  
32 determination is made that the effluent meets discharge limits. The effluent can be returned to the  
33 primary treatment train for additional treatment, or to the LERF, should a treated effluent not meet  
34 Discharge Permit or Final Delisting requirements.

35 The three verification tanks alternate between three operating modes: receiving treated effluent, holding  
36 treated effluent during laboratory analysis and verification, or discharging verified effluent. Treated  
37 effluent may also be returned to the 200 Area ETF to provide 'clean' service water for operational and  
38 maintenance functions, e.g., for boiler water and for backwashing the filters. This recycling keeps the  
39 quantity of fresh water used to a minimum.

#### 40 **C.2.4 Secondary Treatment Train**

41 The secondary treatment system typically receives and processes the following by-products generated  
42 from the primary treatment train: concentrate from the first RO stage, filter backwash, regeneration waste  
43 from the ion exchange system, and spillage or overflow received into the process sumps. Depending on  
44 the operating configuration, however, some aqueous waste could be processed in the secondary treatment  
45 train before the primary treatment train (refer to Figure C.5 and Figure C.6 for example operating  
46 configurations).

47 The secondary treatment train provides the following processes:

- 1 • Secondary waste receiving - tank receiving and chemical addition
- 2 • Evaporation - concentrates secondary waste streams
- 3 • Concentrate staging - concentrate receipt, pH adjustment, and chemical addition
- 4 • Thin film drying - dewatering of secondary waste streams
- 5 • Container handling - packaging of dewatered secondary waste

6 **Secondary Waste Receiving.** Waste to be processed in the secondary treatment train is received into two  
7 secondary waste receiving tanks, where the pH can be adjusted with sulfuric acid or sodium hydroxide for  
8 optimum evaporator performance. Chemicals, such as reducing agents, may be added to waste in the  
9 secondary waste receiving tanks to reduce the toxicity or mobility of constituents in the powder.

10 **Evaporation.** The 200 Area ETF evaporator is fed alternately by the two secondary waste receiving  
11 tanks. One tank serves as a waste receiver while the other tank is operated as the feed tank. The  
12 200 Area ETF evaporator vessel (also referred to as the vapor body) is the principal component of the  
13 evaporation process (Figure C.12).

14 Feed from the secondary waste receiving tanks is pumped through a heater to the recirculation loop of the  
15 200 Area ETF evaporator. In this loop, concentrated waste is recirculated from the 200 Area ETF  
16 evaporator, to a heater, and back into the evaporator where vaporization occurs. As water leaves the  
17 evaporator system in the vapor phase, the concentration of the waste in the evaporator increases. When  
18 the concentration of the waste reaches the appropriate density, a portion of the concentrate is pumped to  
19 one of the concentrate tanks.

20 The vapor that is released from the 200 Area ETF evaporator is routed to the entrainment separator, where  
21 water droplets and/or particulates are separated from the vapor. The 'cleaned' vapor is routed to the vapor  
22 compressor and converted to steam. The steam from the vapor compressor is sent to the heater (reboiler)  
23 and used to heat the recirculating concentrate in the 200 Area ETF evaporator. From the heater, the steam  
24 is condensed and fed to the distillate flash tank, where the saturated condensate received from the heater  
25 drops to atmospheric pressure and cools to the normal boiling point through partial flashing (rapid  
26 vaporization caused by a pressure reduction). The resulting distillate is routed to the surge tank. The  
27 non-condensable vapors, such as air, are vented through a vent gas cooler to the vessel off gas system.

28 **Concentrate Staging.** The concentrate tanks make up the head end of the thin film drying process. From  
29 the 200 Area ETF evaporator, concentrate is pumped into two concentrate tanks, and pH adjusted  
30 chemicals, such as reducing agents, may be added to reduce the toxicity or mobility of constituents when  
31 converted to powder. Waste is transferred from the concentrate tanks to the thin film dryer for conversion  
32 to a powder. The concentrate tanks function alternately between concentrate receiver and feed tank for  
33 the thin film dryer. However, one tank may serve as both concentrate receiver and feed tank.

34 Because low solubility solids (i.e., calcium and magnesium sulfate) tend to settle in the concentrate tanks,  
35 these solids must be removed to prevent fouling and to protect the thin film dryer, and to maintain  
36 concentrate tank capacity.

37 **Thin Film Drying.** From the concentrate tanks, feed is pumped to the thin film dryer (Figure C.13) that  
38 is heated by steam. As the concentrated waste flows down the length of the dryer, the waste is dried. The  
39 dried film, or powder, is scraped off the dryer cylinder by blades attached to a rotating shaft. The powder  
40 is funneled through a cone-shaped powder hopper at the bottom of the dryer and into the Container  
41 Handling System.

42 Overhead vapor released by the drying of the concentrate is condensed in the distillate condenser. Excess  
43 heat is removed from the distillate by a water-cooled heat exchanger. Part of the distillate is circulated  
44 back to the condenser spray nozzles. The remaining distillate is pumped to the surge tank. Any  
45 noncondensable vapors and particulates from the spray condenser are exhausted to the vessel off gas  
46 system.

47 **Container Handling.** Before an empty container is moved into the Container Handling System  
48 (Figure C.14), the lid is removed and the container is placed on a conveyor. The containers are moved

1 into the container filling area after passing through an air lock. The empty container is located under the  
2 thin film dryer, and raised into position. The container is sealed to the thin film dryer and a rotary valve  
3 begins the transfer of powder to the empty container. Air displaced from the container is vented to the  
4 distillate condenser attached to the 200 Area ETF evaporator that exhausts to the vessel off gas system.

5 The container is filled to a predetermined level, then lowered from the thin film dryer and moved along a  
6 conveyor. The filled container is manually recapped, and moved along the conveyor to the airlock. At  
7 the airlock, the container is moved onto the conveyor by remote control. The airlock is opened, the smear  
8 sample (surface wipe) is taken, and the contamination level counted. A 'C' ring is installed to secure the  
9 container lid. If the container has contaminated material on the outside, the container is wiped down and  
10 retested. Filled containers that pass the smear test are labeled, placed on pallets, and moved by forklift to  
11 the filled container storage area. Section C.3 provides a more detailed discussion of container handling.

## 12 **C.2.5 Other Effluent Treatment Facility Systems**

13 The 200 Area ETF is provided with support systems that facilitate treatment in the primary and secondary  
14 treatment trains and that provide for worker safety and environmental protection. An overview of the  
15 following systems is provided:

- 16 • Monitor and control system
- 17 • Vessel off gas system
- 18 • Sump collection system
- 19 • Chemical injection feed system
- 20 • Verification tank recycle system
- 21 • Utilities

### 22 **C.2.5.1 Monitor and Control System**

23 The operation of the 200 Area ETF is monitored and controlled by a centralized computer system (i.e.,  
24 monitor and control system or MCS). The MCS continuously monitors data from various field indicators,  
25 such as pH, flow, tank level, temperature, pressure, conductivity, alarm status, and valve switch positions.  
26 Data gathered by the MCS enable operations and engineering personnel to document and adjust the  
27 operation of the ETF.

28 [Emergency communications equipment and warning systems are included in Addendum J, Contingency](#)  
29 [Plan. These do not rely upon continuous control room monitoring.](#)

### 31 **C.2.5.2 Vessel Off gas System**

32 Ventilation for various tanks and vessels is provided through the vessel off gas system. The system  
33 includes a moisture separator, duct heater, pre-filter, high-efficiency particulate air filters, carbon absorber  
34 (when required to reduce organic emissions), exhaust fans, and ductwork. Gasses ventilated from the  
35 tanks and vessels enter the exhaust system through the connected ductwork. The vessel off gas system  
36 draws vapors and gasses off the following tanks and treatment systems:

- 37 • Surge tank
- 38 • Vent gas cooler (off the ETF evaporator/distillate flash tank)
- 39 • pH adjustment tank
- 40 • Concentrate tanks
- 41 • Degasification system
- 42 • First and second RO stages
- 43 • Dry powder hopper
- 44 • Effluent pH adjustment tank
- 45 • Drum capping station
- 46 • Secondary waste receiving tanks
- 47 • Distillate condenser (off the thin film dryer)

1 • Sump tanks 1 and 2

2 The vessel off gas system maintains a negative pressure with respect to the atmosphere, which produces a  
3 slight vacuum within tanks, vessels, and ancillary equipment for the containment of gas vapor. This  
4 system also provides for the collection, monitoring, and treatment of confined airborne in-vessel  
5 contaminants to preclude over-pressurization. The high-efficiency particulate air filters remove  
6 particulates and condensate from the air stream before these are discharged to the heating, ventilation, and  
7 air conditioning system.

8 **C.2.5.3 Sump Collection System**

9 Sump tanks 1 and 2 compose the sump collection system that provides containment of waste streams and  
10 liquid overflow associated with the 200 Area ETF processes. The process area floor is sloped to two  
11 separate trenches that each drain to a sump tank located under the floor of the 200 Area ETF  
12 (Figure C.15). One trench runs the length of the primary treatment train and drains to Sump Tank 2,  
13 located underneath the verification tank pump floor. The second trench collects spillage primarily from  
14 the secondary treatment train and flows to Sump Tank 1, located near the 200 Area ETF evaporator.  
15 Sump tanks 1 and 2 are located below floor level (Figure C.15). An eductor in these tanks prevents  
16 sludge from accumulating.

17 **C.2.5.4 Chemical Injection Feed System**

18 At several points within the primary and secondary treatment trains, sulfuric acid and sodium hydroxide  
19 (or dilute solutions of these reagents) are metered into specific process units to adjust the pH. For  
20 example, a dilute solution of 4 percent sulfuric acid and 4 percent sodium hydroxide could be added to  
21 the secondary waste receiving tanks to optimize the evaporation process.

22 **C.2.5.5 Verification Tank Recycle System**

23 To reduce the amount of water added to the process, verification tank water (i.e., verified effluent) is  
24 recycled throughout the 200 Area ETF process. Tanks and ancillary equipment that use verification tank  
25 water include:

- 26 • 4 percent H<sub>2</sub>SO<sub>4</sub> solution tank and ancillary equipment
- 27 • 4 percent NaOH solution tank and ancillary equipment
- 28 • Clean-in-place tank and ancillary equipment
- 29 • IX columns (during resin regeneration)
- 30 • 200 Area ETF evaporator boiler and ancillary equipment
- 31 • Thin film dryer boiler and ancillary equipment
- 32 • Seal water system. In addition, verification tank water is used extensively during maintenance  
33 activities. For example, it may be used to flush piping systems or to confirm the integrity of piping, a  
34 process tank or tank truck.

35 **C.2.5.6 Utilities**

36 The 200 Area ETF maintains the following utility supply systems required for the operation of the ETF:

- 37 • Cooling water system - removes heat from process water via heat exchangers and a cooling tower
- 38 • Compressed air system - provides air to process equipment and instrumentation
- 39 • Seal water system - provides cool, clean, pressurized water to process equipment for pump seal  
40 cooling and pump seal lubrication, and provides protection against failure and fluid leakage
- 41 • Demineralized water system - removes solids from raw water system to produce high quality, low  
42 ion-content, water for steam boilers, and for the hydrogen peroxide feed system.
- 43 • Heating, ventilation, and air conditioning system - provides continuous heating, cooling, and air  
44 humidity control throughout the ETF.

45 The following utilities support 200 Area ETF activities:

- 46 • Electrical power

- 1 • Sanitary water
- 2 • Communication systems
- 3 • Raw water

### 4 **C.3 CONTAINERS**

5 This section provides specific information on container storage and treatment operations at the 200 Area  
6 ETF, including descriptions of containers, labeling, and secondary containment structures.

7 A list of dangerous and/or mixed waste managed in containers at the 200 Area ETF is presented in  
8 Addendum A. The types of dangerous and/or mixed waste managed in containers in the 200 Area ETF  
9 could include:

- 10 • Secondary waste powder generated from the treatment process
- 11 • Aqueous waste received from other Hanford site sources awaiting treatment
- 12 • Miscellaneous waste generated by operations and maintenance activities.

13 The secondary treatment train processes the waste by-products from the primary treatment train, which  
14 are concentrated and dried into a powder. Containers are filled with dry powder waste from the thin film  
15 dryer via a remotely controlled system. Containers of aqueous waste received from other Hanford site  
16 sources are stored at 200 Area ETF until their contents can be transferred to the process for treatment.  
17 The waste is usually transferred to the secondary waste receiving or concentration tanks. Miscellaneous  
18 waste generated from maintenance and operations activities are stored at the ETF. The waste could  
19 include process waste, such as used filter elements; spent RO membranes; damaged equipment, and  
20 decontamination and maintenance waste, such as contaminated rags, gloves, and other personal protective  
21 equipment. Containers of miscellaneous waste which have free liquids generally are packaged with  
22 absorbents.

23 Several container collection areas could be located within the 200 Area ETF process and container  
24 handling areas. These collection areas are used only to accumulate waste in containers. Once a container  
25 is filled, the container is transferred to a container storage area (Figure C.3 and Figure C.4), to another  
26 TSD unit, or to a less-than-90-day storage pad. Containers stored in the additional storage area  
27 (Figure C.4) are elevated or otherwise protected from contact with accumulated liquids. The container  
28 storage area within 200 Area ETF is a 22.9 x 8.5-meter room located adjacent to the 200 Area ETF  
29 process areas. The containers within the container storage area are clearly labeled, and access to these  
30 containers is limited by barriers and by administrative controls. The 200 Area ETF floor provides  
31 secondary containment, and the 200 Area ETF roof and walls protects all containers from exposure to the  
32 elements.

33 Waste also could be placed in containers for treatment as indicated in Addendum A. For example, sludge  
34 that accumulates in the bottoms of the process tanks is removed periodically and placed into containers.  
35 In this example, the waste is solidified by decanting the supernate from the container and the remainder of  
36 the waste is allowed to evaporate, or absorbents are added, as necessary, to address remaining liquids.  
37 Following treatment, this waste either is stored at the 200 Area ETF or transferred to another TSD unit.

#### 38 **C.3.1 Description of Containers**

39 The containers used to collect and store dry powder waste are 208-liter steel containers. Most of the  
40 aqueous waste received at 200 Area ETF, and maintenance and operation waste generated, are stored in  
41 208-liter steel or plastic containers; however, in a few cases, the size of the container could vary to  
42 accommodate the size of a particular waste. For example, some process waste, such as spent filters,  
43 might not fit into a 208-liter container. In the case of spent resin from the IX columns, the resin is  
44 dewatered, and could be packaged in a special disposal container. In these few cases, specially sized  
45 containers could be required. In all cases, however, only approved containers are used and are compatible  
46 with the associated waste. Typically, 208-liter containers are used for treatment.

47 Current operating practices indicate the use of new 208-liter containers that have either a polyethylene  
48 liner or a protective coating. Any reused or reconditioned container is inspected for container integrity

1 before use. Overpack containers are available for use with damaged containers. Overpack containers  
2 typically are unlined steel or polyethylene.

3 Per Addendum A, a maximum of 147,630 liters of dangerous and/or mixed waste could be stored in  
4 containers in the 200 Area ETF.

### 5 **C.3.2 Container Management Practices**

6 Before use, each container is checked for signs of damage such as dents, distortion, corrosion, or  
7 scratched coating. For dry powder loading, empty containers on pallets are raised by a forklift and  
8 manually placed on the conveyor that transports the containers to the automatic filling station in the  
9 container handling room (Figure C.14). The container lids are removed and replaced manually following  
10 the filling sequence. After filling, containers exit the container handling room via the filled drum  
11 conveyor. Locking rings are installed, the container label is affixed, and the container is moved by dolly  
12 or forklift to the container storage area.

13 Before receipt at 200 Area ETF, each container from other Hanford site sources is inspected for leaks,  
14 signs of damage, and a loose lid. The identification number on each container is checked to ensure the  
15 proper container is received. The containers are typically placed on pallets and moved by dolly or forklift  
16 to the container storage area. These containers are later moved to the process area and the contents  
17 transferred to the process for treatment.

18 Containers used for storing maintenance and operations secondary waste are labeled before being placed  
19 in the container storage area or in a collection area. Lids are secured on these containers when not being  
20 filled. When the containers in a collection area are full, the containers are transferred by dolly or forklift  
21 to the container storage area or to an appropriate TSD unit. Containers used for treating waste also are  
22 labeled. The lids on these containers are removed as required to allow for treatment. During treatment,  
23 access to these containers is controlled through physical barriers and/or administrative controls.

24 The filled containers in the container storage area are inventoried, checked for proper labeling, and placed  
25 on pallets or in a separate containment device as necessary. Each pallet is moved by forklift. Within the  
26 container storage area, palletized containers are stacked no more than three pallets high and in rows no  
27 more than two containers wide. Unobstructed aisles with a minimum of 76-centimeter aisle space  
28 separate rows.

### 29 **C.3.3 Container Labeling**

30 Labels are affixed on containers used to store dry powder when the containers leave the container  
31 handling room. Labels are affixed on other waste containers before use. Every container is labeled with  
32 the date that the container was filled. Appropriate major risk labels, such as "corrosive", "toxic", or  
33 "F-listed", also are added. Each container also has a label with an identification number for tracking  
34 purposes.

### 35 **C.3.4 Containment Requirements for Managing Containers**

36 Secondary containment is provided in the container management areas within the ETF. The secondary  
37 containment provided for tank systems also serves the container management areas. This section  
38 describes the design and operation of the secondary containment structure for these areas.

#### 39 **C.3.4.1 Secondary Containment System Design**

40 For the container management areas, the reinforced concrete floor and a 15.2-centimeter rise (berm) along  
41 the walls of the container storage area of the 200 Area ETF provides secondary containment. The  
42 engineering assessment required for tanks (Mausshardt 1995) also describes the design and construction  
43 of the secondary containment provided for the 200 Area ETF container management areas. All systems  
44 were designed to national codes and standards (e.g., American Society for Testing Materials, American  
45 Concrete Institute standards).

1 The floor is composed of cast-in-place, pre-formed concrete slabs, and has a minimum thickness of 15.2  
2 centimeters. All slab joints and floor and wall joints have water stops installed at the mid-depth of the  
3 slab. In addition, filler was applied to each joint. The floor and berms are coated with a chemically  
4 resistant; high-solids epoxy coating system consisting of primer and top coating. This coating material is  
5 compatible with the waste managed in containers and is an integral part of the secondary containment  
6 system for containers.

7 The floor is sloped to drain any solution in the container storage area to floor drains along the west wall,  
8 Each floor drain consists of a grating over a 20.3-centimeter diameter drain port connected to a 4-inch  
9 polyvinyl chloride transfer pipe. The pipe passes under this wall and connects to a trench running along  
10 the east wall of the adjacent process area. This trench drains solution to sump tank 1.

11 The container storage area is separated from the process area by a common wall and a door for access to  
12 the two areas (Figure C.3). These two areas also share a common floor and trenches that, with the  
13 15.2-centimeter rise of the containing walls, form the secondary containment system for the process area  
14 and the container storage area.

#### 15 **C.3.4.2 Structural Integrity of Base**

16 Engineering calculations were performed showing the floor of the container storage area is capable of  
17 supporting the weight of containers. These calculations were reviewed and certified by a professional  
18 engineer (Mausshardt 1995). The concrete was inspected for damage during construction. Cracks were  
19 identified and repaired to the satisfaction of the professional engineer. Documentation of these  
20 certifications is included in the engineering assessment (Mausshardt 1995).

#### 21 **C.3.4.3 Containment System Capacity**

22 The container storage area is primarily used to store dry powder, aqueous waste awaiting treatment, and  
23 maintenance and operation waste. Where appropriate, absorbents are added to fix any trace liquids  
24 present. Large volumes of liquid are not stored in the container storage area. However, liquids might be  
25 present in those containers that are in the treatment process. The maximum volume of waste that can be  
26 stored in containers in the container storage area is 147,630 liters.

27 Because they are interconnected by floor drains, both the process area and the container storage area are  
28 considered in the containment system capacity. The volume available for secondary containment in the  
29 process area is approximately 68,000 liters, as discussed in the engineering assessment (Mausshardt  
30 1995). Using the dimensions of the container storage area (23.6 by 8.5 by 0.2 meters), and assuming that  
31 50 percent of the floor area is occupied by containers, the volume of the container storage area is  
32 15,300 liters. The Truck Bay loading areas (see Figure C.4) also provides 10,500 liters of containment as  
33 it is connected to the other two areas. The combined volume of the Truck Bay loading areas and process  
34 area, and container handling area available for secondary containment, is 93,800 liters. This volume is  
35 greater than 10 percent of the maximum total volume of containers allowed for storage in the ETF, as  
36 discussed previously.

#### 37 **C.3.4.4 Control of Run-on**

38 The container management areas are located within the ETF, which serves to prevent run-on of  
39 precipitation.

#### 40 **C.3.4.5 Removal of Liquids from Containment Systems**

41 The container storage area is equipped with drains that route solution to a trench in the process area,  
42 which drains to sump tank 1. The sump tanks are equipped with alarms that notify operating personnel  
43 that a leak is occurring. The sump tanks also are equipped with pumps to transfer waste to the surge tank  
44 or the secondary treatment train.

### 1 C.3.4.6 Prevention of Ignitable, Reactive, and Incompatible Wastes in Containers

2 Individual waste types (i.e., ignitable, corrosive, and reactive) are stored in separate containers. A waste  
3 that could be incompatible with other wastes is separated and protected from the incompatible waste.  
4 Incompatible wastes are evaluated using the methodology documented in [40 CFR 264](#), Appendix V. For  
5 example, acidic and caustic wastes are stored in separate containers. Free liquids are absorbed in  
6 miscellaneous waste containers that hold incompatible waste. Additionally, ETF-specific packaging  
7 requirements for these types of waste provide extra containment with each individual container. For  
8 example, each item of acidic waste is individually bagged and sealed within a lined container.

## 9 C.4 TANK SYSTEMS

10 This section provides specific information on tank systems and process units. This section also includes a  
11 discussion on the types of waste to be managed in the tanks, tank design information, integrity  
12 assessments, and additional information on the 200 Area ETF tanks that treat and store dangerous and/or  
13 mixed waste. The 200 Area ETF dangerous waste tanks are identified in Section 4C.4.1.1, and the  
14 relative locations of the tanks and process units in the 200 Area ETF are presented in Figure C.3.

### 15 C.4.1 Design Requirements

16 The following sections provide an overview of the design specifications for the tanks within the ETF. A  
17 separate discussion on the design of the process units also is provided. In accordance with the new tank  
18 system requirements of [WAC 173-303-640\(3\)](#), the following tank components and specifications were  
19 assessed:

- 20 • Dimensions, capacities, wall thicknesses, and pipe connections
- 21 • Materials of construction and linings and compatibility of materials with the waste being processed
- 22 • Materials of construction of foundations and structural supports
- 23 • Review of design codes and standards used in construction
- 24 • Review of structural design calculations, including seismic design basis
- 25 • Waste characteristics and the effects of waste on corrosion

26 This assessment was documented in the *Final RCRA Information Needs Report* (Mausshardt 1995; the  
27 engineering assessment performed for the 200 Area ETF tank systems by an independent professional  
28 engineer. A similar assessment of design requirements was performed for Load-in tanks 59A-TK-109  
29 and -117 and is documented in *200 Area Effluent BAT/AKART Implementation, ETF Truck Load-in*  
30 *Facility, Project W-291H Integrity Assessment Report* (KEH 1994). An assessment was also performed  
31 when Load-in tank 59A-TK-1 was placed into service for receipt of dangerous and mixed wastes. The  
32 assessment is documented in *200 Area ETF Purgewater Unloading Facility Tank System Integrity*  
33 *Assessment* (HNF 2009a).

34 The specifications for the preparation, design, and construction of the tank systems at the 200 Area ETF  
35 are documented in the *Design Construction Specification, Project C-018H, 242-A Evaporator/PUREX*  
36 *Plant Process Condensate Treatment Facility* (WHC 1992a). The preparation, design, and construction  
37 of Load-in tanks 59A-TK-109 and -117 are provided in the construction specifications in *Project W-291,*  
38 *200 Area Effluent BAT/AKART Implementation ETF Truck Load-in Facility* (KEH 1994). The  
39 preparation, design and construction of Load-in 59A-TK-1 are documented in *Purgewater Unloading*  
40 *Facility Project Documentation* (HNF 2009b).

41 Most of the tanks in the 200 Area ETF are constructed of stainless steel. According to the design of the  
42 ETF, it was determined stainless steel would provide adequate corrosion protection for these tanks.  
43 Exceptions include Load-in tank 59A-TK-1, which is constructed of fiberglass-reinforced plastic and the  
44 verification tanks, which are constructed of carbon steel with an epoxy coating. The 200 Area ETF  
45 evaporator/vapor body (and the internal surfaces of the thin film dryer) is constructed of a corrosion  
46 resistant alloy, known as alloy 625, to address the specific corrosion concerns in the secondary treatment  
47 train. Finally, the hydrogen peroxide decomposer vessels are constructed of carbon steel and coated with  
48 a vinyl ester lining.

1 The shell thicknesses of the tanks identified in Table C.5 represent a nominal thickness of a new tank  
2 when placed into operation. The tank capacities identified in this table represent the maximum volumes.  
3 Nominal tank volumes discussed below represent the maximum volume in a tank unit during normal  
4 operations.

#### 5 **C.4.1.1 Codes and Standards for Tank System Construction**

6 Specific standards for the manufacture of tanks and process systems installed in the 200 Area ETF are  
7 briefly discussed in the following sections. In addition to these codes and industrial standards, a seismic  
8 analysis for each tank and process system is required [WAC 173-303-806(4)(a)(xi)]. The seismic  
9 analysis was performed in accordance with UCRL-15910 *Design and Evaluation Guidelines for*  
10 *Department of Energy Facilities Subjected to Natural Phenomena Hazards*, Section 4 (UCRL 1987).  
11 The results of the seismic analyses are summarized in the engineering assessment of the 200 Area ETF  
12 tank systems (Mausshardt 1995).

13 **Storage and Treatment Tanks.** The following tanks store and/or treat dangerous waste at the ETF.

14 <u>Tank name</u>	<u>Tank number</u>
15 Surge tank	2025E-60A-TK-1
16 pH adjustment tank	2025E-60C-TK-1
17 Effluent pH adjustment tank	2025E-60C-TK-2
18 First RO feed tank	2025E-60F-TK-1
19 Second RO feed tank	2025E-60F-TK-2
20 Verification tanks (three)	2025E-60H-TK-1A/1B/1C
21 Secondary waste receiving tanks (two)	2025E-60I-TK-1A/1B
22 Evaporator (vapor body)	2025E-60I-EV-1
23 Concentrate tanks (two)	2025E-60J-TK-1A/1B
24 Sump tanks (two)	2025E-20B-TK-1/2
25 Distillate flash tank	2025E-60I-TK-2
26 Load-in tanks	2025ED-59A-TK-1/109/117

27 The relative location of these tanks is presented in Figure C.3. These tanks are maintained at or near  
28 atmospheric pressure. The codes and standards applicable to the design, construction, and testing of the  
29 above tanks and ancillary piping systems are as follows:

30 ASME - B31.3 Chemical Plant and Petroleum Refinery Piping (ASME 1990)

31 ASME Sect. VIII, Division I Pressure Vessels (ASME 1992a)

32 AWS - D1.1 Structural Welding Code - Steel (AWS 1992)

33 ANSI - B16.5 Pipe Flanges and Flanged Fittings (ANSI 1992)

34 ASME Sect. IX Welding and Brazing Qualifications (ASME 1992b)

35 API 620 Design and Construction of Large Welded Low Pressure Storage Tanks (API 1990)

36 AWWA - D100 Welded Steel Tanks for Water Storage (AWWA 1989)

37 AWWA - D103 Factory-Coated Bolted Steel Tanks for Water Storage (AWWA 1987)

38 AWWA - D120 Thermosetting Fiberglass-Reinforced Plastic Tanks (AWWA 1984)

39 ASTM-D3299 Filament Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion Resistant Tanks.

40  
41 The application of these standards to the construction of 200 Area ETF tanks and independent verification  
42 of completed systems ensured that the tank and tank supports had sufficient structural strength and that  
43 seams and connections were adequate to ensure tank integrity. In addition, each tank met strict quality  
44 assurance requirements. Each tank constructed offsite was tested for integrity and leak tightness before

1 shipment to the Hanford Facility. Following installation, the systems were inspected for damage to  
2 ensure against leakage and to verify proper operation. If a tank was damaged during shipment or  
3 installation, leak tightness testing was repeated onsite.

#### 4 **C.4.1.2 Design Information for Tanks Located Outside of Effluent Treatment Facility**

5 The load-in tanks, surge tank, and verification tanks are located outside the ETF. These tanks are located  
6 within concrete structures that provide secondary containment.

7 **Load-In Tanks and Ancillary Equipment.** The load-in tanks 59A-TK-109 and -117 are heated and  
8 constructed of stainless steel, and have a nominal capacity of 31,000 liters. Load-in tank 59A-TK-1 is  
9 heated and constructed of fiberglass reinforced plastic and has a nominal capacity of 24,500 liters. Load-  
10 in tanks 59A-TK-109 and -117 are located outside of the metal building while Load-in tank 59A-TK-1 is  
11 located inside the building. Ancillary equipment includes transfer pumps, filtration systems, a double  
12 encased, fiberglass transfer pipeline, level instruments for tanker trucks, and leak detection equipment.  
13 From the Load-In Station, aqueous waste can be routed to the surge tank or to the LERF through a  
14 double-encased line. The load-in tanks, sump, pumps, and truck pad are all provided with secondary  
15 containment.

16 **Surge Tank and Ancillary Equipment.** The surge tank is constructed of stainless steel and has a  
17 nominal capacity of 421,000 liters. Ancillary equipment to the surge tank includes two underground  
18 double encased (i.e., pipe-within-a-pipe) transfer lines connecting to LERF and three pumps for  
19 transferring aqueous waste to the primary treatment train. The surge tank is located at the south end of  
20 the ETF. The surge tank is insulated and the contents heated to prevent freezing. Eductors in the tank  
21 provide mixing.

22 **Verification Tanks and Ancillary Equipment.** The verification tanks are located north of the ETF.  
23 The verification tanks have a nominal capacity of 2,760,000 liters each. For support, the tanks have a  
24 center post with a webbing of beams that extend from the center post to the sides of the tank. The roof is  
25 constructed of epoxy covered carbon steel that is attached to the cross beams of the webbing. The tank  
26 floor also is constructed of epoxy covered carbon steel and is sloped. Eductors are installed in each tank  
27 to provide mixing.

28 Ancillary equipment includes a return pump that provides circulation of treated effluent through the  
29 eductors. The return pump also recycles effluent back to the 200 Area ETF for retreatment and can  
30 provide service water for 200 Area ETF functions. Two transfer pumps are used to discharge treated  
31 effluent to SALDS or back to the LERF.

#### 32 **C.4.1.3 Design Information for Tanks Located Inside the Effluent Treatment Facility** 33 **Building**

34 Most of the 200 Area ETF tanks and ancillary equipment that store or treat dangerous and/or mixed waste  
35 are located within the ETF. The structure serves as secondary containment for the tank systems.

36 **pH Adjustment Tank and Ancillary Equipment.** The pH adjustment tank has a nominal capacity of  
37 16,000 liters. Ancillary equipment for this tank includes overflow lines to a sump tank and pumps to  
38 transfer waste to other units in the main treatment train.

39 **Effluent pH Adjustment Tank and Ancillary Equipment.** The effluent pH adjustment tank has a  
40 nominal capacity of 13,700 liters. Ancillary equipment includes overflow lines to a sump tank and pumps  
41 to transfer waste to the verification tanks.

42 **First and Second Reverse Osmosis Feed Tanks and Ancillary Equipment.** The first RO feed tank is a  
43 vertical, stainless steel tank with a round bottom and has a nominal capacity of 19,700 liters. Conversely,  
44 the second RO feed tank is a rectangular vessel with the bottom of the tank sloping sharply to a single  
45 outlet in the bottom center. The second RO feed tank has a nominal capacity of 7,800 liters. Each RO  
46 tank has a pump to transfer waste to the RO arrays. Overflow lines are routed to a sump tank.

1 **Secondary Waste Receiving Tanks and Ancillary Equipment.** Two nominal 69,000-liter secondary  
2 waste receiving tanks collect waste from the units in the main treatment train, such as concentrate solution  
3 (retentate) from the RO units and regeneration solution from the IX columns. These are vertical,  
4 cylindrical tanks with a semi-elliptical bottom and a flat top. Ancillary equipment includes overflow lines  
5 to a sump tank and pumps to transfer aqueous waste to the 200 Area ETF evaporator.

6 **Effluent Treatment Facility Evaporator and Ancillary Equipment.** The 200 Area ETF evaporator,  
7 the principal component of the evaporation process, is a cylindrical pressure vessel with a conical bottom.  
8 Aqueous waste is fed into the lower portion of the vessel. The top of the vessel is domed and the vapor  
9 outlet is configured to prevent carryover of liquid during the foaming or bumping (violent boiling) at the  
10 liquid surface. The 200 Area ETF evaporator has a nominal operating capacity of approximately  
11 18,500 liters.

12 The 200 Area ETF evaporator includes the following ancillary equipment:

- 13 • Preheater
- 14 • Recirculation pump
- 15 • Waste heater with steam level control tank
- 16 • Concentrate transfer pump
- 17 • Entrainment separator
- 18 • Vapor compressor with silencers
- 19 • Silencer drain pump.

20 **Distillate Flash Tank and Ancillary Equipment.** The distillate flash tank is a horizontal tank that has a  
21 nominal operating capacity of 780 liters. Ancillary equipment includes a pump to transfer the distillate to  
22 the surge tank for reprocessing.

23 **Concentrate Tanks and Ancillary Equipment.** Each of the two concentrate tanks has an approximate  
24 nominal capacity of 22,700 liters. Ancillary equipment includes overflow lines to a sump tank and pumps  
25 for recirculation and transfer.

26 **Sump Tanks.** Sump tanks 1 and 2 are located below floor level. Both sump tanks are double-walled,  
27 rectangular tanks, placed inside concrete vaults. Both tanks have a working volume of 4,000 liters each.  
28 The sump tanks are located in pits below grade to allow gravity drain of solutions to the tanks. Each  
29 sump tank has two vertical pumps for transfer of waste to the secondary waste receiving tanks or to the  
30 surge tank for reprocessing.

#### 31 **C.4.1.4 Design Information for Effluent Treatment Facility Process Units**

32 As with the 200 Area ETF tanks, process units that treat and/or store dangerous and/or mixed waste are  
33 maintained at or near atmospheric pressure. These units were constructed to meet a series of design  
34 standards, as discussed in the following sections. Table C.6 presents the materials of construction and the  
35 ancillary equipment associated with these process units. All piping systems are designed to withstand the  
36 effects of internal pressure, weight, thermal expansion and contraction, and any pulsating flow. The  
37 design and integrity of these units are presented in the engineering assessment (Mausshardt 1995).

38 **Filters.** The load-in fine and rough filter vessels (including the influent and auxiliary filters) are designed  
39 to comply with the ASME Section VIII, Division I, Pressure Vessels (ASME 1992a). The application of  
40 these standards to the construction of the 200 Area ETF filter system and independent inspection ensure  
41 that the filter and filter supports have sufficient structural strength and that the seams and connections are  
42 adequate to ensure the integrity of the filter vessels.

43 **Ultraviolet Oxidation System.** The UV/OX reaction chamber is designed to comply with manufacturers  
44 standards.

45 **Degasification System.** The codes and standards applicable to the design, fabrication, and testing of the  
46 degasification column are identified as follows:

- 47 • ASME - B31.3, Chemical Plant and Petroleum Refinery Piping (ASME 1990)

- 1 • AWS - D1.1, Structural Welding Code - Steel (AWS 1992)
- 2 • ANSI - B16.5, Pipe Flanges and Flanged Fittings (ANSI 1992)

3 **Reverse Osmosis System.** The pressure vessels in the RO unit are designed to comply with ASME  
4 Section VIII, Division I, Pressure Vessels (ASME 1992a), and applicable codes and standards.

5 **Ion Exchange (Polishers).** The IX columns are designed in accordance with ASME Section VIII,  
6 Division I, Pressure Vessels (ASME 1992a), and applicable codes and standards. Polisher piping is  
7 fabricated of type 304 stainless steel or polyvinyl chloride (PVC) and meets the requirements of  
8 ASME B31.3, Chemical Plant and Petroleum Refinery Piping (ASME 1990).

9 **Effluent Treatment Facility Evaporator.** The 200 Area ETF evaporator is designed to meet the  
10 requirements of ASME Section VIII, Division I, Pressure Vessels (ASME 1992a), and applicable codes  
11 and standards. The 200 Area ETF evaporator piping meets the requirements of ASME B31.3, Chemical  
12 Plant and Petroleum Refinery Piping (ASME 1990).

13 **Thin Film Dryer System.** The thin film dryer is designed to meet the requirements of ASME  
14 Section VIII, Division I, Pressure Vessels (ASME 1992a), and applicable codes and standards. The  
15 piping meets the requirements of ASME - B31.3, Chemical Plant and Petroleum Refinery Piping  
16 (ASME 1990).

#### 17 **C.4.1.5 Integrity Assessments.**

18 The integrity assessment for 200 Area ETF (Mausshardt 1995) attests to the adequacy of design and  
19 integrity of the tanks and ancillary equipment to ensure that the tanks and ancillary equipment will not  
20 collapse, rupture, or fail over the intended life considering intended uses. For the load-in tanks, a similar  
21 integrity assessment was performed (KEH 1995 and HNF 2009a). Specifically, the assessment  
22 documents the following considerations:

- 23 • Adequacy of the standards used during design and construction of the facility
- 24 • Characteristics of the solution in each tank
- 25 • Adequacy of the materials of construction to provide corrosion protection from the solution in each  
26 tank
- 27 • Results of the leak tests and visual inspections

28 The results of these assessments demonstrate that tanks and ancillary equipment have sufficient structural  
29 integrity and are acceptable for storing and treating dangerous and/or mixed waste. The assessments also  
30 state that the tanks and building were designed and constructed to withstand a design-basis earthquake.  
31 Independent, qualified registered professional engineers certified these tank assessments.

32 The scope of the 200 Area ETF tank integrity assessment was based on characterization data from process  
33 condensate. To assess the effect that other aqueous waste might have on the integrity of the 200 Area  
34 ETF tanks, the chemistry of an aqueous waste will be evaluated for its potential to corrode a tank (e.g.,  
35 chloride concentrations will be evaluated). The tank integrity assessment for the load-in tanks was based  
36 on characterization data from several aqueous waste streams. The chemistry of an aqueous waste stream  
37 not considered in the load-in tank integrity assessment also will be evaluated for the potential to corrode a  
38 load-in tank.

39 Consistent with the recommendations of the integrity assessment, a corrosion inspection program was  
40 developed. Periodic integrity assessments are scheduled for those tanks predicted to have the highest  
41 potential for corrosion. These inspections are scheduled annually or longer, based on age of the tank  
42 system, materials of construction, characteristics of the waste, operating experience, and  
43 recommendations of the initial integrity assessment. These 'indicator tanks' include the concentrate  
44 tanks, secondary waste receiving tanks, and verification tanks. One of each of these tanks will be  
45 inspected yearly to determine if corrosion or coating failure has occurred. Should significant corrosion or  
46 coating failure be found, an additional tank of the same type would be inspected during the same year. In

1 the case of the verification tanks, if corrosion or coating failure is found in the second tank, the third tank  
2 also will be inspected. If significant corrosion were observed in all three sets of tanks, the balance of the  
3 200 Area ETF tanks would be considered for inspection. For tanks predicted to have lower potential for  
4 corrosion, inspections also are performed nonroutinely as part of the corrective maintenance program.

#### 5 **C.4.2 Additional Requirements for New Tanks**

6 Procedures for proper installation of tanks, tank supports, piping, concrete, etc., are included in  
7 *Construction Specification, Project C-018H, 242-A Evaporator/PUREX Plant Process Condensate*  
8 *Treatment Facility* (WHC 1992a). For the load-in tanks, procedures are included in the construction  
9 specifications in *Project W-291, 200 Area Effluent BAT/AKART Implementation ETF Truck Load-in*  
10 *Facility* (KEH 1994) and *Purgewater Unloading Facility Project Documentation* (HNF 2009b).  
11 Following installation, an independent, qualified, registered professional engineer inspected the tanks and  
12 secondary containment. Deficiencies identified included damage to the surge tank, damage to the  
13 verification tank liners, and 200 Area ETF secondary containment concrete surface cracking. All  
14 deficiencies were repaired to the satisfaction of the engineer. The tanks and ancillary equipment were  
15 leak tested as part of acceptance of the system from the construction contractor. Information on the  
16 inspections and leak tests are included in the engineering assessment (Mausshardt 1995). No deficiencies  
17 were identified during installation of the load-in tanks and ancillary equipment.

#### 18 **C.4.3 Secondary Containment and Release Detection for Tank Systems**

19 This section describes the design and operation of secondary containment and leak detection systems at  
20 the ETF.

##### 21 **C.4.3.1 Secondary Containment Requirements for All Tank Systems**

22 The specifications for the preparation, design, and construction of the secondary containment systems at  
23 the 200 Area ETF are documented (WHC 1992a). The preparation, design, and construction of the  
24 secondary containment for the load-in tanks are provided in the construction specifications (KEH 1994  
25 and HNF 2009b). All systems were designed to national codes and standards. Constructing the 200 Area  
26 ETF per these specifications ensured that foundations are capable of supporting tank and secondary  
27 containment systems and that uneven settling and failures from pressure gradients should not occur.

##### 28 **C.4.3.1.1 Common Elements**

29 The following text describes elements of secondary containment that are common to all 200 Area ETF  
30 tank systems. Details on the secondary containment for specific tanks, including leak detection systems  
31 and liquids removal, are provided in Section 4C.4.4.1.2.

32 **Foundation and Construction.** For the tanks within the ETF, except for the sump tanks, secondary  
33 containment is provided by a coated concrete floor and a 15.2-centimeter rise (berm) along the containing  
34 walls. The double-wall construction of the sump tanks provides secondary containment. Additionally,  
35 trenches are provided in the floor that also provides containment and drainage of any liquid to a sump pit.  
36 For tanks outside the ETF, secondary containment also is provided with coated concrete floors in a  
37 containment pit (load-in tanks) or surrounded by concrete dikes (the surge and verification tanks).

38 The transfer piping that carries aqueous waste into the 200 Area ETF is pipe-within-a-pipe construction,  
39 and is buried approximately 1.2 meters below ground surface. The pipes between the verification tanks  
40 and the verification tank pumps within the 200 Area ETF are located in a concrete pipe trench.

41 For this discussion, there are five discrete secondary containment systems associated with the following  
42 tanks and ancillary equipment that treat or store dangerous waste:

- 43 • Load-in tanks
- 44 • Surge tank
- 45 • Process area (including sump tanks)
- 46 • Verification tanks
- 47 • Transfer piping and pipe trenches

1 All of the secondary containment systems are designed with reinforcing steel and base and berm thickness  
2 to minimize failure caused by pressure gradients, physical contact with the waste, and climatic conditions.  
3 Classical theories of structural analysis, soil mechanics, and concrete and structural steel design were used  
4 in the design calculations for the foundations and structures. These calculations are maintained at the  
5 ETF. In each of the analyses, the major design criteria from the following documents were included:

V-C018HC1-001	Design Construction Specification, Project C-018H, 242A Evaporator/PUREX Plant Process Condensate Treatment Facility (WHC 1992a)
DOE Order 6430.1A	General Design Criteria
SDC-4.1	Standard Architectural-Civil Design Criteria, Design Loads for Facilities (DOE-RL 1988)
UCRL-15910	Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards (UCRL 1987)
UBC-91	Uniform Building Code, 1991 Edition (ICBO 1991)
UBC-97	Uniform Building Code, 1997 Edition (ICC 1997, for Load-in tank 59A-TK-1)

6 The design and structural analysis calculations substantiate the structural designs in the referenced  
7 drawings. The conclusions drawn from these calculations indicate that the designs are sound and that the  
8 specified structural design criteria were met. This conclusion is verified in the independent design review  
9 that was part of the engineering assessment (Mausshardt 1995, KEH 1994, and HNF 2009a).

10 **Containment Materials.** The concrete floor consists of cast-in-place and preformed concrete slabs. All  
11 slab joints and floor and wall joints have water stops installed at the mid-depth of the slab. In addition,  
12 filler was applied to each joint.

13 Except for the sump tank vaults, all of the concrete surfaces in the secondary containment system,  
14 including berms, trenches, and pits, are coated with a chemical-resistant, high-solids, epoxy coating that  
15 consists of a primer and a top coating. This coating material is compatible with the waste being treated,  
16 and with the sulfuric acid, sodium hydroxide, and hydrogen peroxide additives to the process. The  
17 coating protects the concrete from contact with any chemical materials that might be harmful to concrete  
18 and prevents the concrete from being in contact with waste material. Table C.8 summarizes the specific  
19 types of primer and top coats specified for the concrete and masonry surfaces in the ETF. The epoxy  
20 coating is considered integral to the secondary containment system for the tanks and ancillary equipment.

21 The concrete containment systems are maintained such that any cracks, gaps, holes, and other  
22 imperfections are repaired in a timely manner. Thus, the concrete containment systems do not allow  
23 spilled liquid to reach soil or groundwater. There are a number of personnel doorways and vehicle access  
24 points into the 200 Area ETF process areas. Releases of any spilled or leaked material to the environment  
25 from these access points are prevented by 15.2-centimeter concrete curbs, sloped areas of the floor  
26 (e.g., truck ramp), or trenches.

27 **Containment Capacity and Maintenance.** Each of these containment areas is designed to contain more  
28 than 100 percent of the volume of the largest tank in each respective system. Secondary containment  
29 systems for the surge tank, and the verification tanks, which are outside the ETF, also are large enough to  
30 include the additional volume from a 25-year, 24-hour storm event; i.e., 5.3 centimeters of precipitation.

31 **Sprinkler System.** The sprinkler system within the 200 Area ETF supplies firewater protection to the  
32 process area and the container storage area. This system is connected to a site wide water supply system  
33 and has the capacity to supply sufficient water to suppress a fire at the ETF. However, in the event of  
34 failure, the sprinkler system can be hooked up to another water source (e.g., tanker truck).

#### 35 **C.4.3.1.2 Specific Containment Systems**

36 The following discussion presents a description of the individual containment systems associated with  
37 specific tank systems.

1 **Load-In Tank Secondary Containment.** The load-in tanks 59A-TK-109 and -117 are mounted on a 46-  
2 centimeter-thick reinforced concrete slab (Drawing H-2-817970). Secondary containment is provided by  
3 a pit with 30.5-centimeter-thick walls and a floor constructed of reinforced concrete. The load-in tank pit  
4 is sloped to drain solution to a sump. The depth of the pit varies with the slope of the floor, with an  
5 average thickness of about 1.1 meters. The volume of the secondary containment is about 73,000 liters,  
6 which is capable of containing the volume of at least one load-in tank (i.e., 34,200 liters). Leaks are  
7 detected by a leak detector that alarms locally, in the 200 Area ETF control room, and by visual  
8 inspection of the secondary containment. Alarms are monitored continuously during Load-in Station  
9 transfers and at least daily at other times

10 Adjacent to the pit is a 25.4-centimeter-thick reinforced concrete pad that serves as secondary  
11 containment for the load-in tanker trucks, containers, transfer pumps, and filter system that serve as the  
12 first tanker truck unloading bay. The pad is inside the metal Load-in building and is 15.2 centimeters  
13 below grade with north and south walls gently sloped to allow truck access. The pad has a 3-inch drain  
14 pipe to route waste solution to the adjacent load-in tank pit. The pad does not have protective coating  
15 because it would experience excessive wear from the vehicle traffic.

16 Load-in tank 59A-TK-1 is located on a 25.4-centimeter-thick reinforced concrete slab (Drawing H-2-  
17 817970) inside the metal Load-in building. The tank has a flat bottom which sits on a concrete slab in the  
18 secondary containment. Secondary containment for the tank, filter system, and truck unloading piping is  
19 provided by an epoxy coated catch basin with a capacity of about 3,400 liters. The catch basin is sloped  
20 to route solution from the catch basin through a 15.2-centimeter-wide by 14.3-centimeter-deep trench to  
21 the adjacent truck unloading pad. This pad drains to the Load-in tank pit discussed above. The volume of  
22 the combined secondary containment of these two systems is greater than 76,400 liters, which is capable  
23 of holding the volume of tank 59A-TK-1 (i.e., 26,000 liters).

24 Adjacent to tank 59A-TK-1 catch basin is a 25.4-centimeter-thick reinforced concrete pad that serves as  
25 the second tanker truck unloading bay. The pad is inside the metal Load-in building and has a 2.4-meter  
26 by 4.0-meter shallow, sloping pit to catch leaks during tanker truck unloading. The pit has a maximum  
27 depth of 6.0 centimeters and a 15.2-centimeter-wide by 6.0-centimeter-deep trench to route leaks to the  
28 adjacent tank 59A-TK-1 catch basin. The pad does not have protective coating because it would  
29 experience excessive wear from the vehicle traffic.

30 **Surge Tank Secondary Containment.** The surge tank is mounted on a reinforced concrete ringwall.  
31 Inside the ringwall, the flat-bottomed tank is supported by a bed of compacted sand and gravel with a  
32 high-density polyethylene liner bonded to the ringwall. The liner prevents galvanic corrosion between the  
33 soil and the tank. The secondary containment is reinforced concrete with a 15.2-centimeter thick floor  
34 and a 20.3-centimeter thick dike. The secondary containment area shares part of the southern wall of the  
35 main process area. The dike extends up 2.9 meters to provide a containment volume of 856,000 liters for  
36 the 462,000-liter surge tank.

37 The floor of the secondary containment slopes to a sump in the northwest corner of the containment area.  
38 Leaks into the secondary containment are detected by level instrumentation in the sump, ~~which alarms in~~  
39 ~~the 200 Area ETF control room,~~ and/or by routine visual inspections. Sump alarms are monitored  
40 continuously during ETF processing operations and at least daily at other times. A sump pump is used to  
41 transfer solution in the secondary containment to a sump tank.

42 **Process Area Secondary Containment.** The process area contains the tanks and ancillary equipment of  
43 the primary and secondary treatment trains, and has a jointed, reinforced concrete slab floor. The  
44 concrete floor of the process area provides the secondary containment. This floor is a minimum of  
45 15.2 centimeters thick. With doorsills 15.2 centimeter high, the process area has a containment volume of  
46 approximately 93,800 liters. The largest tanks in the process area are the secondary waste receiving  
47 tanks, which each have a maximum capacity of 73,800 liters.

48 The floor of the process area is sloped to drain liquids to two trenches that drain to a sump. Each trench is  
49 approximately 38.1 centimeters wide with a sloped trough varying from 39.4 to 76.2 centimeters deep.

1 Leaks into the secondary containment are detected by routine visual inspections of the floor area near the  
2 tanks, ancillary equipment, and in the trenches.

3 A small dam was placed in the trench that comes from the thin film dryer room to contain minor liquid  
4 spills originating in the dryer room to minimize the spread of contamination into the process area. The  
5 dryer room is inspected for leaks in accordance with the inspection schedule in Addendum I. Operators  
6 clean up these minor spills by removing the liquid waste and decontaminating the spill area.

7 A small dam was also placed in the trench adjacent to the chemical feed skid when the chemical berm  
8 area was expanded to accommodate acid and caustic pumps, which were moved indoors from the top of  
9 the surge tank to resolve a safety concern. This dam was designed to contain minor spills originating in  
10 the chemical berm area and prevent them from entering the process sump.

11 The northwest corner of the process area consists of a pump pit containing the pumps and piping for  
12 transferring treated effluent from the verification tanks to SALDS. The pit is built 1.37 meters below the  
13 process area floor level and is sloped to drain to a trench built along its north wall that routes liquid to  
14 sump tank 1. Leaks into the secondary containment of the pump pit are detected by routine visual  
15 inspections.

16 **Sump Tanks.** The sump tanks support the secondary containment system, and collect waste from several  
17 sources, including:

- 18 • Process area drain trenches
- 19 • Tank overflows and drains
- 20 • Container washing water
- 21 • Resin dewatering solution
- 22 • Steam boiler blow down
- 23 • Sampler system drains.

24 These double-contained tanks are located within unlined, concrete vaults. The sump tank levels are  
25 monitored by remote level indicators or through visual inspections from the sump covers. These  
26 indicators are connected to high- and low-level alarms that are monitored ~~in the control room~~ during ETF  
27 processing operations and at least daily at other times. When a high-level alarm is activated, a pump is  
28 activated and the sump tank contents usually are routed to the secondary treatment train for processing.  
29 The contents also could be routed to the surge tank for treatment in the primary treatment train. In the  
30 event of an abnormally high inflow rate, a second sump pump is initiated automatically.

31 **Verification Tank Secondary Containment.** The three verification tanks are each mounted on  
32 ringwalls with high-density polyethylene liners similar to the surge tank. The secondary containment for  
33 the three tanks is reinforced concrete with a 15.2-centimeter thick floor and a 20.3-centimeter thick dike.  
34 The dike extends up 2.6 meters to provide a containment of approximately 3,390,000 liters exceeding the  
35 capacity of a single verification tank (See Table C.5).

36 The floor of the secondary containment slopes to a sump along the southern wall of the dike. Leaks into  
37 the secondary containment are detected by level instrumentation in the sump ~~that alarms in the control~~  
38 ~~room~~ and/or by routine visual inspections. Sump alarms are monitored continuously during ETF  
39 processing operations and at least daily at other times. A sump pump is used to transfer solution in the  
40 secondary containment to a sump tank.

#### 41 **C.4.3.2 Additional Requirements for Specific Types of Systems**

42 This section addresses additional requirements in WAC 173-303-640 for double-walled tanks like the  
43 sump tanks and secondary containment for ancillary equipment and piping associated with the tank  
44 systems.

##### 45 **C.4.3.2.1 Double-Walled Tanks**

46 The sump tanks are the only tanks in the 200 Area ETF classified as 'double-walled' tanks. These tanks  
47 are located in unlined concrete vaults and support the secondary containment system for the process area.

1 The sump tanks are equipped with a leak detector between the walls of the tanks that provide continuous  
2 monitoring for leaks. ~~The leak detector provides immediate notification through an alarm in the control~~  
3 ~~room.~~ Sump tank alarms are monitored during ETF processing operations and at least daily at other times.

4 The inner tanks are contained completely within the outer shells. The tanks are contained completely  
5 within the concrete structure of the 200 Area ETF so corrosion protection from external galvanic  
6 corrosion is not necessary.

#### 7 **C.4.3.2.2 Ancillary Equipment**

8 The secondary containment provided for the tanks and process systems also serves as secondary  
9 containment for the ancillary equipment associated with these systems.

10 **Ancillary Equipment.** Section D.4.3.1.2 describes the secondary containment systems that also serve  
11 most of the ancillary equipment within the 200 Area ETF. Between the 200 Area ETF and the  
12 verification tanks, a pipeline trench provides secondary containment for four pipelines connecting the  
13 transfer pumps (i.e., discharge and return pumps) in the 200 Area ETF with the verification tanks  
14 (Figure C.2). This concrete trench crosses under the road and extends from the verification tank pumps to  
15 the verification tanks. Treated effluent flows through these pipelines from the verification tank pumps to  
16 the verification tanks. The return pump is used to return effluent to the 200 Area ETF for use as service  
17 water or for reprocessing.

18 For all of the ancillary equipment housed within the ETF, the concrete floor, trenches, and berms form the  
19 secondary containment system. For the ancillary equipment of the surge tank and the verification tanks,  
20 secondary containment is provided by the concrete floors and dikes associated with these tanks. The  
21 concrete floor and pit provide secondary containment for the ancillary equipment of the load-in tanks.

22 **Transfer Piping and Pipe Trenches.** The two buried transfer lines between LERF and the surge tank  
23 have secondary containment in a pipe-within-a-pipe arrangement. The 4-inch transfer line has an 8-inch  
24 outer pipe, while the 3-inch transfer, line has a 6-inch outer pipe. The pipes are fiberglass and are sloped  
25 towards the surge tank. The outer piping ends with a drain valve in the surge tank secondary  
26 containment.

27 These pipelines are equipped with leak detection located in the annulus between the inner and outer pipes;  
28 the leak detection equipment can continuously 'inspect' the pipelines during aqueous waste transfers. ~~The~~  
29 ~~alarms on the leak detection system are monitored in the control room.~~ Alarms are monitored  
30 continuously during aqueous waste transfers between LERF and the ETF surge tank and at least daily at  
31 other times. A low-volume air purge of the annulus is provided to prevent condensation buildup and  
32 minimize false alarms by the leak detection system. In the event that these leak detectors are not in  
33 service, the pipelines are inspected during transfers by opening a drain valve to check for solution in the  
34 annular space between the inner and outer pipe.

35 The 3-inch transfer line between the load-in tanks and the surge tank has a 6-inch outer pipe in a pipe-  
36 within-a-pipe arrangement. The piping is made of fiberglass-reinforced plastic and slopes towards the  
37 load-in tank secondary containment pit. The drain valve and leak detection system for the load-in tank  
38 pipelines are operated similarly to the leak detection system for the LERF to 200 Area ETF pipelines.

39 As previously indicated, a reinforced concrete pipe trench provides secondary containment for piping  
40 under the roadway between the 200 Area ETF and the verification tanks. Three 15.2 centimeter thick  
41 reinforced concrete partitions divide the trench into four portions and support metal gratings over the  
42 trench. Each portion of the trench is 1.2 meters wide, 0.76 meter deep, and slopes To route any solution  
43 present to 4-inch drain lines through the north wall of the ETF building. These drain lines route solution  
44 to sump tank 2 in ETF. The floor of the pipe trench is 30.5 centimeters thick and the sides are  
45 15.2 centimeters thick. The concrete trenches are coated with water sealant and covered with metal  
46 gratings at ground level to allow vehicle traffic on the roadway.

## 1 C.4.4 Tank Management Practices

2 When an aqueous waste stream is identified for treatment or storage at 200 Area ETF, the generating unit  
3 is required to characterize the waste. Based on characterization data, the waste stream is evaluated to  
4 determine if the stream is acceptable for treatment or storage. Specific tank management practices are  
5 discussed in the following sections.

### 6 C.4.4.1 Rupture, Leakage, Corrosion Prevention

7 Most aqueous waste streams can be managed such that corrosion would not be a concern. For example,  
8 an aqueous waste stream with high concentrations of chloride might cause corrosion problems when  
9 concentrated in the secondary treatment train. One approach is to adjust the corrosion control measures in  
10 the secondary treatment train. An alternative might be to blend this aqueous waste in a LERF basin with  
11 another aqueous waste that has sufficient dissolved solids, such that the concentration of the chlorides in  
12 the secondary treatment train would not pose a corrosion concern.

13 Additionally, the materials of construction used in the tanks systems (Table C.5) make it unlikely that an  
14 aqueous waste would corrode a tank. For more information on corrosion prevention, refer to  
15 Addendum B, Waste Analysis Plan.

16 If operating experience suggests that most aqueous waste streams can be managed such that corrosion  
17 would not be a concern, operating practices and integrity assessment schedules and requirements will be  
18 reviewed and modified as appropriate.

19 When a leak in a tank system is discovered, the leak is immediately contained or stopped by isolating the  
20 leaking component. Following containment, the requirements of [WAC 173-303-640\(7\)](#), incorporated by  
21 reference, are followed. These requirements include repair or closure of the tank/tank system component,  
22 and certification of any major repairs.

### 23 C.4.4.2 Overfilling Prevention

24 Operating practices and administrative controls used at the 200 Area ETF to prevent overfilling a tank are  
25 discussed in the following paragraphs. The 200 Area ETF process is controlled by the MCS. The MCS  
26 monitors liquid levels in the 200 Area ETF tanks and has alarms that annunciate on high-liquid level to  
27 notify operators that actions must be taken to prevent overfilling of these vessels. As an additional  
28 precaution to prevent spills, many tanks are equipped with overflow lines that route solutions to sump  
29 tanks 1 and 2. These tanks include the pH adjustment tank; RO feed tanks, effluent pH adjustment tank,  
30 secondary waste receiving tanks, and concentrate tanks.

31 The following section discusses feed systems, safety cutoff devices, bypass systems, and pressure  
32 controls for specific tanks and process systems.

33 **Tanks.** All tanks are equipped with liquid level sensors that give a reading of the tank liquid volume. All  
34 of the tanks are equipped further with liquid level alarms that are actuated if the liquid volume is near the  
35 tank overflow capacity. In the actuation of the surge tank alarm, a liquid level switch trips, sending a  
36 signal to the valve actuator on the tank influent lines, and causing the influent valves to close.

37 The operating mode for each verification tank, i.e., receiving, holding, or discharging, can be designated  
38 through the MCS; modes also switch automatically. When the high-level set point on the receiving  
39 verification tank is reached, the flow to this tank is diverted and another tank becomes the receiver. The  
40 full tank is switched into verification mode. The third tank is reserved for discharge mode.

41 The liquid levels in the pH adjustment, first and second RO feed, and effluent pH adjustment tanks are  
42 maintained within predetermined operating ranges. Should any of these tanks overflow, the excess waste  
43 is piped along with any leakage from the feed pumps to a sump tank.

44 When waste in a secondary waste-receiving tank reaches the high-level set point, the influent flow of  
45 waste is redirected to the second tank. In a similar fashion, the concentrate tanks switch receipt modes  
46 when the high-level set point of one tank is reached.

1 **Filter Systems.** All filters at 200 Area ETF (i.e., the Load-In Station, rough, fine, and auxiliary filter  
2 systems) are in leak-tight steel casings. For the rough and fine filters, a high differential pressure, which  
3 could damage the filter element, activates a valve that shuts off liquid flow to protect the filter element  
4 from possible damage. To prevent a high-pressure situation, the filters are cleaned routinely with pulses  
5 of compressed air that force water back through the filter. Cleaning is terminated automatically by  
6 shutting off the compressed air supply if high pressure develops. The differential pressure across the  
7 auxiliary filters also is monitored. A high differential pressure in these filters would result in a system  
8 shutdown to allow the filters to be changed out.

9 The Load-In Station filtration system has pressure gauges for monitoring the differential pressure across  
10 each filter. A high differential pressure would result in discontinuing filter operation until the filter is  
11 replaced.

12 **Ultraviolet Light/Oxidation System and Decomposers.** A rupture disk on the inlet piping to each of  
13 the UV/OX reaction vessels relieves to the pH adjustment tank in the event of excessive pressure  
14 developing in the piping system. Should the rupture disk fail, the aqueous waste would trip the moisture  
15 sensor, shut down the UV lamps, and close the surge tank feed valve. Also provided is a level sensor to  
16 protect UV lamps against the risk of exposure to air. Should those sensors be actuated, the UV lamps  
17 would be shut down immediately.

18 The piping and valving for the hydrogen peroxide decomposers are configured to split the waste flow:  
19 half flows to one decomposer and half flows to the other decomposer. Alternatively, the total flow of  
20 waste can be treated in one decomposer or both decomposers can be bypassed. A safety relief valve on  
21 each decomposer vessel can relieve excess system pressure to a sump tank.

22 **Degasification System.** The degasification column is typically supplied aqueous waste feed by the pH  
23 adjustment tank feed pump. This pump transfers waste solution through the hydrogen peroxide  
24 decomposer, the fine filter, and the degasification column to the first RO feed tank.

25 The degasification column is designed for operation at a partial vacuum. A pressure sensor in the outlet  
26 of the column detects the column pressure. The vacuum in the degasification column is maintained by a  
27 blower connected to the vessel off gas system. The column is protected from extremely low pressure  
28 developed by the column blower by the use of an intake vent that is maintained in the open position  
29 during operation. The column liquid level is regulated by a flow control system with a high- and low-  
30 level alarm. Plate-type heat exchanger cools the waste solution fed to the degasification column.

31 **Reverse Osmosis System.** The flow through the first and second RO stages is controlled to maintain  
32 constant liquid levels in the first and second stage RO feed tanks.

33 **Polisher.** Typically, two of the three columns are in operation (lead/lag) and the third (regenerated)  
34 column is in standby. When the capacity of the resin in the first column is exceeded, as detected by an  
35 increase in the conductivity of the column effluent, the third column, containing freshly regenerated IX  
36 resin, is brought online. The first column is taken offline, and the waste is rerouted to the second column,  
37 and to the third. Liquid level instrumentation and automatically operated valves are provided in the IX  
38 system to prevent overfilling.

39 **Effluent Treatment Facility Evaporator.** Liquid level instrumentation in the secondary waste receiving  
40 tanks is designed to preclude a tank overflow. A liquid level switch actuated by a high-tank liquid level  
41 causes the valves to reposition, closing off flow to the secondary waste receiving tanks. Secondary  
42 containment for these tanks routes liquids to a sump tank.

43 Valves in the 200 Area ETF evaporator feed line can be positioned to bypass the secondary waste around  
44 the 200 Area ETF evaporator and to transfer the secondary waste to the concentrate tanks.

45 **Thin Film Dryer.** The two concentrate tanks alternately feed the thin film dryer. Typically, one tank  
46 serves as a concentrate waste receiver while the other tank serves as the dryer feed tank. One tank may  
47 serve as both concentrate waste receiver and dryer feed tank. Liquid level instrumentation prevents tank

1 overflow by diverting the concentrate flow from the full concentrate tank to the other concentrate tank.  
2 Secondary containment for these tanks routes liquids to a sump tank.

3 An alternate route is provided from the concentrate receiver tank to the secondary waste receiving tanks.  
4 Dilute concentrate in the concentrate receiver tank can be reprocessed through the 200 Area ETF  
5 evaporator by transferring the concentrate back to a secondary waste-receiving tank.

#### 6 **C.4.5 Labels or Signs**

7 Each tank or process unit in the 200 Area ETF is identified by a nameplate attached in a readily visible  
8 location. Included on the nameplate are the equipment number and the equipment title. Those tanks that  
9 store or treat dangerous waste at the 200 Area ETF (Section 4C.4.1.1) are identified with a label, which  
10 reads *PROCESS WATER/WASTE*. The labels are legible at a distance of at least fifty feet or as  
11 appropriate for legibility within the ETF. Additionally, these tanks bear a legend that identifies the waste  
12 in a manner, which adequately warns employees, emergency personnel, and the public of the major risk(s)  
13 associated with the waste being stored or treated in the tank system(s).

14 Caution plates are used to show possible hazards and warn that precautions are necessary. Caution signs  
15 have a yellow background and black panel with yellow letters and bear the word *CAUTION*. Danger  
16 signs show immediate danger and signify that special precautions are necessary. These signs are red,  
17 black, and white and bear the word *DANGER*.

18 Tanks and vessels containing corrosive chemicals are posted with black and white signs bearing the word  
19 *CORROSIVE. DANGER - UNAUTHORIZED PERSONNEL KEEP OUT* signs are posted on all exterior  
20 doors of the ETF, and on each interior door leading into the process area. Tank ancillary piping is also  
21 labeled *PROCESS WATER* or *PROCESS LIQUID* to alert personnel which pipes in the process area  
22 contains dangerous and/or mixed waste.

23 All tank systems holding dangerous waste are marked with labels or signs to identify the waste contained  
24 in the tanks. The labels or signs are legible at a distance of at least 50-feet and bear a legend that  
25 identifies the waste in a manner that adequately warns employees, emergency response personnel, and the  
26 public, of the major risk(s) associated with the waste being stored or treated in the tank system(s).

#### 27 **C.4.6 Air Emissions**

28 Tank systems that contain extremely hazardous waste that is acutely toxic by inhalation must be designed  
29 to prevent the escape of such vapors. To date, no extremely hazardous waste has been managed in  
30 200 Area ETF tanks and is not anticipated. However, the 200 Area ETF tanks have forced ventilation that  
31 draws air from the tank vapor spaces to prevent exposure of operating personnel to any toxic vapors that  
32 might be present. The vapor passes through a charcoal filter and two sets of high-efficiency particulate  
33 air filters before discharge to the environment. The Load-in tanks and verification tanks are vented to the  
34 atmosphere.

#### 35 **C.4.7 Management of Ignitable or Reactive Wastes in Tanks Systems**

36 Although the 200 Area ETF is permitted to accept waste that is designated ignitable or reactive, such  
37 waste would be treated or blended immediately after placement in the tank system so that the resulting  
38 waste mixture is no longer ignitable or reactive. Aqueous waste received does not meet the definition of a  
39 combustible or flammable liquid given in National Fire Protection Association (NFPA) code number  
40 30 (NFPA 1996). The buffer zone requirements in NFPA-30, which require tanks containing combustible  
41 or flammable solutions be a safe distance from each other and from public way, are not applicable.

#### 42 **C.4.8 Management of Incompatible Wastes in Tanks Systems**

43 The 200 Area ETF manages dilute solutions that can be mixed without compatibility issues. The  
44 200 Area ETF is equipped with several systems that can adjust the pH of the waste for treatment  
45 activities. Sulfuric acid and sodium hydroxide are added to the process through the MCS for pH  
46 adjustment to ensure there will be no large pH fluctuations and adverse reactions in the tank systems.

## 1 C.5 SURFACE IMPOUNDMENTS

2 This section provides specific information on surface impoundment operations at the LERF, including  
3 descriptions of the liners and secondary containment structures, as required by [WAC 173-303-650](#) and  
4 [WAC 173-303-806\(4\)\(d\)](#).

5 The LERF consists of three lined surface impoundments (basins) with a design operating capacity of  
6 29.5 million liters each. The maximum capacity of each basin is 34 million liters. The dimensions of  
7 each basin at the anchor wall are approximately 103 meters by 85 meters. The typical top dimensions of  
8 the wetted area are approximately 89 meters by 71 meters, while the bottom dimensions are  
9 approximately 57 by 38 meters. Total depth from the top of the dike to the bottom of the basin is  
10 approximately 7 meters. The typical finished basin bottoms lie at about 4 meters below the initial grade  
11 and 175 meters above sea level. The dikes separating the basins have a typical height of 3 meters and  
12 typical top width of 11.6 meters around the perimeter of the impoundments.

### 13 C.5.1 List of Dangerous Waste

14 A list of dangerous and/or mixed aqueous waste that can be stored in LERF is presented in Addendum A.  
15 Addendum B, Waste Analysis Plan also provides a discussion of the types of waste that are managed in  
16 the LERF.

### 17 C.5.2 Construction, Operation, and Maintenance of Liner System

18 General information concerning the liner system is presented in the following sections. Information  
19 regarding loads on the liner, liner coverage, UV light exposure prevention, and location relative to the  
20 water table are discussed.

#### 21 C.5.2.1 Liner Construction Materials

22 The LERF employs a double-composite liner system with a leachate detection, collection, and removal  
23 system between the primary and secondary liners. Each basin is constructed with an upper or primary  
24 liner consisting of a high-density polyethylene geomembrane laid over a bentonite carpet liner. The lower  
25 or secondary liner in each basin is a composite of a geomembrane laid over a layer of soil/bentonite  
26 admixture with a hydraulic conductivity less than  $10^{-7}$  centimeters per second. The synthetic liners extend  
27 up the dike wall to a concrete anchor wall that surrounds the basin at the top of the dike. A batten system  
28 bolts the layers in place to the anchor wall (Figure C.16).

29 Figure C.17 is a schematic cross-section of the liner system. The liner components, listed from the top to  
30 the bottom of the liner system, are the following:

- 31 • Primary 1.5-millimeter high-density polyethylene geomembrane
- 32 • Bentonite carpet liner
- 33 • Geotextile
- 34 • Drainage gravel (bottom) and geonet (sides)
- 35 • Geotextile
- 36 • Secondary 1.5-millimeter high-density polyethylene geomembrane
- 37 • Soil/bentonite admixture (91 centimeters on the bottom, 107 centimeters on the sides)
- 38 • Geotextile

39 The primary geomembrane, made of 1.5-millimeter high-density polyethylene, forms the basin surface  
40 that holds the aqueous waste. The secondary geomembrane, also 1.5-millimeter high-density  
41 polyethylene, forms a barrier surface for leachate that might penetrate the primary liner. The high-density  
42 polyethylene chemically is resistant to constituents in the aqueous waste and has a relatively high strength  
43 compared to other lining materials. The high-density polyethylene resin specified for the LERF contains  
44 carbon black, antioxidants, and heat stabilizers to enhance its resistance to the degrading effects of UV  
45 light. The approach to ensuring the compatibility of aqueous waste streams with the LERF liner materials  
46 and piping is discussed in Addendum B, Waste Analysis Plan.

1 Three geotextile layers are used in the LERF liner system. The layers are thin, nonwoven polypropylene  
2 fabric that chemically is resistant, highly permeable, and resistant to microbiological growth. The first  
3 two layers prevent fine soil particles from infiltrating and clogging the drainage layer. The second  
4 geotextile also provides limited protection for the secondary geomembrane from the drainage rock. The  
5 third geotextile layer prevents the mixing of the soil/bentonite admixture with the much more porous and  
6 granular foundation material.

7 A 30.5-centimeters-thick gravel drainage layer on the bottom of the basins between the primary and  
8 secondary liners provides a flow path for liquid to the leachate detection, collection, and removal system.  
9 A geonet (or drainage net) is located immediately above the secondary geomembrane on the basin  
10 sidewalls. The geonet functions as a preferential flow path for liquid between the liners, carrying liquid  
11 down to the gravel drainage layer and subsequently to the leachate sump. The geonet is a mesh made of  
12 high-density polyethylene, with approximately 13-millimeter openings.

13 The soil/bentonite layer is 91 centimeters thick on the bottom of the basins and 107 centimeters thick on  
14 the basin sidewalls; its permeability is less than  $10^{-7}$  centimeters per second. This composite liner design,  
15 consisting of a geomembrane laid over essentially impermeable soil/bentonite, is considered best  
16 available technology for solid waste landfills and surface impoundments. The combination of synthetic  
17 and clay liners is reported in the literature to provide the maximum protection from waste migration  
18 (Forseth and Kmet 1983).

19 A number of laboratory tests were conducted to measure the engineering properties of the soil/bentonite  
20 admixture, in addition to extensive field tests performed on three test fills constructed near the LERF site.  
21 For establishing an optimum ratio of bentonite to soil for the soil/bentonite admixture, mixtures of various  
22 ratios were tested to determine permeability and shear strength. A mixture of 12 percent bentonite was  
23 selected for the soil/bentonite liner and tests described in the following paragraphs demonstrated that the  
24 admixture meets the desired permeability of less than  $10^{-7}$  centimeters per second. Detailed discussion of  
25 test procedures and results is provided in Report of Geotechnical Investigation, 242-A Evaporation and  
26 PUREX Interim Storage Basins (Chen-Northern 1990).

27 Direct shear tests were performed according to ASTM D3080 test procedures (ASTM 1990) on  
28 soil/bentonite samples of various ratios. Based on these results, the conservative minimum Mohr-  
29 Coulomb shear strength value of 30 degrees was estimated for a soil/bentonite admixture containing  
30 12 percent bentonite.

31 The high degree of compaction of the soil/bentonite layer [92 percent per ASTM D1557 (ASTM 1991)]  
32 was expected to maximize the bonding forces between the clay particles, thereby minimizing moisture  
33 transport through the liner. With respect to particle movement ('piping'), estimated fluid velocities in this  
34 low-permeability material are too low to move the soil particles. Therefore, piping is not considered a  
35 problem.

36 For the soil/bentonite layer, three test fills were constructed to demonstrate that materials, methods, and  
37 procedures used would produce a soil/bentonite liner that meets the EPA permeability requirement of less  
38 than  $10^{-7}$  centimeters per second. All test fills met the EPA requirements. A thorough discussion of  
39 construction procedures, testing, and results is provided in *Report of Permeability Testing, Soil-bentonite*  
40 *Test Fill* (Chen-Northern 1991a).

41 The aqueous waste stored in the LERF is typically a dilute mixture of organic and inorganic constituents.  
42 Though isolated instances of soil liner incompatibility have been documented in the literature (Forseth  
43 and Kmet 1983), these instances have occurred with concentrated solutions that were incompatible with  
44 the geomembrane liners in which the solutions were contained. Considering the dilute nature of the  
45 aqueous waste that is and will be stored in LERF and the moderate pH, and test results demonstrating the  
46 compatibility of the high-density polyethylene liners with the aqueous waste [9090 Test Results  
47 (WHC 1991)], gross failure of the soil/bentonite layer is not probable.

48 Each basin also is equipped with a floating very low-density polyethylene cover. The cover is anchored

1 and tensioned at the concrete wall at the top of the dikes, using a patented mechanical tensioning system.  
2 Figure C.16 depict the tension mechanism and the anchor wall at the perimeter of each basin. Additional  
3 information on the cover system is provided in Section C.5.2.5.

#### 4 **C.5.2.1.1 Material Specifications**

5 Material specifications for the liner system and leachate collection system, including liners, drainage  
6 gravel, and drainage net are discussed in the following sections. Material specifications are documented  
7 in the *Final Specifications 242-A Evaporator and PUREX Interim Retention Basins* (KEH 1990a) and  
8 *Construction Specifications for 242-A Evaporator and PUREX Interim Retention Basins* (KEH 1990b).

9 **Geomembrane Liners.** The high-density polyethylene resin for geomembranes for the LERF meets the  
10 material specifications listed in Table C.9. Key physical properties include thickness (1.5 millimeters  
11 [60 mil]) and impermeability (hydrostatic resistance of over 360,000 kilogram per square meter).  
12 Physical properties meet National Sanitation Foundation Standard 54 (NSF 1985). Testing to determine  
13 if the liner material is compatible with typical dilute waste solutions was performed and documented in  
14 *9090 Test Results* (WHC 1991).

15 **Soil/Bentonite Liner.** The soil/bentonite admixture consists of 11.5 to 14.5 percent bentonite mixed into  
16 well-graded silty sand with a maximum particle size of 4.75 millimeters (No. 4 sieve). Test fills were  
17 performed to confirm the soil/bentonite admixture applied at LERF has hydraulic conductivity less than  
18  $10^{-7}$  centimeters per second, as required by [WAC 173-303-650\(2\)\(j\)](#) for new surface impoundments.

19 **Bentonite Carpet Liner.** The bentonite carpet liner consists of bentonite (90 percent sodium  
20 montmorillonite clay) in a primary backing of woven polypropylene with nylon filler fiber, and a cover  
21 fabric of open weave spunlace polyester. The montmorillonite is anticipated to retard migration of  
22 solution through the liner, exhibiting a favorable cation exchange for adsorption of some constituents  
23 (such as ammonium). Based on composition of the bentonite carpet and of the type of aqueous waste  
24 stored at LERF, no chemical attack, dissolution, or degradation of the bentonite carpet liner is anticipated.

25 **Geotextile.** The nonwoven geotextile layers consist of long-chain polypropylene polymers containing  
26 stabilizers and inhibitors to make the filaments resistant to deterioration from UV light and heat exposure.  
27 The geotextile layers consist of continuous geotextile sheets held together by needle punching. Edges of  
28 the fabric are sealed or otherwise finished to prevent outer material from pulling away from the fabric or  
29 raveling.

30 **Drainage Gravel.** The drainage layer consists of thoroughly washed and screened, naturally occurring  
31 rock meeting the size specifications for Grading Number 5 in Washington State Department of  
32 Transportation construction specifications (WSDOT 1988). The specifications for the drainage layer are  
33 given in Table C.10. Hydraulic conductivity tests (Chen-Northern 1992a, 1992b, 1992c) showed the  
34 drainage rock used at LERF met the sieve requirements and had a hydraulic conductivity of at least  
35 1 centimeter per second, which exceeded the minimum of at least 0.1 centimeters per second required by  
36 [WAC 173-303-650\(2\)\(j\)](#) for new surface impoundments.

37 **Geonet.** The geonet is fabricated from two sets of parallel high-density polyethylene strands, spaced  
38 1.3 centimeters center-to-center maximum to form a mesh with minimum two strands per 2.54 centimeter  
39 in each direction. The geonet is located between the liners on the sloping sidewalls to provide a  
40 preferential flow path for leachate to the drainage gravel and subsequently to the leachate sump.

41 **Leachate Collection Sump.** Materials used to line the 3.0-meter by 1.8-meter by 0.30-meter-deep  
42 leachate sump, at the bottom of each basin in the northwest corner, include [from top to bottom  
43 (Figure C.18)]:

- 44 • 25 millimeter high-density polyethylene flat stock (supporting the leachate riser pipe)
- 45 • Geotextile
- 46 • 1.5-millimeter high-density polyethylene rub sheet
- 47 • Secondary composite liner:
  - 48 – 1.5-millimeter high-density polyethylene geomembrane

- 1 - 91 centimeters of soil/bentonite admixture
- 2 - Geotextile

3 Specifications for these materials are identical to those discussed previously.

4 **Leachate System Risers.** Risers for the leachate system consist of 10-inch and 4-inch pipes from the  
5 leachate collection sump to the catch basin northwest of each basin (Figure C.18). The risers lay below  
6 the primary liner in a gravel-filled trench that also extends from the sump to the concrete catch basin  
7 (Figure C.19).

8 The risers are high-density polyethylene pipes fabricated to meet the requirements in ASTM D1248  
9 (ASTM 1989). The 10-inch riser is perforated every 20.3 centimeters with 1.3-centimeter holes around  
10 the diameter. Level sensors and leachate pump are inserted in the 10-inch riser to monitor and remove  
11 leachate from the sump. To prevent clogging of the pump and piping with fine particulate, the end of the  
12 riser is encased in a gravel-filled box constructed of high-density polyethylene geonet and wrapped in  
13 geotextile. The 4-inch riser is perforated every 10.2 centimeters with 0.64-centimeter holes around the  
14 diameter. A level detector is inserted in the 4-inch riser.

15 **Leachate Pump.** A deep-well submersible pump, designed to deliver approximately 110 liters per  
16 minute, is installed in the 10-inch leachate riser in each basin. Wetted parts of the leachate pump are  
17 made of 316L stainless steel, providing both corrosion resistance and durability.

#### 18 C.5.2.1.2 Loads on Liner System

19 The LERF liner system is subjected to the following types of stresses.

20 **Stresses from Installation or Construction Operations.** Contractors were required to submit  
21 construction quality control plans that included procedures, techniques, tools, and equipment used for the  
22 construction and care of liner and leachate system. Methods for installation of all components were  
23 screened to ensure that the stresses on the liner system were kept to a minimum.

24 Calculations were performed to estimate the risk of damage to the secondary high-density polyethylene  
25 liner during construction (*Calculations for LERF Part B Permit Application* [HNF 1997]). The greatest  
26 risk expected was from spreading the gravel layer over the geotextile layer and secondary geomembrane.  
27 The results of the calculations show that the strength of the geotextile was sufficiently high to withstand  
28 the stress of a small gravel spreader driving on a minimum of 15 centimeters of gravel over the geotextile  
29 and geomembrane. The likelihood of damage to the geomembrane lying under the geotextile was  
30 considered low.

31 To avoid driving heavy machinery directly on the secondary liner, a 28-meter conveyer was used to  
32 deliver the drainage gravel into the basins. The gravel was spread and consolidated by hand tools and a  
33 bulldozer. The bulldozer traveled on a minimum thickness of 30.5 centimeters of gravel. Where the  
34 conveyer assembly was placed on top of the liner, cribbing was placed to distribute the conveyer weight.  
35 No heavy equipment was allowed for use directly in contact with the geomembranes.

36 Additional calculations were performed to estimate the ability of the leachate riser pipe to withstand the  
37 static and dynamic loading imposed by lightweight construction equipment riding on the gravel layer  
38 (HNF 1997). Those calculations demonstrated that the pipe could buckle under the dynamic loading of  
39 small construction equipment; therefore, the pipe was avoided by equipment during spreading of the  
40 drainage gravel.

41 Installation of synthetic lining materials proceeded only when winds were less than 24 kilometers per  
42 hour, and not during precipitation. The minimum ambient air temperature for unfolding or unrolling the  
43 high-density polyethylene sheets was -10 C, and a minimum temperature of 0 C was required for seaming  
44 the high-density polyethylene sheets. Between shifts, geomembranes and geotextile were anchored with  
45 sandbags to prevent lifting by wind. Calculations were performed to determine the appropriate spacing of  
46 sandbags on the geomembrane to resist lifting caused by 130 kilometer per hour winds (HNF 1997). All  
47 of the synthetic components contain UV light inhibitors and no impairment of performance is anticipated

1 from the short-term UV light exposure during construction. Section C.5.2.4 provides further detail on  
2 exposure prevention.

3 During the laying of the soil/bentonite layer and the overlying geomembrane, moisture content of the  
4 admixture was monitored and adjusted to ensure optimum compaction and to avoid development of  
5 cracks.

### 6 **C.5.2.1.3 Static and Dynamic Loads and Stresses from the Maximum Quantity of Waste**

7 When a LERF basin is full, liquid depth is approximately 6.4 meters. Static load on the primary liner is  
8 roughly 6,400 kilograms per square meter. Load on the secondary liner is slightly higher because of the  
9 weight of the gravel drainage layer. Assuming a density of 805 kilograms per square meter for the  
10 drainage gravel [conservative estimate based on specific gravity of 2.65 (Ambrose 1988)], the secondary  
11 high-density polyethylene liner carries approximately 7,200 kilograms per square meter when a basin is  
12 full.

13 Side slope liner stresses were calculated for each of the layers in the basin sidewalls and for the pipe  
14 trench on the northwest corner of each basin (HNF 1997). Results of these calculations indicate factors of  
15 safety against shear were 1.5 or greater for the primary geomembrane, geotextile, geonet, and secondary  
16 geomembrane.

17 Because the LERF is not located in an area of seismic concern, as identified in Appendix VI of  
18 [40 CFR 264](#) and [WAC 173-303-282\(6\)\(a\)\(I\)](#), discussion and calculation of potential seismic events are  
19 not required.

### 20 **C.5.2.1.4 Stresses Resulting from Settlement, Subsidence, or Uplift**

21 Uplift stresses from natural sources are expected to have negligible impact on the liner. Groundwater lies  
22 approximately 62 meters below the LERF, average annual precipitation is only 16 centimeters, and the  
23 average unsaturated permeability of the soils near the basin bottoms is high, ranging from about  
24  $5.5 \times 10^4$  centimeters per second to about 1 centimeter per second (Chen-Northern 1991b). Therefore, no  
25 hydrostatic uplift forces are expected to develop in the soil underneath the basins. In addition, the soil  
26 under the basins consists primarily of gravel and sand, and contains few or no organic constituents.  
27 Therefore, uplift caused by gas production from organic degradation is not anticipated.

28 Based on the design of the soil-bentonite liner, no structural uplift stresses are present within the lining  
29 system (Chen-Northern 1991b).

30 Regional subsidence is not anticipated because neither petroleum nor extractable economic minerals are  
31 present in the strata underlying the LERF basins, nor is karst (erosive limestone) topography present.

32 Dike soils and soil/bentonite layers were compacted thoroughly and proof-rolled during construction.  
33 Calculation of settlement potential showed that combined settlement for the foundation and soil/bentonite  
34 layer is expected to be about 2.7 centimeters. Settlement impact on the liner and basin stability is  
35 expected to be minimal (Chen-Northern 1991b).

### 36 **C.5.2.1.5 Internal and External Pressure Gradients**

37 Pressure gradients across the liner system from groundwater are anticipated to be negligible. The LERF  
38 is about 62 meters above the seasonal high water table, which prevents buildup of water pressure below  
39 the liner. The native gravel foundation materials of the LERF are relatively permeable and free draining.  
40 The 2 percent slope of the secondary liner prevents the pooling of liquids on top of the secondary liner.  
41 Finally, the fill rate of the basins is slow enough (average 190 liters per minute) that the load of the liquid  
42 waste on the primary liner is gradually and evenly distributed.

43 To prevent the buildup of gas between the liners, each basin is equipped with 21 vents in the primary  
44 geomembrane located above the maximum water level that allow the reduction of any excess gas  
45 pressure. Gas passing through these vents exit through a single pipe that penetrates the anchor wall into a

1 carbon adsorption filter. This filter extracts nearly all of the organic compounds, ensuring that emissions  
2 to the air from the basins are not toxic.

### 3 **C.5.2.2 Liner System Location Relative to High-Water Table**

4 The lowest point of each LERF basin is the northwest corner of the sump, where the typical subgrade  
5 elevation is 175 meters above mean sea level. Based on data collected from the groundwater monitoring  
6 wells at the LERF site, the seasonal high-water table is located approximately 62 meters or more below  
7 the lowest point of the basins. This substantial thickness of unsaturated strata beneath the LERF provides  
8 ample protection to the liner from hydrostatic pressure because of groundwater intrusion into the  
9 soil/bentonite layer. Further discussion of the unsaturated zone and site hydrogeology is provided in  
10 Addendum D, Groundwater Monitoring Plan.

### 11 **C.5.2.3 Liner System Foundation**

12 Foundation materials are primarily gravels and cobbles with some sand and silt. The native soils onsite  
13 are derived from unconsolidated Holocene sediments. These sediments are fluvial and glaciofluvial sands  
14 and gravels deposited during the most recent glacial and postglacial event. Grain-size distributions and  
15 shape analyses of the sediments indicate that deposition occurred in a high-energy environment (Chen-  
16 Northern 1990).

17 Analysis of five soil borings from the LERF site was conducted to characterize the natural foundation  
18 materials and to determine the suitability of onsite soils for construction of the impoundment dikes and  
19 determine optimal design factors. Well-graded gravel containing varying amounts of silt, sand, and  
20 cobbles comprises the layer in which the basins were excavated. This gravel layer extends to depths of  
21 10 to 11 meters below land surface (Chen-Northern 1990). The basins are constructed directly on the  
22 subgrade. Excavated soils were screened to remove oversize cobbles (greater than 15 centimeters in the  
23 largest dimension) and used to construct the dikes.

24 Settlement potential of the foundation material and soil/bentonite layer was found to be low. The  
25 foundation is comprised of undisturbed native soils. The bottom of the basin excavation lies within the  
26 well-graded gravel layer, and is dense to very dense. Below the gravel is a layer of dense to very dense  
27 poorly graded and well-graded sand. Settlement was calculated for the gravel foundation soils and for the  
28 soil/bentonite layer, under the condition of hydrostatic loading from 6.4 meters of fluid depth. The  
29 combined settlement for the soils and the soil/bentonite layer is estimated to be about 2.7 centimeters.  
30 This amount of settlement is expected to have minimal impact on overall liner or basin stability  
31 (Chen-Northern 1991b). Settlement calculations are provided in *Calculations for Liquid Effluent*  
32 *Retention Facility Part B Permit Application* (HNF 1997).

33 The load bearing capacity of the foundation material, based on the soil analysis discussed previously, is  
34 estimated at about 48,800 kilograms per square meter [maximum advisable presumptive bearing capacity  
35 (Hough 1969)]. Anticipated static and dynamic loading from a full basin is estimated to be less than  
36 9,000 kilograms per square meter (Section C.5.2.1.3), which provides an ample factor of safety.

37 When the basins are empty, excess hydrostatic pressure in the foundation materials under the liner system  
38 theoretically could result in uplift and damage. However, because the native soil forming the foundations  
39 is unsaturated and relatively permeable, and because the water table is located at a considerable depth  
40 beneath the basins, any infiltration of surface water at the edge of the basin is expected to travel  
41 predominantly downward and away from the basins, rather than collecting under the excavation itself.  
42 No gas is expected in the foundation because gas-generating organic materials are not present.

43 Subsidence of undisturbed foundation materials is generally the result of fluid extraction (water or  
44 petroleum), mining, or karst topography. Neither petroleum, mineral resources, nor karst are believed to  
45 be present in the sediments overlying the Columbia River basalts. Potential groundwater resources do  
46 exist below the LERF. Even if these sediments were to consolidate from fluid withdrawal, their depth  
47 most likely would produce a broad, gently sloping area of subsidence that would not cause significant

1 strains in the LERF liner system. Consequently, the potential for subsidence related failures are expected  
2 to be negligible.

3 Borings at the LERF site, and extensive additional borings in the 200 East Area, have not identified any  
4 significant quantities of soluble materials in the foundation soil or underlying sediments (Last et al. 1989).  
5 Consequently, the potential for sinkholes is considered negligible.

#### 6 **C.5.2.4 Liner System Exposure Prevention**

7 Both primary and secondary geomembranes and the floating cover are stabilized with carbon black to  
8 prevent degradation from UV light. Furthermore, none of the liner layers experience long-term exposure  
9 to the elements. During construction, thin polyethylene sheeting was used to maintain optimum moisture  
10 content and provide protection from the wind for the soil/bentonite layer until the secondary  
11 geomembrane was laid in place. The secondary geomembrane was covered by the geonet and geotextile  
12 as soon as quality control testing was complete. Once the geotextile layer was completed, drainage  
13 material immediately was placed over the geotextile. The final (upper) geotextile layer was placed over  
14 the drainage gravel and immediately covered by the bentonite carpet liner. This was covered  
15 immediately, in turn, by the primary high-density polyethylene liner.

16 Both high-density polyethylene liners, geotextile layers, and geonet are anchored permanently to a  
17 concrete wall at the top of the basin berm. During construction, liners were held in place with many  
18 sandbags on both the basin bottoms and side slopes to prevent wind from lifting and damaging the  
19 materials. Calculations were performed to determine the amount of fluid needed in a basin to prevent  
20 wind lift damage to the primary geomembrane. Approximately 15 to 20 centimeters of solution are kept  
21 in each basin to minimize the potential for uplifting the primary liner (HNF 1997).

22 The entire lining system is covered by a very low-density polyethylene floating cover that is bolted to the  
23 concrete anchor wall. The floating cover prevents evaporation and intrusion from dust, precipitation,  
24 vegetation, animals, and birds. A patented tensioning system is employed to prevent wind from lifting the  
25 cover and automatically accommodate changes in liquid level in the basins. The cover tension  
26 mechanism consists of a cable running from the flexible geosynthetic cover over a pulley on the tension  
27 tower (located on the concrete anchor wall) to a dead man anchor. These anchors (blocks) simply hang  
28 from the cables on the exterior side of the tension towers. The anchor wall also provides for solid  
29 attachment of the liner layers and the cover, using a 6.4-millimeter batten and neoprene gasket to bolt the  
30 layers to the concrete wall, effectively sealing the basin from the intrusion of light, precipitation, and  
31 airborne dust (Figure C.16).

32 The floating cover, made of very low-density polyethylene with UV light inhibitors, is not anticipated to  
33 experience unacceptable degradation during the service life of the LERF. The very low-density  
34 polyethylene material contains carbon black for UV light protection, anti-oxidants to prevent heat  
35 degradation, and seaming enhancers to improve its ability to be welded. A typical manufacturer's limited  
36 warranty for weathering of very low-density polyethylene products is 20 years (Poly America, undated).  
37 This provides a margin of safety for the anticipated medium-term use of the LERF for aqueous waste  
38 storage.

39 The upper 3.4 to 4.6 meters of the sidewall liner also could experience stresses in response to temperature  
40 changes. Accommodation of thermal influences for the LERF geosynthetic layers is affected by inclusion  
41 of sufficient slack as the liners were installed. Calculations demonstrate that approximately  
42 67 centimeters of slack is required in the long basin bottom dimension, 46 centimeters across the basin,  
43 and 34 centimeters from the bottom of the basin to the top of the basin wall (HNF 1997).

44 Thermal stresses also are experienced by the floating cover. As with the geomembranes, sufficient slack  
45 was included in the design to accommodate thermal contraction and expansion.

#### 46 **C.5.2.4.1 Liner Repairs During Operations**

47 Should repair of a basin liner be required while the basin is in operation, the basin contents will be  
48 transferred to the 200 Area ETF or another available basin. After the liner around the leaking section is

1 cleaned, repairs to the geomembrane will be made by the application of a piece of high-density  
2 polyethylene sheeting, sufficient in size to extend approximately 8 to 15 centimeters beyond the damaged  
3 area, or as recommended by the vendor. A round or oval patch will be installed using the same type of  
4 equipment and criteria used for the initial field installations.

#### 5 **C.5.2.4.2 Control of Air Emissions**

6 The floating covers limit evaporation of aqueous waste and releases of volatile organic compounds into  
7 the atmosphere. To accommodate volumetric changes in the air between the fluid in the basin and the  
8 cover, and to avoid problems related to 'sealing' the basins too tightly, each basin is equipped with a  
9 carbon filter breather vent system. Any air escaping from the basins must pass through this vent,  
10 consisting of a pipe that penetrates the anchor wall and extends into a carbon adsorption filter unit.

#### 11 **C.5.2.5 Liner Coverage**

12 The liner system covers the entire ground surface that underlies the retention basins. The primary liner  
13 extends up the side slopes to a concrete anchor wall at the top of the dike encircling the entire basin  
14 (Figure C.16).

#### 15 **C.5.3 Prevention of Overtopping**

16 Overtopping prevention is accomplished through administrative controls and liquid-level instrumentation  
17 installed in each basin. The instrumentation includes local liquid-level indication as well as remote  
18 indication at the ETF. Before an aqueous waste is transferred into a basin, administrative controls are  
19 implemented to ensure overtopping will not occur during the transfer. The volume of feed to be  
20 transferred is compared to the available volume in the receiving basin. The transfer is not initiated unless  
21 there is sufficient volume available in the receiving basin or a cut-off level is established. The transfer  
22 into the basin would be stopped when this cut-off level is reached.

23 In the event of a 25-year, 24-hour storm event, precipitation would accumulate on the basin covers.  
24 Through the self-tensioning design of the basin covers and maintenance of adequate freeboard, all  
25 accumulated precipitation would be contained on the covers and none would flow over the dikes or  
26 anchor walls. The 25-year, 24-hour storm is expected to deliver 5.3 centimeters of rain or approximately  
27 61 centimeters of snow. Cover specifications include the requirement that the covers be able to withstand  
28 the load from this amount of precipitation. Because the cover floats on the surface of the fluid in the  
29 basin, the fluid itself provides the primary support for the weight of the accumulated precipitation.  
30 Through the cover self-tensioning mechanism, there is ample 'give' to accommodate the overlying load  
31 without overstressing the anchor and attachment points.

32 Rainwater and snow evaporate readily from the cover, particularly in the arid Hanford Facility climate,  
33 where evaporation rates exceed precipitation rates for most months of the year. The black color of the  
34 cover further enhances evaporation. Thus, the floating cover prevents the intrusion of precipitation into  
35 the basin and provides for evaporation of accumulated rain or snow.

#### 36 **C.5.3.1 Freeboard**

37 Under current operating conditions, 0.61 meter of freeboard is maintained at each LERF basin, which  
38 corresponds to an operating level of 6.8 meters, or 29.5 million liters.

#### 39 **C.5.3.2 Immediate Flow Shutoff**

40 The mechanism for transferring aqueous waste is either through pump transfers with on/off switches or  
41 through gravity transfers with isolation valves. These methods provide positive ability to shut off  
42 transfers immediately in the event of overtopping. Overtopping a basin during a transfer is very unlikely  
43 because the low flow rate into the basin provides long response times. At a flow rate of 284 liters per  
44 minute, approximately 11 days would be required to fill a LERF basin from the 6.8-meter operating level  
45 (i.e., 0.61 meter of freeboard) to maximum capacity of 34 million liters (i.e., the 7.4-meter level).

1 **C.5.3.3 Outflow Destination**

2 Aqueous waste in the LERF is transferred routinely to 200 Area ETF for treatment. However, should it  
3 be necessary to immediately empty a basin, the aqueous waste either would be transferred to the 200 Area  
4 ETF for treatment or transferred to another basin (or basins), whichever is faster. If necessary a  
5 temporary pumping system may be installed to increase the transfer rate.

6 **C.5.4 Structural Integrity of Dikes**

7 The structural integrity of the dikes was certified attesting to the structural integrity of the dikes, signed  
8 by a qualified, registered professional engineer.

9 **C.5.4.1 Dike Design, Construction, and Maintenance**

10 The dikes of the LERF are constructed of onsite native soils, generally consisting of cobbles and gravels.  
11 Well-graded mixtures were specified, with cobbles up to 15 centimeters in the largest dimension, but not  
12 constituting more than 20 percent of the volume of the fill. The dikes are designed with a 3:1 (3 units  
13 horizontal to 1 unit vertical) slope on the basin side, and 2.25:1 on the exterior side. The dikes are  
14 approximately 8.2 meters high from the bottom of the basin, and 3 meters above grade.

15 Calculations were performed to verify the structural integrity of the dikes (HNF 1997). The calculations  
16 demonstrate that the structural strength of the dikes is such that, without dependence on any lining  
17 system, the sides of the basins can withstand the pressure exerted by the maximum allowable quantity of  
18 fluid in the impoundment. The dikes have a factor of safety greater than 2.5 against failure by sliding.

19 **C.5.4.2 Dike Stability and Protection**

20 In the following paragraphs, various aspects of stability for the LERF dikes and the concrete anchor wall  
21 are presented, including slope failure, hydrostatic pressure, and protection from the environment.

22 **Failure in Dike/Impoundment Cut Slopes.** A slope stability analysis was performed to determine the  
23 factor of safety against slope failure. The computer program 'PCSTABL5' from Purdue University, using  
24 the modified Janbu Method, was employed to evaluate slope stability under both static and seismic  
25 loading cases. One hundred surfaces per run were generated and analyzed. The assumptions used were  
26 as follows (Chen-Northern 1991b):

- 27 • Weight of gravel: 2,160 kilograms per cubic meter  
28 • Maximum dry density of gravel: 2,315 kilograms per cubic meter  
29 • Mohr-Coulomb shear strength angle for gravel: minimum 33 degrees  
30 • Weight of soil/bentonite: 1,600 kilograms per cubic meter  
31 • Mohr-Coulomb shear strength angle for soil/bentonite: minimum 30 degrees  
32 • Slope: 3 horizontal: 1 vertical  
33 • No fluid in impoundment (worst case for stability)  
34 • Soils at in-place moisture (not saturated conditions)

35 Results of the static stability analysis showed that the dike slopes were stable with a minimum factor of  
36 safety of 1.77 (Chen-Northern 1991b).

37 The standard horizontal acceleration required in the *Hanford Plant Standards*, "Standard Architectural-  
38 Civil Design Criteria, Design Loads for Facilities" (DOE-RL 1988), for structures on the Hanford Site is  
39 0.12 g. Adequate factors of safety for cut slopes in units of this type generally are considered 1.5 for  
40 static conditions and 1.1 for dynamic stability (Golder 1989). Results of the stability analysis showed that  
41 the LERF basin slopes were stable under horizontal accelerations of 0.10 and 0.15 g, with minimum  
42 factors of safety of 1.32 and 1.17, respectively (Chen-Northern 1991b). Printouts from the PCSTABL5  
43 program are provided in *Calculations for Liquid Effluent Retention Facility Part B Permit Application*  
44 (HNF 1997).

45 **Hydrostatic Pressure.** Failure of the dikes due to buildup of hydrostatic pressure, caused by failure of  
46 the leachate system or liners, is very unlikely. The liner system is constructed with two essentially

1 impermeable layers consisting of a synthetic layer overlying a soil layer with low-hydraulic conductivity.  
2 It would require a catastrophic failure of both liners to cause hydrostatic pressures that could endanger  
3 dike integrity. Routine inspections of the leachate detection system, indicating quantities of leachate  
4 removed from the basins, provide an early warning of leakage or operational problems that could lead to  
5 excessive hydrostatic pressure. A significant precipitation event (e.g., a 25-year, 24-hour storm) will not  
6 create a hydrostatic problem because the interior sidewalls of the basins are covered completely by the  
7 liners. The covers can accommodate this volume of precipitation without overtopping the dike  
8 (Section C.5.3), and the coarse nature of the dike and foundation materials on the exterior walls provides  
9 for rapid drainage of precipitation away from the basins.

10 **Protection from Root Systems.** Risk to structural integrity of the dikes because of penetrating root  
11 systems is minimal. Excavation and construction removed all vegetation on and around the  
12 impoundments, and native plants (such as sagebrush) grow very slowly. The large grain size of the  
13 cobbles and gravel used as dike construction material do not provide an advantageous germination  
14 medium for native plants. Should plants with extending roots become apparent on the dike walls, the  
15 plants will be controlled with appropriate herbicide application.

16 **Protection from Burrowing Mammals.** The cobble size materials that make up the dike construction  
17 material and the exposed nature of the dike sidewalls do not offer an advantageous habitat for burrowing  
18 mammals. Lack of vegetation on the LERF site discourages foraging. The risk to structural integrity of  
19 the dikes from burrowing mammals is therefore minimal. Periodic visual inspections of the dikes provide  
20 observations of any animals present. Should burrowing mammals be noted onsite, appropriate pest  
21 control methods such as trapping or application of rodenticides will be employed.

22 **Protective Cover.** Approximately 7.6 centimeters of crushed gravel serve as the cover of the exterior  
23 dike walls. This coarse material is inherently resistant to the effect of wind because of its large grain size.  
24 Total annual precipitation is low (16 centimeters) and a significant storm event (e.g., a 25-year, 24-hour  
25 storm) could result in about 5.3 centimeters of precipitation in a 24-hour period. The absorbent capacity  
26 of the soil exceeds this precipitation rate; therefore, the impact of wind and precipitation run-on to the  
27 exterior dike walls will be minimal.

## 28 C.5.5 Piping Systems

29 Aqueous waste from the 242-A Evaporator is transferred to the LERF using a pump located in the  
30 242-A Evaporator and approximately 1,500 meters of pipe, consisting of a 3-inch carrier pipe within a  
31 6-inch outer containment pipeline. Flow through the pump is controlled through a valve at flow rates  
32 from 150 to 300 liters per minute. The pipeline exits the 242-A Evaporator below grade and remains  
33 below grade at a minimum 1.2 meter depth for freeze protection, until the pipeline emerges at the LERF  
34 catch basin, at the corner of each basin. All piping at the catch basin that is less than 1.2 meters below  
35 grade is wrapped with electric heat tracing tape and insulated for protection from freezing.

36 The transfer line from the 242-A Evaporator is centrifugally cast, fiberglass-reinforced epoxy thermoset  
37 resin pressure pipe fabricated to meet the requirements of ASME D2997 (ASME 1984). The 3-inch  
38 carrier piping is centered and supported within 6-inch containment piping. Pipe supports are fabricated of  
39 the same material as the pipe, and meet the strength requirements of ANSI B31.3 (ANSI 1987) for dead  
40 weight, thermal, and seismic loads. A catch basin is provided at the northwest corner of each basin where  
41 piping extends from the basin to allow for basin-to-basin and basin-to-200 Area ETF liquid transfers.  
42 Drawing H-2-88766, Sheets 1 through 4, provide schematic diagrams of the piping system at LERF.  
43 Drawing H-2-79604 provides details of the piping from the 242-A Evaporator to LERF.

### 44 C.5.5.1 Secondary Containment System for Piping

45 The 6-inch containment piping encases the 3-inch carrier pipe from the 242-A Evaporator to the LERF.  
46 All of the piping and fittings that are not directly over a catch basin or a basin liner are of this pipe-  
47 within-a-pipe construction. A catch basin is provided at the northwest corner of each basin where the  
48 inlet pipes, leachate risers, and transfer pipe risers emerge from the basin. The catch basin consists of a

1 20-centimeter-thick concrete pad at the top of the dike. The perimeter of the catch basin has a  
2 20-centimeter-high curb, and the concrete is coated with a chemical resistant epoxy sealant. The concrete  
3 pad is sloped so that any leaks or spills from the piping or pipe connections will drain into the basin. The  
4 catch basin provides an access point for inspecting, servicing, and operating various systems such as  
5 transfer valving, leachate level instrumentation and leachate pump. Drawing H-2-79593 provides a  
6 schematic diagram of the catch basins.

### 7 C.5.5.2 Leak Detection System

8 Single-point electronic leak detection elements are installed along the transfer line at 305-meter intervals.  
9 The leak detection elements are located in the bottom of specially designed test risers. Each sensor  
10 element employs a conductivity sensor, which is connected to a cable leading back to the 242-A  
11 Evaporator control room. If a leak develops in the carrier pipe, fluid will travel down the exterior surface  
12 of the carrier pipe or the interior of the containment pipe. As moisture contacts a sensor unit, ~~an general~~  
13 ~~alarm sounds in the 242-A Evaporator and 200 Area ETF control rooms and the zone of the Sensor unit~~  
14 ~~causing the general alarm can be determined using the 242-~~  
15 ~~A Evaporator leak detection monitoring panel. U at ETF. ETF troubleshoots the alarm and, upon~~  
16 verification of a leak, ~~requests that~~ the pump located in the 242-A Evaporator ~~is be~~ shut down ~~to~~ ;  
17 ~~stopping~~ the flow of aqueous waste through the transfer line. A low-volume air purge of the annulus  
18 between the carrier pipe and the containment pipe is provided to prevent condensation buildup and  
19 minimize false alarms by the leak detection elements.

20 The catch basins have conductivity leak detectors ~~that alarm in the 242-A Evaporator and 200 Area ETF~~  
21 ~~control rooms. Leak detector alarms are monitored continuously during aqueous waste transfers and at~~  
22 ~~least daily at other times.~~ Leaks into the catch basins drain back to the basin through a 5.1-centimeter  
23 drain on the floor of the catch basin.

### 24 C.5.5.3 Certification

25 Although an integrity assessment is not required for piping associated with surface impoundments, an  
26 assessment of the transfer liner was performed, including a hydrostatic leak/pressure test at  
27 10.5 kilograms per square centimeter gauge. A statement by an independent, qualified, registered  
28 professional engineer attesting to the integrity of the piping system is included in *Integrity Assessment*  
29 *Report for the 242-A Evaporator/LERF Waste Transfer Piping, Project W105* (WHC 1993), along with  
30 the results of the leak/pressure test.

### 31 C.5.6 Double Liner and Leak Detection, Collection, and Removal System

32 The double-liner system for LERF is discussed in Section C.5.2. The leachate detection, collection, and  
33 removal system (Figure C.18 and Figure C.19) was designed and constructed to remove leachate that  
34 might permeate the primary liner. System components for each basin include:

- 35 • 30.5-centimeter layer of drainage gravel below the primary liner at the bottom of the basin
- 36 • Geonet below the primary liner on the sidewalls to direct leachate to the gravel layer
- 37 • 3.0-meter by 1.8-meter by 0.30-meter-deep leachate collection sump consisting of a 25 millimeter  
38 high-density polyethylene flat stock, geotextile to trap large particles in the leachate, and  
39 1.5-millimeter high-density polyethylene rub sheet set on the secondary liner
- 40 • 10-inch and 4-inch perforated leachate high-density polyethylene riser pipes from the leachate  
41 collection sump to the catch basin northwest of the basin
- 42 • Leachate collection sump level instrumentation installed in the 4-inch riser
- 43 • Level sensors, submersible leachate pump, and 1.5-inch fiberglass-reinforced epoxy thermoset resin  
44 pressure piping installed in the 10-inch riser
- 45 • Piping at the catch basin to route the leachate through 1.5-inch high-density polyethylene pipe back to  
46 the basins

1 The bottom of the basins has a two percent slope to allow gravity flow of leachate to the leachate  
2 collection sump. This exceeds the minimum of 1 percent slope required by WAC 173-303-650(j) for new  
3 surface impoundments. Material specifications for the leachate collection system are given in  
4 Section C.5.2.1.1.

5 Calculations demonstrate that fluid from a small hole (2 millimeter) (EPA 1989, p. 122) at the furthest  
6 end of the basin, under a low head situation, would travel to the sump in less than 24 hours (HNF 1997).  
7 Additional calculations indicate the capacity of the pump to remove leachate is sufficient to allow time to  
8 readily identify a leak and activate emergency procedures (HNF 1997).

9 ~~Automated controls maintain~~ The fluid level in each leachate sump is maintained below 33 centimeters  
10 to prevent significant liquid backup into the drainage layer. The leachate pump is activated when the  
11 liquid level in the sump reaches about 28 centimeters, and is shut off when the sump liquid level reaches  
12 about 18 centimeters. This operation may be done either manually or automatically. ~~prevents the leachate~~  
13 ~~pump from cycling with no fluid, which could damage the pump.~~ Liquid level control is accomplished  
14 with conductivity probes that trigger relays selected specifically for application to submersible pumps and  
15 leachate fluids. A flow meter/totalizer on the leachate return pipe measures fluid volumes pumped and  
16 pumping rate from the leachate collection sumps, and indicates volume and flow rate on local readouts. In  
17 addition, a timer on the leachate pump tracks the cumulative pump operating hours. Other  
18 instrumentation provided is real-time continuous level monitoring with readout at the catch basin ~~and the~~  
19 ~~242-A Evaporator control room.~~ Leachate levels are monitored at least weekly. A sampling port is  
20 provided in the leachate piping system at the catch basin. ~~Leak detection is provided through inspections~~  
21 ~~of~~ The leak rate through the primary liner is calculated using the leachate flow meter/totalizer readings or  
22 pump operating hours readings along with the pump flow rate. Calculations using either method are  
23 sufficient for compliance. For more information on inspections, refer to Addendum I.

24 The stainless steel leachate pump is designed to deliver 110 liters per minute. The leachate pump returns  
25 draw liquid from the sump via 1.5-inch pipe and discharges into the basin through 1.5-inch high-density  
26 polyethylene pipe.

### 27 **C.5.7 Construction Quality Assurance**

28 The construction quality assurance plan and complete report of construction quality assurance inspection  
29 and testing results are provided in *242-A Evaporator Interim Retention Basin Construction Quality*  
30 *Assurance Plan* (KEH 1991). A general description of construction quality assurance procedures is  
31 outlined in the following paragraphs.

32 For excavation of the basins and construction of the dikes, regular inspections were conducted to ensure  
33 compliance with procedures and drawings, and compaction tests were performed on the dike soils.

34 For the soil/bentonite layer, test fills were first conducted in accordance with EPA guidance to  
35 demonstrate compaction procedures and to confirm compaction and permeability requirements can be  
36 met. The ratio of bentonite to soil and moisture content was monitored; lifts did not exceed  
37 15 centimeters before compaction, and specific compaction procedures were followed. Laboratory and  
38 field tests of soil properties were performed for each lift and for the completed test fill. The same suite of  
39 tests was conducted for each lift during the laying of the soil/bentonite admixture in the basins.

40 Geotextiles and geomembranes were laid in accordance with detailed procedures and quality assurance  
41 programs provided by the manufacturers and installers. These included destructive and nondestructive  
42 tests on the geomembrane seams, and documentation of field test results and repairs.

### 43 **C.5.8 Proposed Action Leakage Rate and Response Action Plan**

44 An action leakage rate limit is established where action must be taken due to excessive leakage from the  
45 primary liner. The action leak rate is based on the maximum design flow rate the leak detection system  
46 can remove without the fluid head on the bottom liner exceeding 30 centimeters. The limiting factor in  
47 the leachate removal rate is the hydraulic conductivity of the drainage gravel. An action leakage rate

1 (also called the rapid or large leak rate) of 20,000 liters per hectare per day ([2,100 gallons/acre/day](#)) was  
2 calculated for each basin (WHC 1992b).

3 When it is determined that the action leakage rate has been exceeded, the response action plan will follow  
4 the actions in [WAC 173-303-650](#)(11)(b) and (c), which includes notification of Ecology in writing  
5 within 7 days, assessing possible causes of the leak, and determining whether waste receipt should be  
6 curtailed and/or the basin emptied.

### 7 **C.5.9 Dike Structural Integrity Engineering Certification**

8 The structural integrity of the dikes was certified attesting to the structural integrity of the dikes, signed  
9 by a qualified, registered professional engineer.

### 10 **C.5.10 Management of Ignitable, Reactive, or Incompatible Wastes**

11 Although ignitable or reactive aqueous waste might be received in small quantities at LERF, such  
12 aqueous waste is mixed with dilute solutions in the basins, removing the ignitable or reactive  
13 characteristics. For compatibility requirements with the LERF liner, refer to Addendum B, Waste  
14 Analysis Plan.

## 15 **C.6 AIR EMISSIONS CONTROL**

16 This section addresses the 200 Area ETF requirements of Air Emission Standards for Process Vents,  
17 under [40 CFR 264](#), Subpart AA ([WAC 173-303-690](#) incorporated by reference) and Subpart CC. The  
18 requirements of [40 CFR 264](#), Subpart BB ([WAC 173-303-691](#)) is not applicable because aqueous waste  
19 with 10 percent or greater organic concentration would not be acceptable for processing at the ETF.

### 20 **C.6.1 Applicability of Subpart AA Standards**

21 The 200 Area ETF evaporator and thin film dryer perform operations that specifically require evaluation  
22 for applicability of [WAC 173-303-690](#). Aqueous waste in these units routinely contains greater than 10  
23 parts per million concentrations of organic compounds and are, therefore, subject to air emission  
24 requirements under [WAC 173-303-690](#). Organic emissions from all affected process vents on the  
25 Hanford Facility must be less than 1.4 kilograms per hour and 2.8 mega grams per year, or control  
26 devices must be installed to reduce organic emissions by 95 percent.

27 The vessel off gas system provides a process vent system. This system provides a slight vacuum on the  
28 200 Area ETF process vessels and tanks (refer to Section C.2.5.2). Two vessel vent header pipes  
29 combine and enter the vessel off gas system filter unit consisting of a demister, electric heater, prefilter,  
30 high-efficiency particulate air filters, activated carbon absorber, and two exhaust fans (one fan in service  
31 while the other is backup). The vessel off gas system filter unit is located in the high-efficiency  
32 particulate air filter room west of the process area. The vessel off gas system exhaust discharges into the  
33 larger building ventilation system, with the exhaust fans and stack located outside and immediately west  
34 of the ETF. The exhaust stack discharge point is 15.5 meters above ground level.

35 The annual average flow rate for the 200 Area ETF stack (which is the combined vessel off gas and  
36 building exhaust flow rates) is 1600 cubic meters per minute with a total annual flow of approximately  
37 8.4 E+08 cubic meters. During waste processing, the airflow through just the vessel off gas system is  
38 about 23 standard cubic meters per minute.

39 Organic emissions occur during waste processing, which occurs less than 310 days each year  
40 (i.e., 85 percent operating efficiency). This operating efficiency represents the maximum annual  
41 operating time for the ETF, as shutdowns are required during the year for planned maintenance outages  
42 and for reconfiguring the 200 Area ETF to accommodate different aqueous waste.

### 43 **C.6.2 Process Vents - Demonstrating Compliance**

44 This section outlines how the 200 Area ETF complies with the requirements and includes a discussion of  
45 the basis for meeting the organic emissions limits, calculations demonstrating compliance, and conditions  
46 for reevaluation.

1 **C.6.2.1 Basis for Meeting Limits/Reductions**

2 The 242-A Evaporator and the 200 Area ETF are currently the only operating TSD units that contribute to  
3 the Hanford Facility volatile organic emissions under [40 CFR 264](#), Subpart AA. The combined release  
4 rate is currently well below the threshold of 1.4 kilograms per hour or 2,800 kilograms per year of volatile  
5 organic compounds. As a result, the 200 Area ETF meets these standards without the use of air pollution  
6 control devices.

7 The amount of organic emissions could change as waste streams are changed, or TSD units are brought  
8 online or are deactivated. The organic air emissions summation will be re-evaluated periodically as  
9 condition warrants. Operations of the TSD units operating under [40 CFR 264](#), Subpart AA, will be  
10 controlled to maintain Hanford Facility emissions below the threshold limits or pollution control device(s)  
11 will be added, as necessary, to achieve the reduction standards specified under [40 CFR 264](#), Subpart AA.

12 **C.6.2.2 Demonstrating Compliance**

13 Calculations to determine organic emissions are performed using the following assumptions:

- 14 • Maximum flow rate from LERF to 200 Area ETF is 568 liters per minute.
- 15 • Emissions of organics from tanks and vessels upstream of the UV/OX process are determined from  
16 flow and transfer rates given in *Clean Air Act Requirements, WAC 173-400, As-built Documentation,*  
17 *Project C-018H, 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility*  
18 *(Adtechs 1995).*
- 19 • UV/OX reaction rate constants and residence times are used to determine the amount of organics,  
20 which are destroyed in the UV/OX process. These constants are given in *200 Area Effluent*  
21 *Treatment Facility Delisting Petition (DOE/RL 1992).*
- 22 • All organic compounds that are not destroyed in the UV/OX process are assumed to be emitted from  
23 the tanks and vessels into the vessel off gas system.
- 24 • No credit for removal of organic compounds in the vessel off gas system carbon absorber unit is  
25 taken. The activated carbon absorbers are used if required to reduce organic emissions.

26 The calculation to determine organic emissions consists of the following steps:

- 27 1. Determine the quantity of organics emitted from the tanks or vessels upstream of the UV/OX process,  
28 using transfer rate values
- 29 2. Determine the concentration of organics in the waste after the UV/OX process using UV/OX reaction  
30 rates and residence times. If the 200 Area ETF is configured such that the UV/OX process is not  
31 used, a residence time of zero is used in the calculations (i.e., none of the organics are destroyed)
- 32 3. Assuming all the remaining organics are emitted, determine the rate which the organics are emitted  
33 using the feed flow rate and the concentrations of organics after the UV/OX process
- 34 4. The amount of organics emitted from the vessel off gas system is the sum of the amount  
35 calculated in steps 1 and 3.

36 The organic emission rates and quantity of organics emitted during processing are determined using these  
37 calculations and are included in the Hanford Facility Operating Record, LERF and 200 Area ETF file.

38 **C.6.2.3 Reevaluating Compliance with Subpart AA Standards**

39 Calculations to determine compliance with Subpart AA will be reviewed when any of the following  
40 conditions occur at the 200 Area ETF:

- 41 • Changes in the maximum feed rate to the 200 Area ETF (i.e., greater than the 568 liters per minute  
42 flow rate)
- 43 • Changes in the configuration or operation of the 200 Area ETF that would modify the assumptions

1 given in Section C.6.2.2 (e.g., taking credit for the carbon absorbers as a control device)

- 2 • Annual operating time exceeds 310 days.

### 3 **C.6.3 Applicability of Subpart CC Standards**

4 The air emission standards of [40 CFR 264](#), Subpart CC apply to tank, surface impoundment, and  
5 container storage units that manage wastes with average volatile organic concentrations equal to or  
6 exceeding 500 parts per million by weight, based on the hazardous waste composition at the point of  
7 origination (61 FR 59972). However, TSD units that are used solely for management of mixed waste are  
8 exempt. Mixed waste is managed at the LERF and 200 Area ETF and dangerous waste could be treated  
9 and stored at these TSD units.

10 TSD owner/operators are not required to determine the concentration of volatile organic compounds in a  
11 hazardous waste if the wastes are placed in waste management units that employ air emission controls  
12 that comply with the Subpart CC standards. Therefore, the approach to Subpart CC compliance at the  
13 LERF and 200 Area ETF is to demonstrate that the LERF and 200 Area ETF meet the Subpart CC control  
14 standards ([40 CFR 264.1084](#) – [40 CFR 264.1086](#)).

#### 15 **C.6.3.1 Demonstrating Compliance with Subpart CC for Tanks**

16 Since the 200 Area ETF tanks already have process vents regulated under [40 CFR 264](#), Subpart AA  
17 ([WAC 173-303-690](#)), they are exempt from Subpart CC [[40 CFR 264.1080\(b\)\(8\)](#)].

#### 18 **C.6.3.2 Demonstrating Compliance with Subpart CC for Containers**

19 Container Level 1 and Level 2 standards are met at the 200 Area ETF by managing all dangerous and/or  
20 mixed wastes in U.S. Department of Transportation containers [[40 CFR 264.1086\(f\)](#)]. Level 1 containers  
21 are those that store more than 0.1 cubic meters and less than or equal to 0.46 cubic meters. Level 2  
22 containers are used to store more than 0.46 cubic meters of waste, which are in 'light material service'.  
23 Light material service is defined where a waste in the container has one or more organic constituents  
24 with a vapor pressure greater than 0.3 kilopascals at 20 C, and the total concentration of such  
25 constituents is greater than or equal to 20 percent by weight.

26 The monitoring requirements for Level 1 and Level 2 containers include a visual inspection when the  
27 container is received at the 200 Area ETF and when the waste is initially placed in the container.  
28 Additionally, at least once every 12 months when stored onsite for 1 year or more, these containers must  
29 be inspected.

30 If compliant containers are not used at the 200 Area ETF, alternate container management practices are  
31 used that comply with the Level 1 standards. Specifically, the Level 1 standards allow for a "container  
32 equipped with a cover and closure devices that form a continuous barrier over the container openings such  
33 that when the cover and closure devices are secured in the closed position there are no visible holes, gaps,  
34 or other open spaces into the interior of the container. The cover may be a separate cover installed on the  
35 container...or may be an integral part of the container structural design..." [[40 CFR 264.1086\(c\)\(1\)\(ii\)](#)].  
36 An organic-vapor-suppressing barrier, such as foam, may also be used [[40 CFR 264.1086\(c\)\(1\)\(iii\)](#)].  
37 Section C.3 provides detail on container management practices at the 200 Area ETF.

38 Container Level 3 standards apply when a container is used for the "treatment of a hazardous waste by a  
39 waste stabilization process" [[40 CFR 264.1086\(2\)](#)]. Because treatment in containers using the  
40 stabilization process is not provided at the 200 Area ETF, these standards do not apply.

#### 41 **C.6.3.3 Demonstrating Compliance with Subpart CC for Surface Impoundments**

42 The Subpart CC emission standards are met at LERF using a floating membrane cover that is constructed  
43 of very-low-density polyethylene that forms a continuous barrier over the entire surface area  
44 [[40 CFR 264.1085\(c\)](#)]. This membrane has both organic permeability properties equivalent to a high-  
45 density polyethylene cover and chemical/physical properties that maintain the material integrity for the

intended service life of the material. The additional requirements for the floating cover at the LERF have been met (Section C.5.2.4).

### C.7 ENGINEERING DRAWINGS

#### C.7.1 Liquid Effluent Retention Facility

Drawings of the containment systems at the LERF are summarized in Table C.1. Because the failure of these containment systems at LERF could lead to the release of dangerous waste into the environment, modifications that affect these containment systems will be submitted to the Washington State Department of Ecology, as a Class 1, 2, or 3 Permit modification, as required by [WAC 173-303-830](#).

**Table C.1. Liquid Effluent Retention Facility Containment System**

LERF System	Drawing Number	Drawing Title
Bottom Liner	H-2-79590, Sheet 1	Civil Plan, Sections and Details; Cell Basin Bottom Liner
Top Liner	H-2-79591, Sheet 1	Civil Plan, Sections and Details; Cell Basin Bottom Liner
Catch Basin	H-2-79593, Sheet 1, 3-5	Civil Plan, Section and Details; Catch Basin

The drawings identified in Table C.2 illustrate the piping and instrumentation configuration within LERF, and of the transfer piping systems between the LERF and the 242-A Evaporator. These drawings are provided for general information and to demonstrate the adequacy of the design of the LERF as a surface impoundment.

**Table C.2. Liquid Effluent Retention Facility Piping and Instrumentation**

LERF System	Drawing Number	Drawing Title
Transfer Piping to 242-A Evaporator	H-2-79604, Sheet 1	Piping Plot and Key Plans; 242-A Evaporator Condensate Stream
LERF Piping and Instrumentation	H-2-88766, Sheet 1	P&ID; LERF Basin and ETF Influent
	H-2-88766, Sheet 2	P&ID; LERF Basin and ETF Influent
	H-2-88766, Sheet 3	P&ID; LERF Basin and ETF Influent
	H-2-88766, Sheet 4	P&ID; LERF Basin and ETF Influent
Legend	H-2-89351, Sheet 1	Piping & Instrumentation Diagram - Legend

#### C.7.2 200 Area Effluent Treatment Facility

Drawings of the secondary containment systems for the 200 Area ETF containers, and tanks and process units, and for the Load-In Tanks are summarized in Table C.3. Because the failure of the secondary containment systems could lead to the release of dangerous waste into the environment, modifications, which affect the secondary containment systems, will be submitted to the Washington State Department of Ecology, as a Class 1, 2, or 3 Permit modification, as required by [WAC 173-303-830](#).

**Table C.3. Effluent Treatment Facility and Load-In Station Secondary Containment Systems**

200 Area ETF Process Unit	Drawing Number	Drawing Title
Surge Tank, Process/ Container Storage Areas and Trenches - Foundation and Containment	H-2-89063, Sheet 1	Architectural/structural – Foundation and Grade Beam Plan
Sump Tank Containment	H-2-89065, Sheet 1	Architectural/structural – Foundation, Sections and Detail
Verification Tank Foundation and Containment	H-2-89068, Sheet 1	Architectural/structural – Verification Tank Foundation
Load-In Facility Foundation and Containment	H-2-817970, Sheet 1	Structural – ETF Truck Load-in Facility Plans and Sections

200 Area ETF Process Unit	Drawing Number	Drawing Title
Load-In Facility Foundation and Containment	H-2-817970, Sheet 2	Structural – ETF Truck Load-in Facility Sections and Details

The drawings identified in Table C.4 provide an illustration of the piping and instrumentation configuration for the major process units and tanks at the ETF, and the Load-In Tanks. Drawings of the transfer piping systems between the LERF and 200 Area ETF, and between the Load-In Station and the 200 Area ETF also are presented in this table. These drawings are provided for general information and to demonstrate the adequacy of the design of the tank systems.

**Table C.4. Major Process Units and Tanks at the Effluent Treatment Facility and Load-In Station**

200 Area ETF Process Unit	Drawing Number	Drawing Title
Load-In Facility	H-2-817974, Sheet 1	P&ID – ETF Truck Load-In Facility
Load-In Facility	H-2-817974, Sheet 2	P&ID – ETF Truck Load-In Facility
Surge Tank	H-2-89337, Sheet 1	P&ID – Surge Tank System
UV/Oxidation	H-2-88976, Sheet 1	P&ID – UV Oxidizer Part 1
UV/Oxidation	H-2-89342, Sheet 1	P&ID – UV Oxidizer Part 2
Reverse Osmosis	H-2-88980, Sheet 1	P&ID – 1st RO Stage
Reverse Osmosis	H-2-88982, Sheet 1	P&ID – 2nd RO Stage
IX/Polishers	H-2-88983, Sheet 1	P&ID – Polisher
Verification Tanks	H-2-88985, Sheet 1	P&ID – Verification Tank System
ETF Evaporator	H-2-89335, Sheet 1	P&ID – Evaporator
Thin Film Dryer	H-2-88989, Sheet 1	P&ID – Thin Film Dryer
Transfer Piping from LERF to ETF	H-2-88768, Sheet 1	Piping Plan/Profile 4"– 60M-002-M17 and 3"–60M-001-M17
Transfer Piping from Load-In Facility to ETF	H-2-817969, Sheet 1	Civil – ETF Truck Load-In Facility Site Plan

1

**Table C.5. 200 Area Effluent Treatment Facility Tank Systems Information**

Tank Description	Material of Construction	Maximum Tank Capacity <sup>1</sup> liters	Inner diameter meters	Height meters	Shell Thickness <sup>2</sup> centimeters	Corrosion Protection <sup>3</sup>
Load-in tanks 59A-TK-109/-117 (2)	304 SS	34,350	3.6	4.7	0.64	Type 304 SS
Load-in tank 59A-TK-1	FRP	26,000	3.0	3.8	0.48 (dome) 0.63 (walls & bottom)	FRP
Surge tank	304 SS	462,000	7.9	9.2	0.48	Type 304 SS
pH adjustment tank	304 SS	16,700	3.0	2.5	0.64	Type 304 SS
First RO feed tank	304 SS	20,600	3.0	3.2	0.64	Type 304 SS
Second RO feed tank	304 SS	9,000	Nonround tank 3.0 m x 1.5 m	1.5	0.48 w/rib stiffeners	Type 304 SS
Effluent pH adjustment tank	304 SS	14,400	2.4	3.6	0.64	Type 304 SS
Verification tanks (3)	Carbon steel with epoxy lining	3,000,000	18.3	11.4	0.79	epoxy coating
Secondary waste receiving tanks (2)	304 SS	73,800	4.3	5.7	0.64	Type 304 SS
Concentrate tanks (2)	316L SS	24,900	3.0	3.8	0.64	Type 316 SS
ETF evaporator (Vapor Body)	Alloy 625	20,000	2.4	6.8	variable	Alloy 625
Distillate flash tank	304 SS	950	Horizontal tank 0.76	Length 2.2	0.7	304 SS
Sump tank 1	304 SS	6,900	1.5 x 1.5	3.4	0.48	304 SS
Sump tank 2	304 SS	6,700	1.5 x 1.5	3.4	0.48	304 SS

2 <sup>1</sup>The maximum operating volume of the tanks is identified.

3 <sup>2</sup>The nominal thickness of ETF tanks is represented.

4 <sup>3</sup>Type 304 SS, 304L, 316 SS and alloy 625 provide corrosion protection.

5 304 SS = stainless steel type 304 or 304L.

6 316L SS = stainless steel type 316L

7 FRP = Fiberglass-reinforced plastic.

8

**Table C.6. 200 Area Effluent Treatment Facility Additional Tank System Information**

Tank Description	Liner Materials	Pressure Controls	Foundation Materials	Structural Support	Seams	Connections
Load-in tanks 59A-TK-109/-117 (2)	None	vent to atmosphere	concrete slab	SS skirt bolted to concrete	welded	flanged
Load-in tank 59A-TK-1	None	vent to atmosphere	concrete slab	bolted to concrete	none	flanged
Surge tank	None	vacuum breaker valve/vent to VOG	reinforced concrete ring plus concrete slab	structural steel on concrete base	welded	flanged
pH adjustment tank	None	vent to VOG	concrete slab	carbon steel skirt	welded	flanged
First RO feed tank	None	vent to VOG	concrete slab	carbon steel skirt	welded	flanged
Second RO feed tank	None	vent to VOG	concrete slab	carbon steel frame	welded	flanged
Effluent pH adjustment tank	None	vent to VOG	concrete slab	carbon steel skirt	welded	flanged
Verification tanks (3)	Epoxy	filtered vent to atmosphere	reinforced concrete ring plus concrete slab	structural steel on concrete base	welded	flanged
Secondary waste receiving tanks (2)	None	vent to VOG	concrete slab	carbon steel skirt	welded	flanged
Concentrate tanks (2)	None	vent to VOG	concrete slab	carbon steel skirt	welded	flanged
ETF evaporator (vapor body)	None	pressure indicator/pressure relief valve vapor vent to DFT/VOG	concrete slab	carbon steel frame	welded	flanged
Distillate flash tank	None	Pressure relief valve/vent to vent gas cooler/VOG	concrete slab	carbon steel I-beam and cradle	welded	flanged
Sump tank 1	None	vent to VOG	concrete containment	reinforced concrete containment basin	welded	flanged
Sump tank 2	None	vent to VOG	concrete containment	reinforced concrete containment basin	welded	flanged

- 2 DFT = distillate flash tank
- 3 VOG = vessel off gas system
- 4

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**Table C.7. Ancillary Equipment and Material Data**

System	Ancillary Equipment	Number	Material	
Load-in tanks	Load-in/transfer pumps (2)	2025ED-P-103A/-103B	316 SS	
		2025ED-P-001A/-001B	Cast iron	
	Load-in filters (6)	59A-FL-001/-002/-003/ -004/-005/-006	304 SS	
Surge tank	Surge tank pumps (3)	2025E-60A-P-1A/-1B/-1C	304 SS	
Rough filter	Rough filter	2025E-60B-FL-1	304 SS	
UV/OX	UV oxidation inlet cooler	2025E-60B-E-1	316 SS	
	UV oxidizers (4)	2025E-60D-UV-1A/-1B/-2A/-2B	316 SS	
pH adjustment	pH adjustment pumps (2)	2025E-60C-P-1A/-1B	304 SS	
Peroxide decomposer	H2O2 decomposers (2)	2025E-60D-CO-1A/-1B	CS with epoxy coating	
Fine filter	Fine filter	2025E-60B-FL-2	304 SS	
Degasification	Degasification column inlet cooler	2025E-60E-E-1	316 SS	
	Degasification column	2025E-60E-CO-1	FRP	
	Degasification pumps (2)	2025E-60E-P-1A/-1B	316 SS	
RO	Feed/booster pumps (6)	2025E-60F-P-1A/-1B/-2A/-2B/-3A/-3B	304 SS	
	Reverse osmosis arrays (21)	2025E-60F-RO-01 through -21	Membranes: polyamide Outer piping: 304 SS	
IX/Polishers	Polishers (3)	2025E-60G-IX-1A/-1B-1C	CS with epoxy coating	
	Resins strainers (3)	2025E-60G-S-1A/-1B/-1C	304 SS	
Effluent pH adjustment	Recirculation/transfer pumps (2)	2025E-60C-P-2A/-2B	304 SS/PVC	
Verification tanks	Return pump	2025E-60H-P-1	304 SS	
	Transfer pumps (2)	2025E-60H-P-2A/-2B		
Secondary waste receiving tanks	Secondary waste feed pumps (2)	2025E-60I-P-1A/-1B	304 SS	
ETF evaporator system	Feed/distillate heat exchanger	2025E-60I-E-02	Tubes: 316 SS Shell: 304 SS	
		2025E-60I-E-01	Tubes: alloy 625 Shell: 304 SS	
	Recirculation pump	2025E-60I-P-02	316 SS	
	Concentrate transfer pump	2025E-60I-P-04	316 SS	
	Entrainment separator	2025E-60I-DE-01	Top section: 316 SS	
			Bottom section: alloy 625	
	Vapor compressor (incl. silencers)	2025E-60I-C-01	304 SS	
	Silencer drain pump	2025E-60I-P-06	316 SS	
	Level control tank	2025E-60I-TK-5	304 SS	
	Distillate flash tank pump	2025E-60I-P-03	316 SS	
	Concentrate tanks	Concentrate circulation pumps (2)	2025E-60J-P-1A/-1B	316 SS
	Thin film dryer	Concentrate feed pump	2025E-60J-P-2	316 SS
		Thin film dryer	2025E-60J-D-1	Interior surfaces: alloy 625 Rotor and blades: 316 SS
Powder hopper		2025E-60J-H-1	316 SS	
Spray condenser		2025E-60J-DE-01	316 SS	
Distillate condenser		2025E-60J-CND-01	Tubes: 304 SS	
			Shell: CS	
Dryer distillate pump		2025E-60J-P-3	316 SS	
Resin dewatering	Dewatering pump	2025E-80E-P-1		

**Table C.8. Concrete and Masonry Coatings**

Location	Product Name	Applied Film Thickness, Estimated
<b>ETF Process and Container Storage Areas</b>		
Floor: Topcoat	Steelcote Floor-Nu Finish <sup>1</sup>	2 coats at 10-12 mils
Floor: Primer	Steelcote Monomid Hi-Build <sup>1</sup>	2.0 mils
Walls to 7 feet, Doors & Jambs	Chemproof PermaCoat 4000 Vertical <sup>2</sup>	2 coats at 12-16 mils
<b>Load-in Station Tank Pit</b>		
Floor and Walls	Ameron Amercoat 351 <sup>3</sup>	2 coats at 8.0-12 mils
<b>Surge Tank and Verification Tank Berms</b>		
Floors (and Walls at Surge Tank): Topcoat	KCC Corrosion Control Elasti-Liner <sup>4</sup>	80 mils
Floors (and Walls at Surge Tank): Primer	KCC Corrosion Control Techni-Plus E3 <sup>4</sup>	5.0-7.0 mils

<sup>1</sup>Floor-Nu Finish and Monomid Hi-Build are trademarks of Steelcote Manufacturing, Incorporated

<sup>2</sup>PermaCoat is a trademark of Chemproof Polymers, Incorporated

<sup>3</sup>Amercoat is a trademark of Ameron International, Incorporated

<sup>4</sup>Elasti-Liner and Techni-Plus are trademarks of KCC Corrosion Control, Incorporated

**Table C.9. Geomembrane Material Specifications**

Property	Value
Specific gravity	0.932 to 0.950
Melt flow index	1.0 g/10 min., maximum
Thickness (thickness of flow marks shall not exceed 200% of the nominal liner thickness)	60 mil 310% (1.5 mm 3 10%)
Carbon black content	1.8 to 3%, bottom liner 2 to 3% top liner
<b>Tensile properties (each direction)</b>	
Tensile strength at yield	21.5 kgf/cm width, minimum
Tensile strength at break	32.2 kgf/cm width, minimum
Elongation at yield	10%, minimum
Elongation at break	500%, minimum
Tear resistance	13.6 kgf, minimum
Puncture resistance	31.3 kgf, minimum
Low temperature/brittleness	-400 C, maximum
Dimensional (%change each direction)	32%, maximum
Environmental stress crack	750 h, minimum
Water absorption	0.1 maximum and weight change
Hydrostatic resistance	316,000 kgf/m <sup>2</sup>
Oxidation induction time (200 C/l atm. O <sub>2</sub> )	90 minutes

Reference: Construction Specifications (KEH 1990b). Format uses NSF 54 table for high-density polyethylene as a guide (NSF 1985). However, RCRA values for dimensional stability and environmental stress crack have been added.

% = percent

g = gram

min = minute

h = hour

max = maximum

kgf = kilograms force

m = meters

mm = millimeters

1

**Table C.10. Drainage Gravel Specifications**

Property	Value
<b>Sieve size</b>	
25 millimeters	100 wt% passing
19 millimeters	80 – 100 wt% passing
9.5 millimeters	10 – 40 wt% passing
4.75 millimeters	0 – 4 wt% passing
Permeability	0.1 cm/sec, minimum

2

Reference: Sieve size is from WSDOT M41-10-88, Section 9.03.1(3)C for Grading No. 5 (WSDOT 1988).

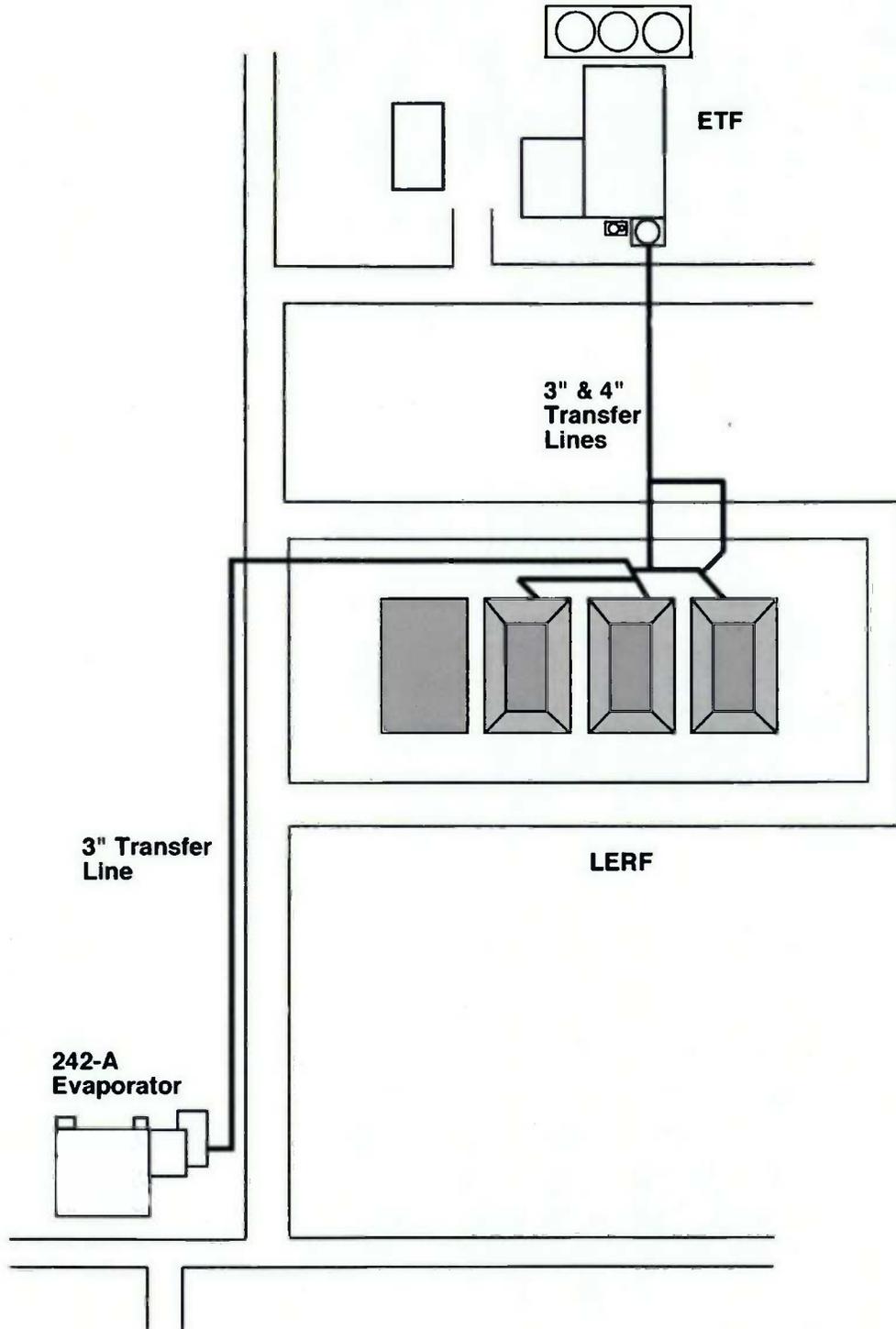
3

Permeability requirement is from [WAC 173-303-650\(2\)\(j\)](#) for new surface impoundments.

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Figure C.1. Liquid Effluent Retention Facility Layout

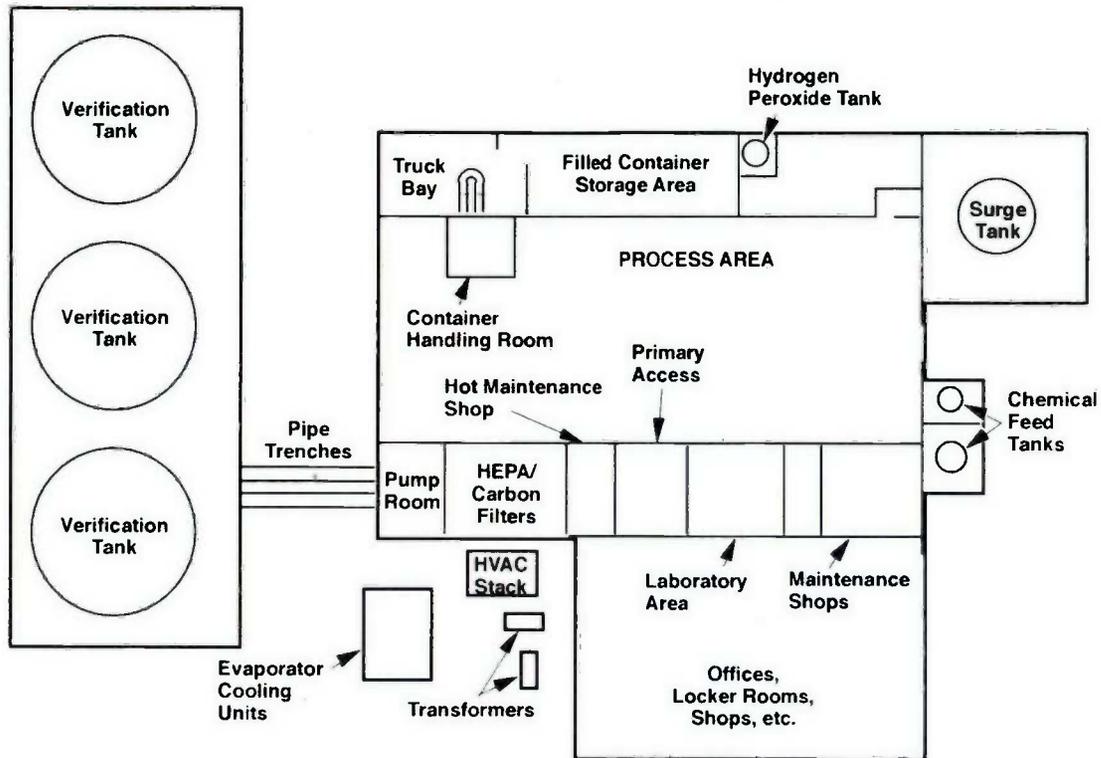


ETF = Effluent Treatment Facility  
LERF = Liquid Effluent Retention Facility

M0704-3.5  
4-21-07

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Figure C.2. Plan View of the 200 Area Effluent Treatment Facility



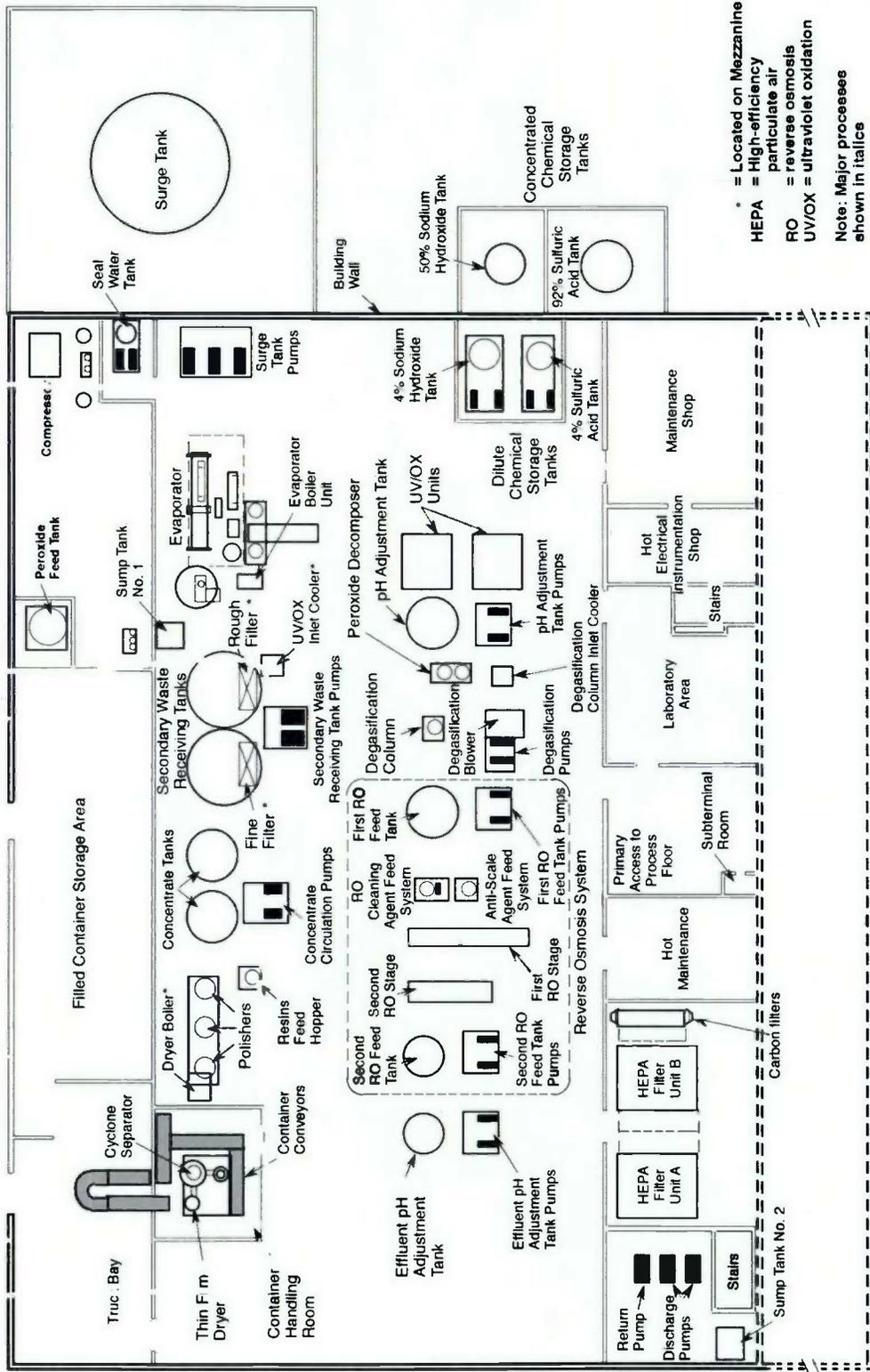
HEPA = High-efficiency particulate air  
HVAC = Heating, ventilation, and air conditioning

M0704-3.6  
4-24-07

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Figure C.3. 200 Area Effluent Treatment Facility Layout



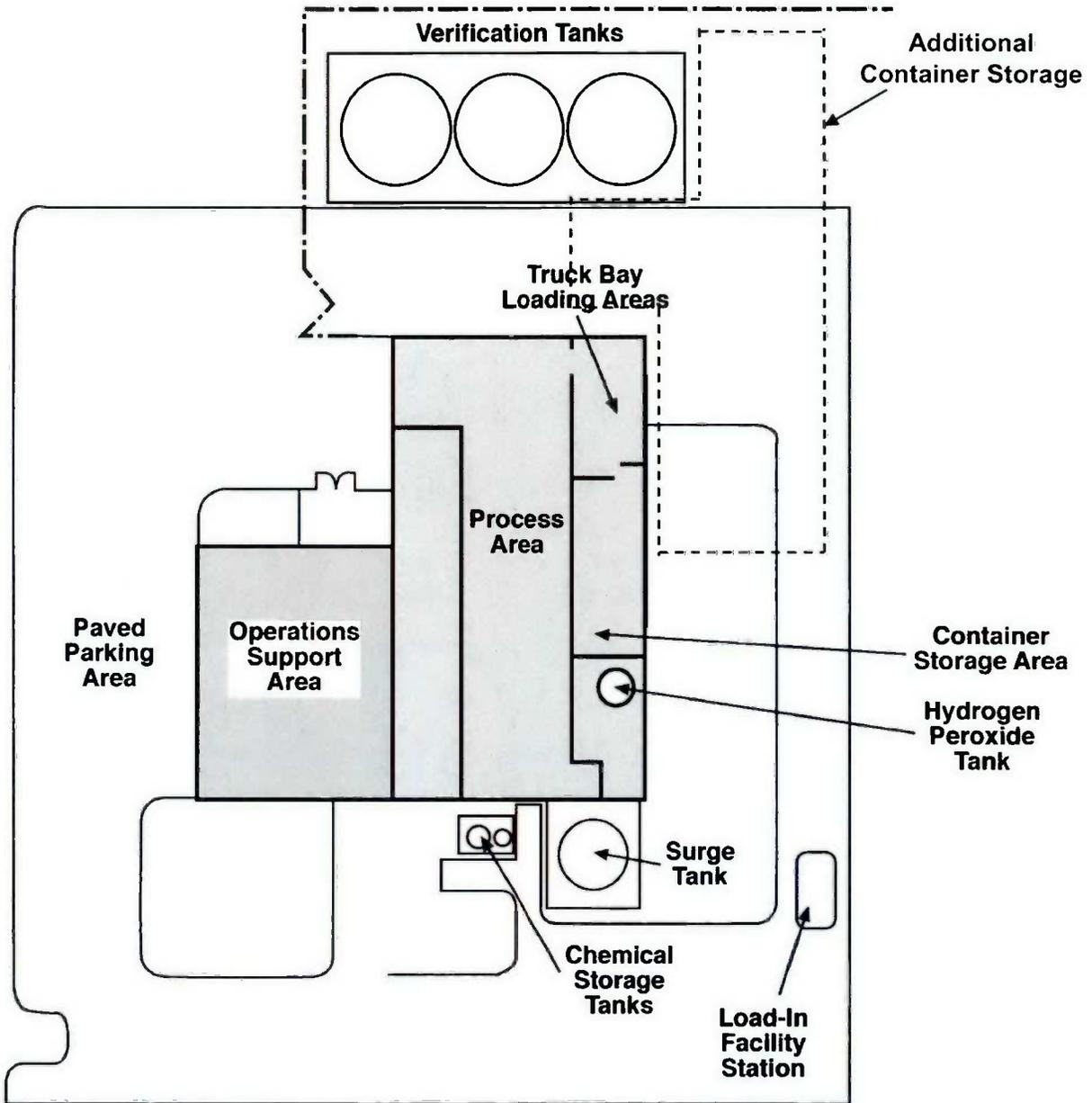
\* = Located on Mezzanine  
 HEPA = High-efficiency particulate air  
 RO = reverse osmosis  
 UV/OX = ultraviolet oxidation  
 Note: Major processes shown in italics

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 4-21-07

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Figure C.4. 200 Area Effluent Treatment Facility



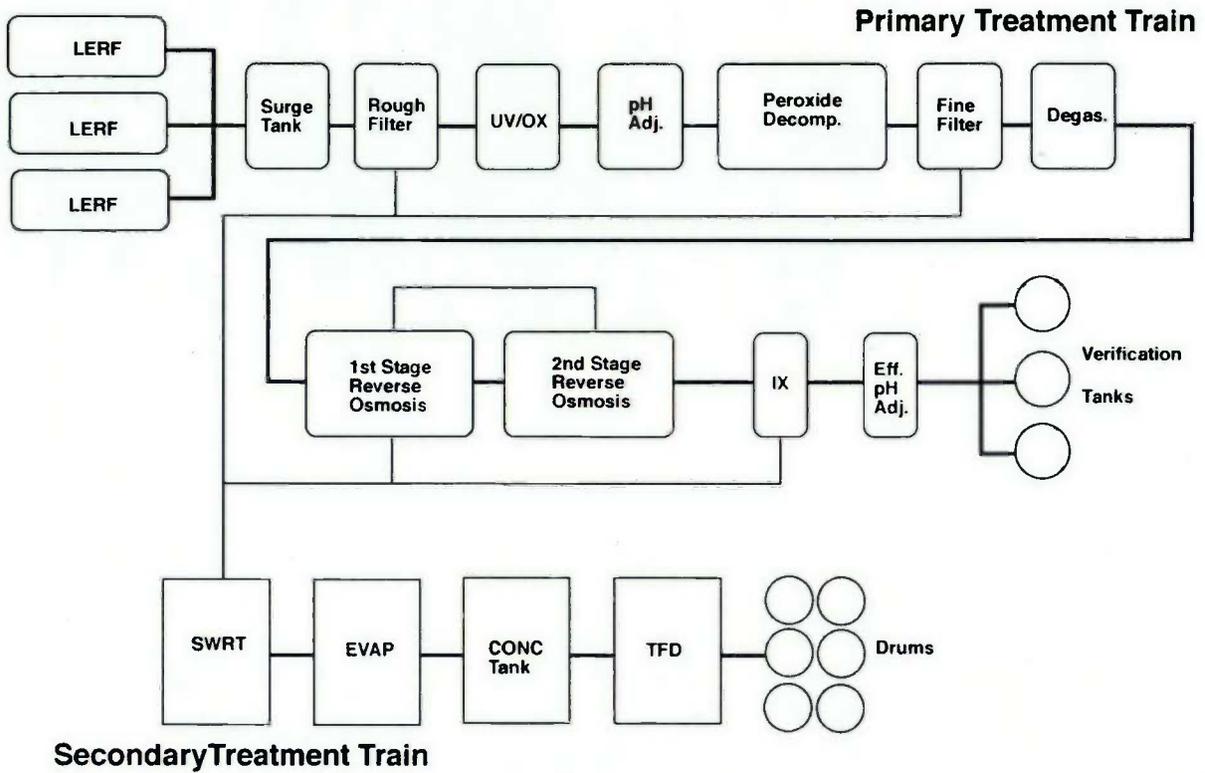
2

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4-21-07

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Figure C.5. Example - 200 Area Effluent Treatment Facility Configuration 1



- CONC Tank = Concentrate tank
- Degas. = Degasification column
- Eff. pH Adj. = Effluent pH adjustment tank
- EVAP = Evaporator
- IX = Ion Exchange
- LERF = Liquid Effluent Retention Facility
- pH Adj. = pH adjustment tank
- SWRT = Secondary waste receiving tank
- TFD = Thin film dryer
- UV/OX = Ultraviolet Oxidation

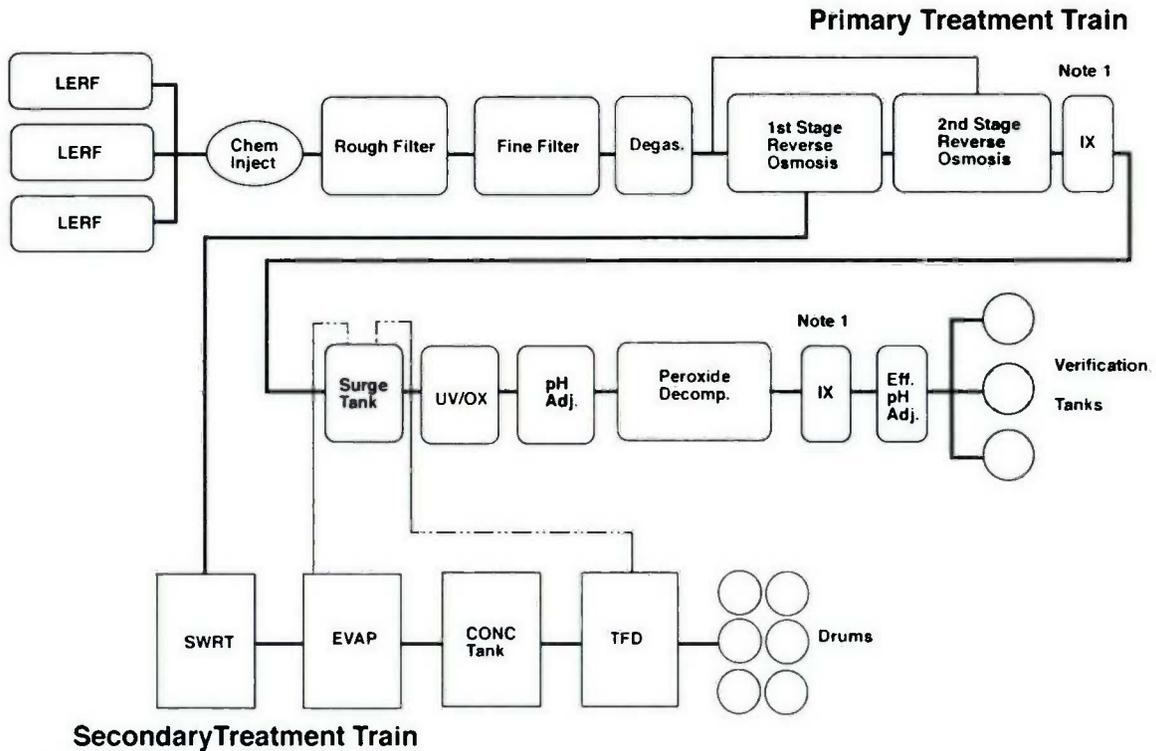
M0704-3.8  
 4-21-07

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Figure C.6. Example - 200 Area Effluent Treatment Facility Configuration 2



**Secondary Treatment Train**

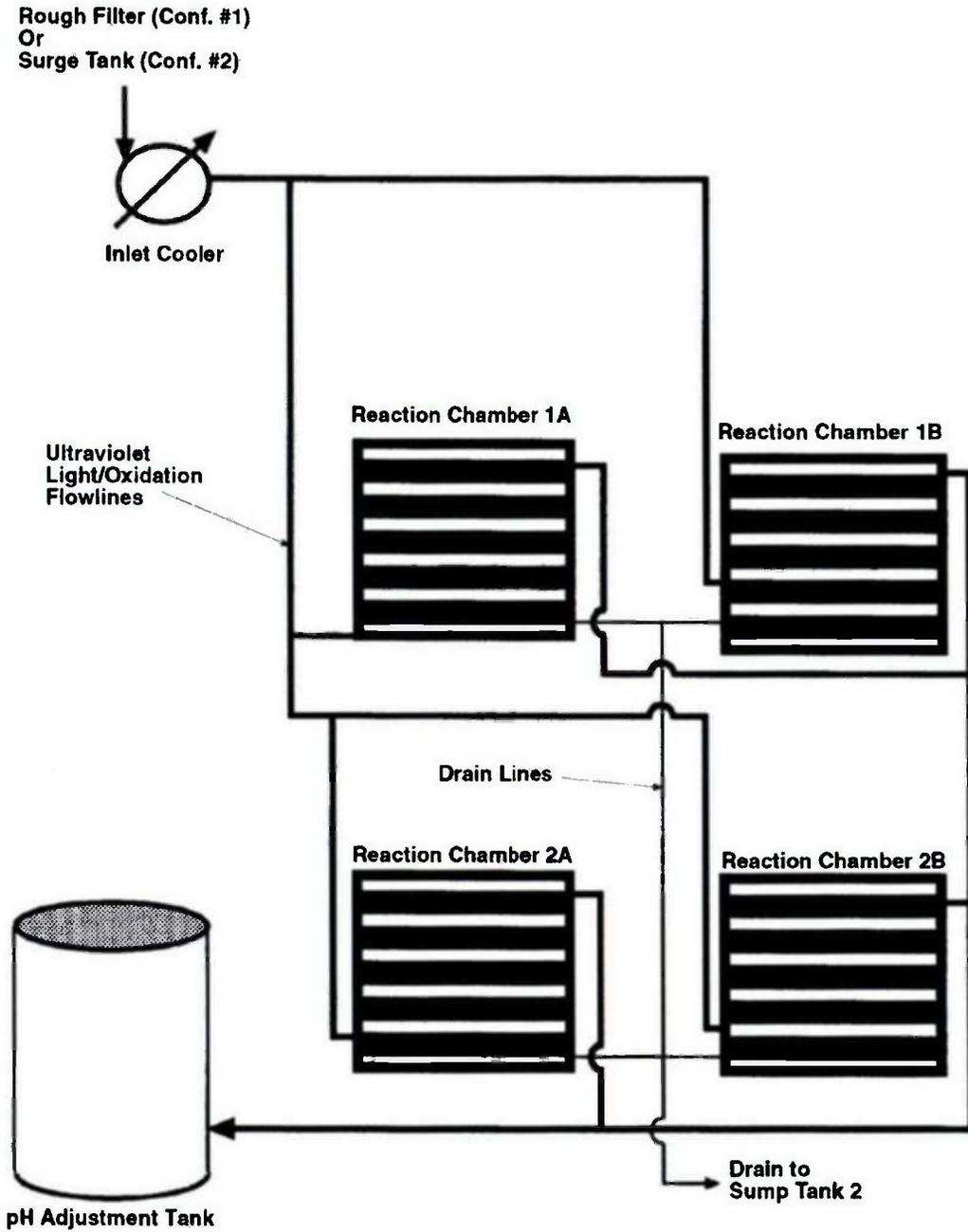
Note 1: IX can be in either location  
 CONC Tank = Concentrate tank  
 Degas. = Degasification column  
 Eff. pH Adj. = Effluent pH adjustment tank  
 Evap = Evaporator  
 IX = Ion exchange  
 pH Adj. = pH adjustment tank  
 SWRT = Secondary waste receiving tank  
 TFD = Thin film dryer  
 UV/OX = Ultraviolet Oxidation

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 4-21-07



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Figure C.8. Ultraviolet Light/Oxidation Unit

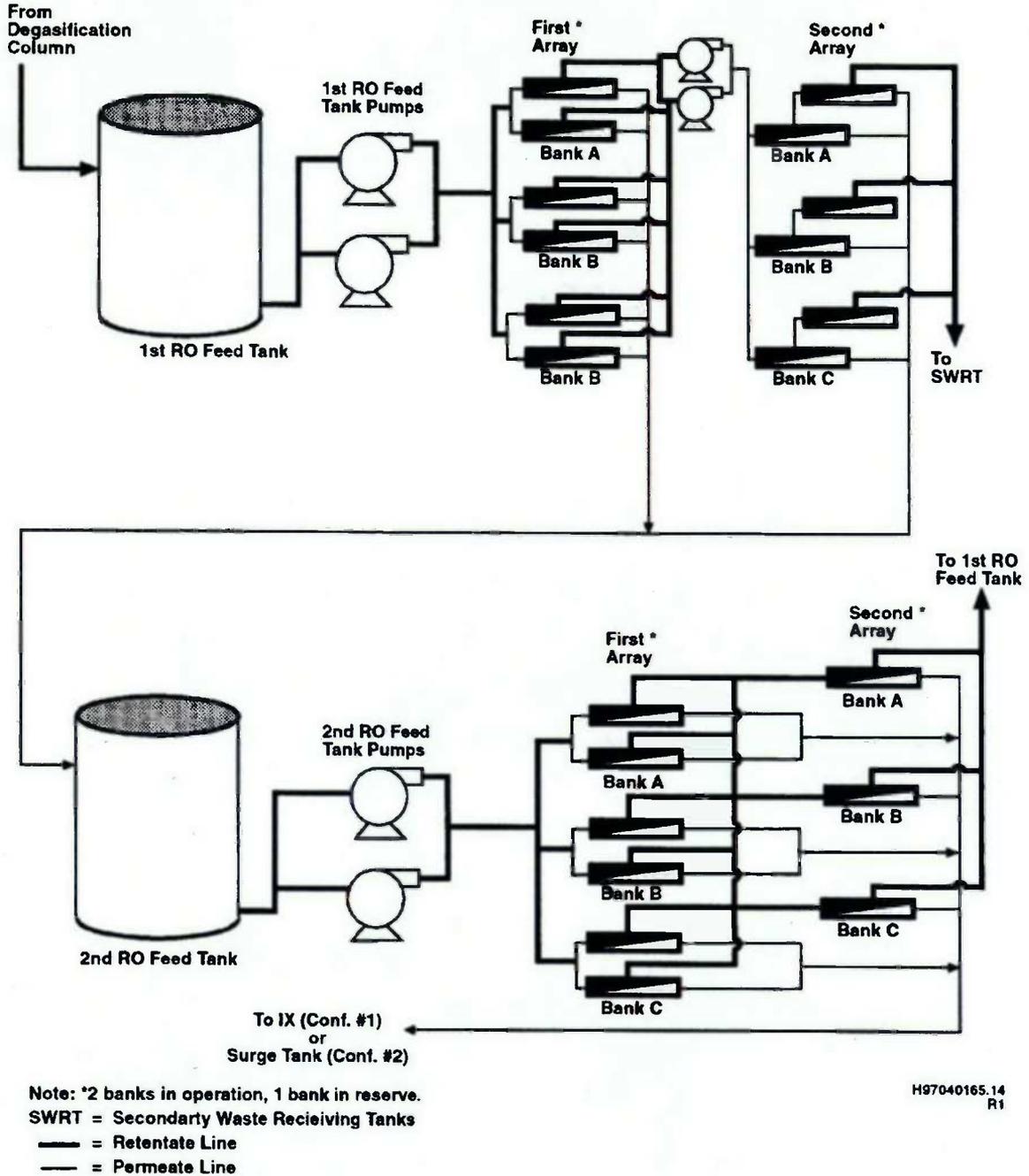


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Figure C.9. Reverse Osmosis Unit

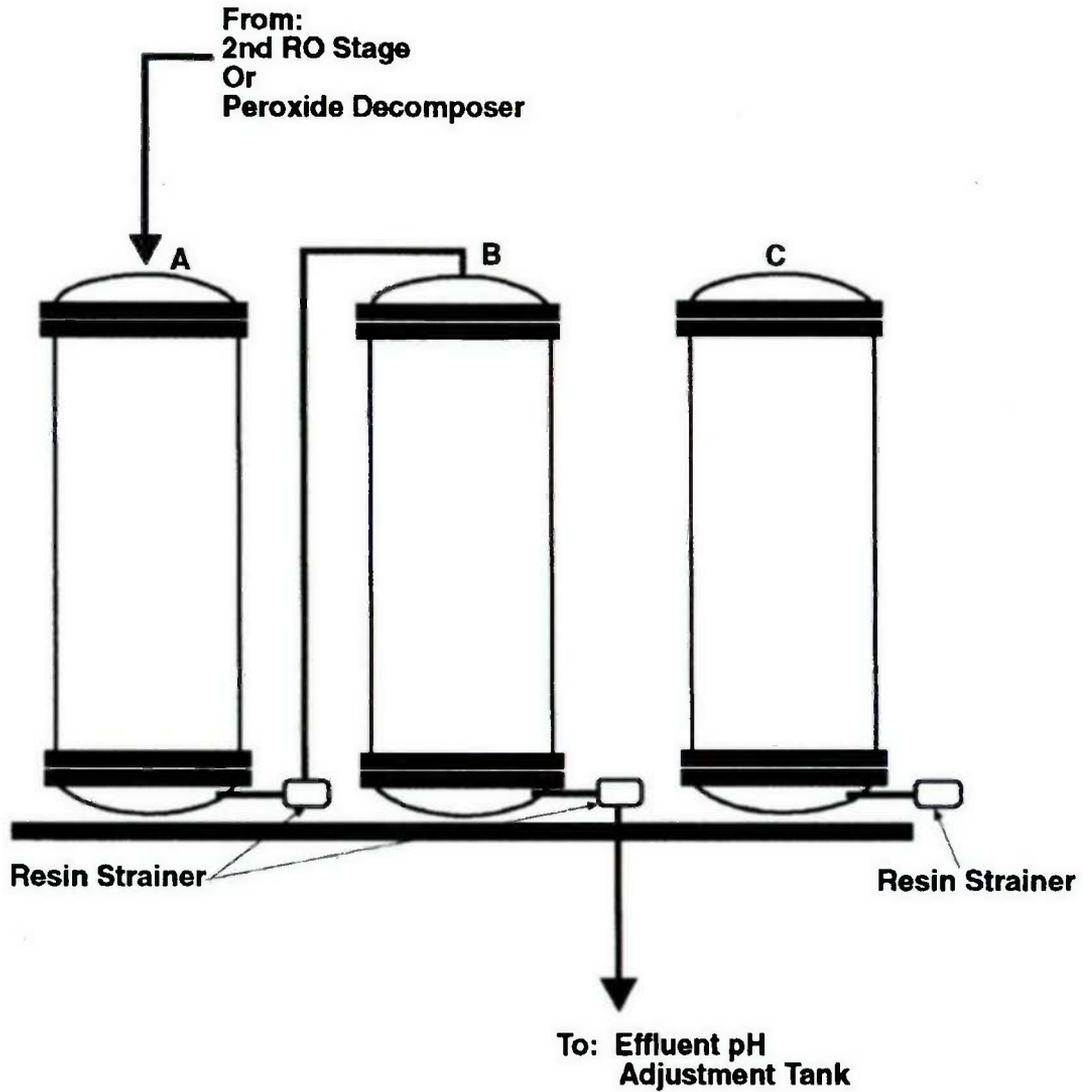


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Figure C.10. Ion Exchange Unit



**NOTE: Example Configuration- Column A and B in Operation,  
Column C in Standby Mode**

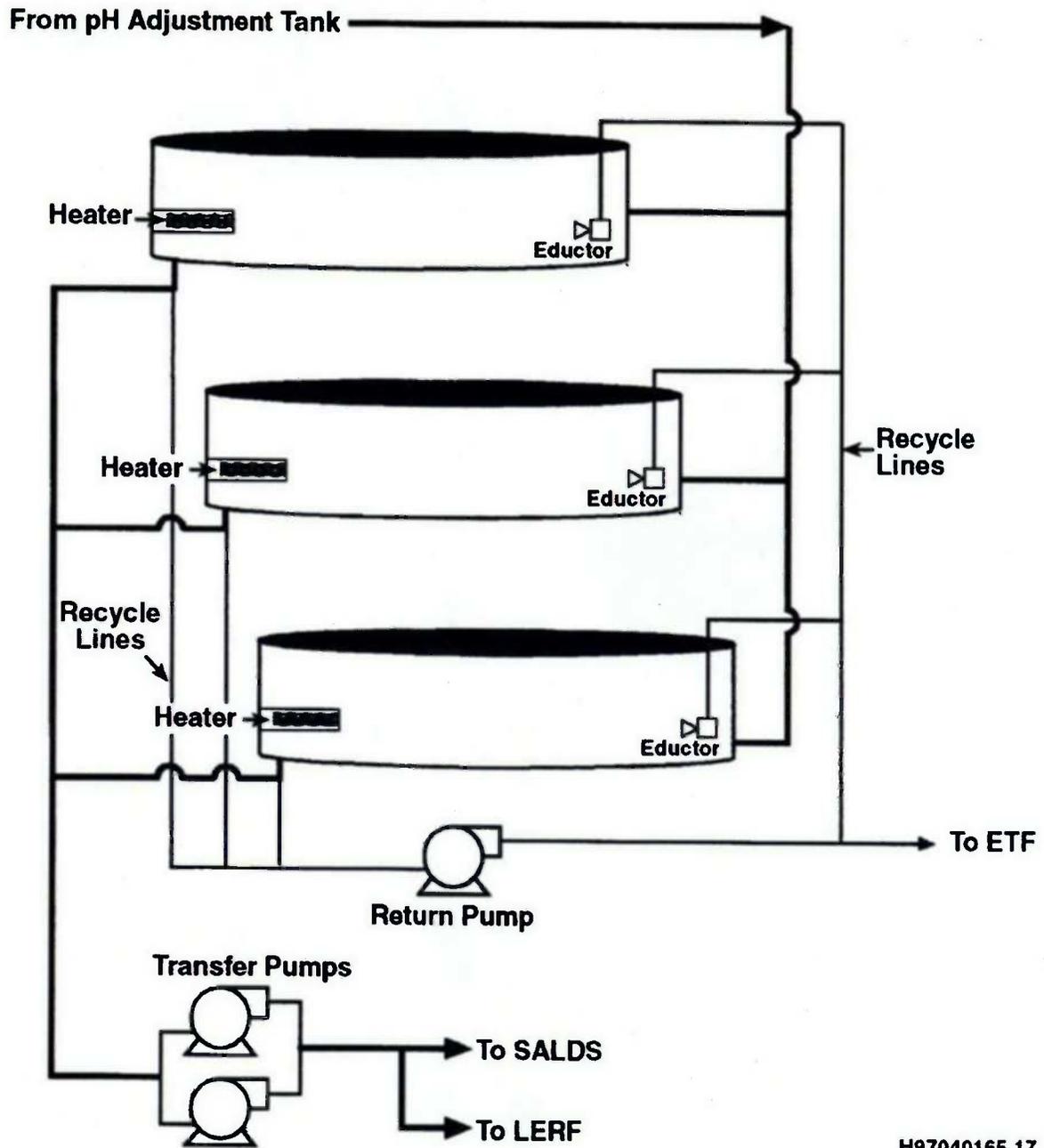
H97040165.18

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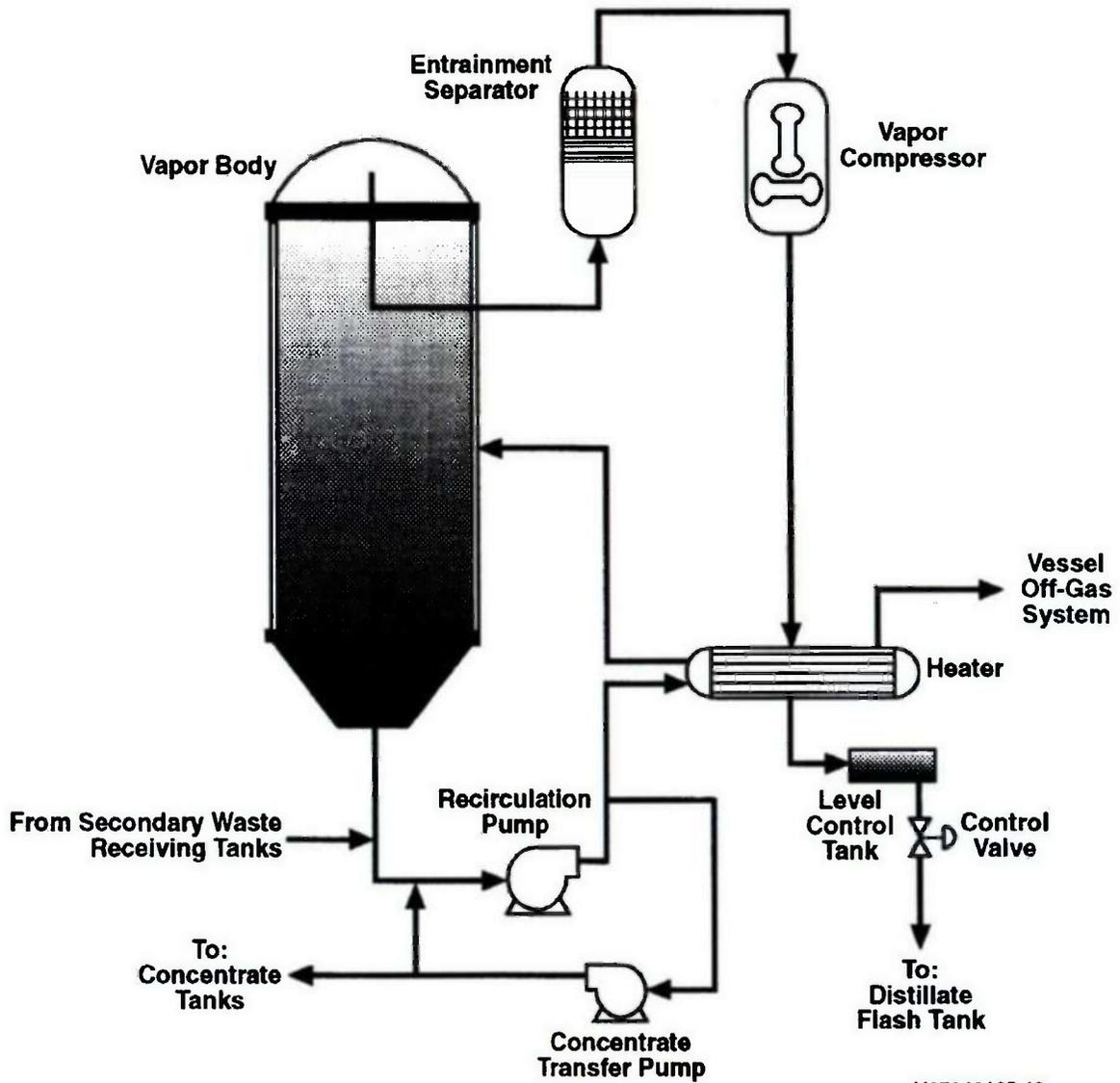
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Figure C.11. Verification Tanks



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R1

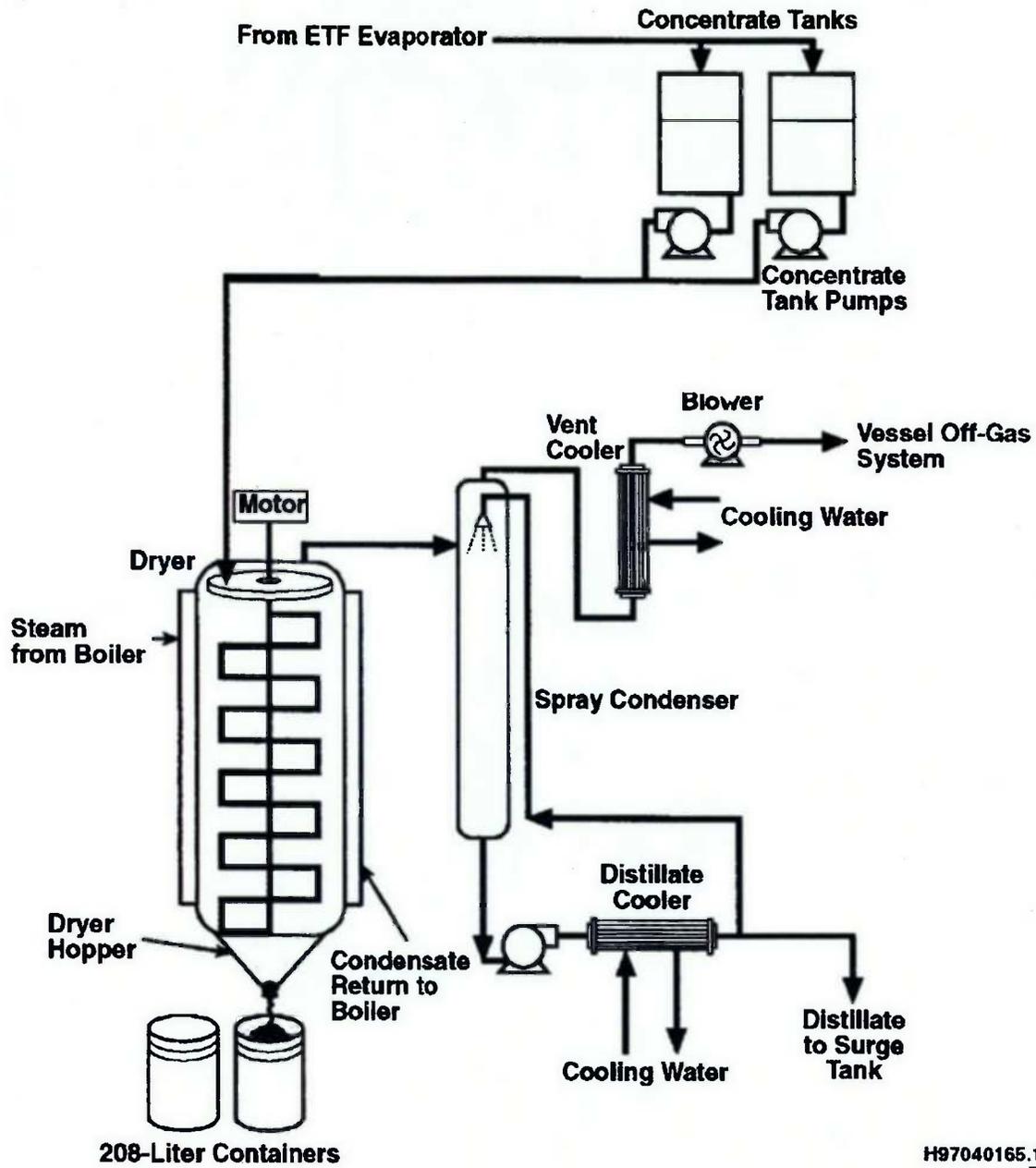
Figure C.12. Effluent Treatment Facility Evaporator



H97040165.10  
R2

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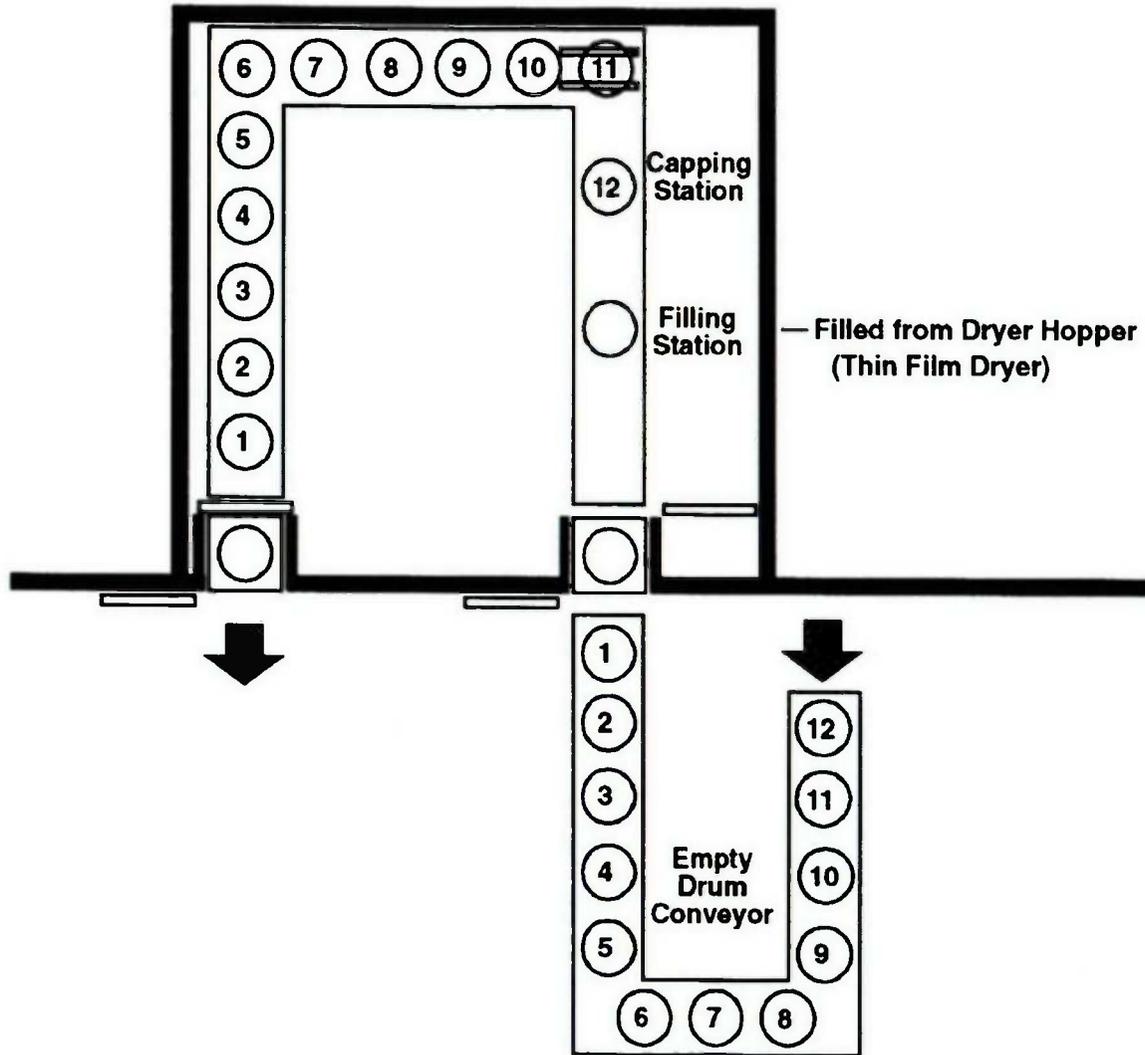
Figure C.13. Thin Film Dryer



H97040165.16  
R1

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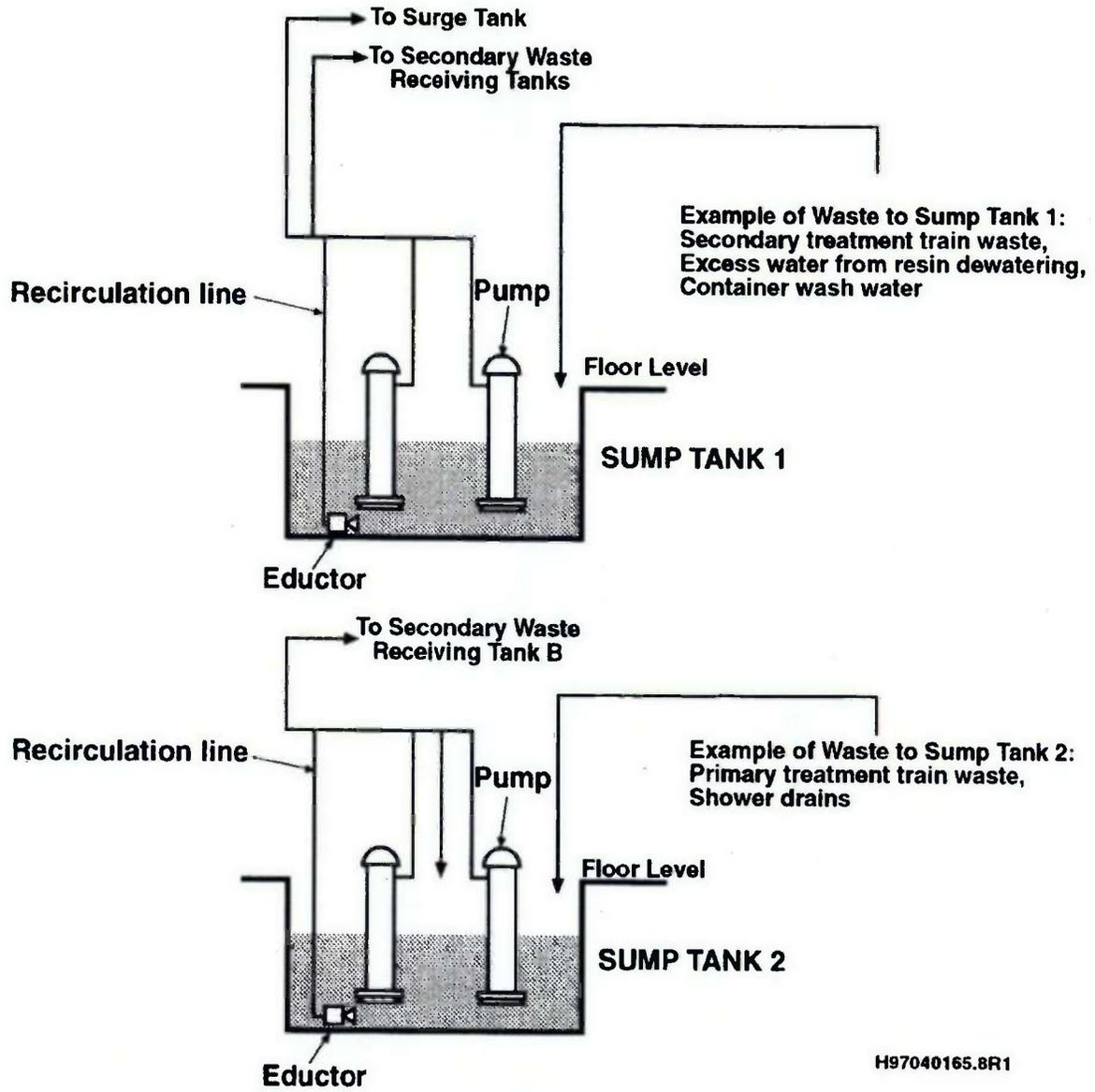
Figure C.14. Container Handling System



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R1

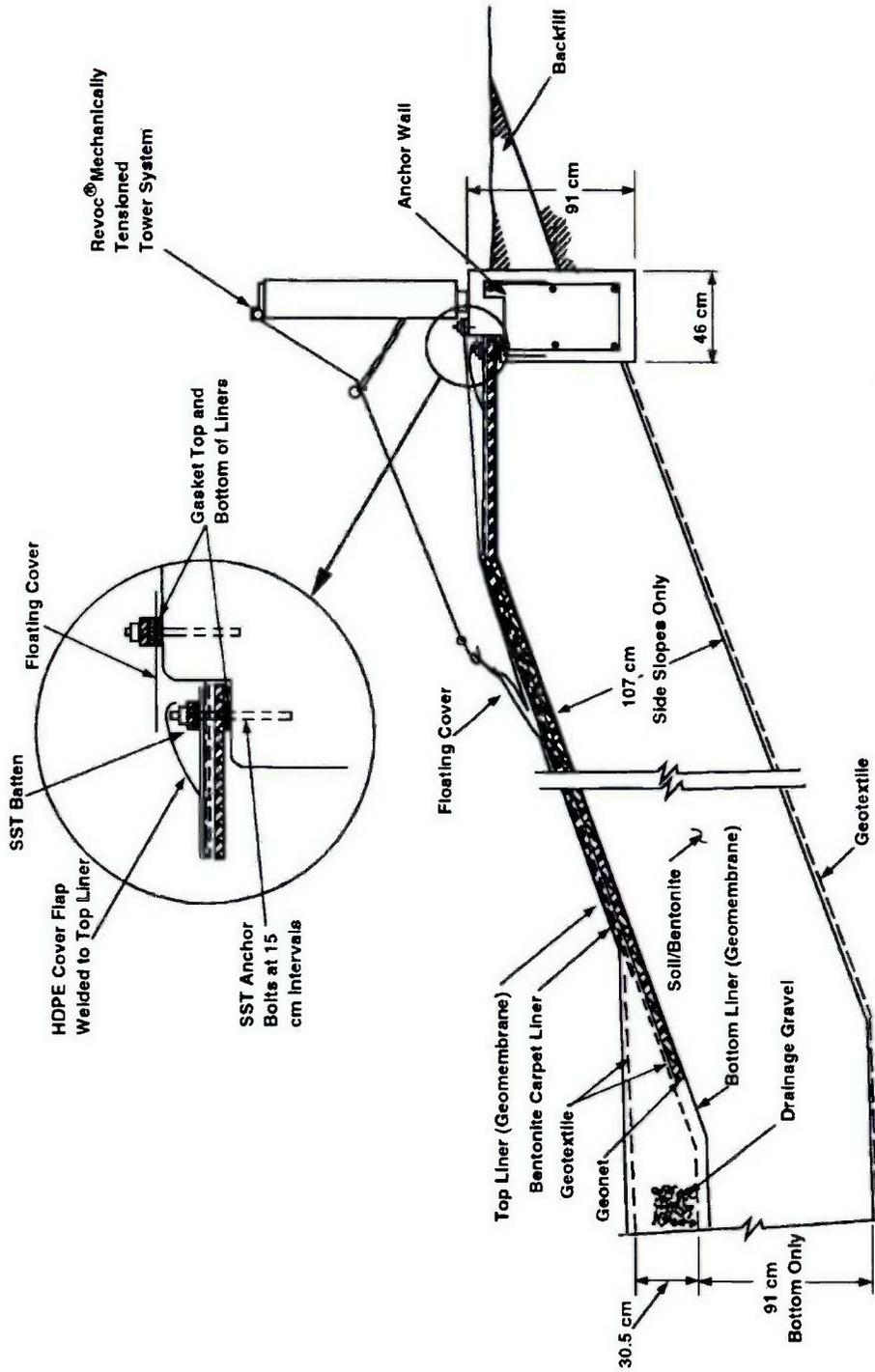
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Figure C.15. Effluent Treatment Facility Sump Tanks



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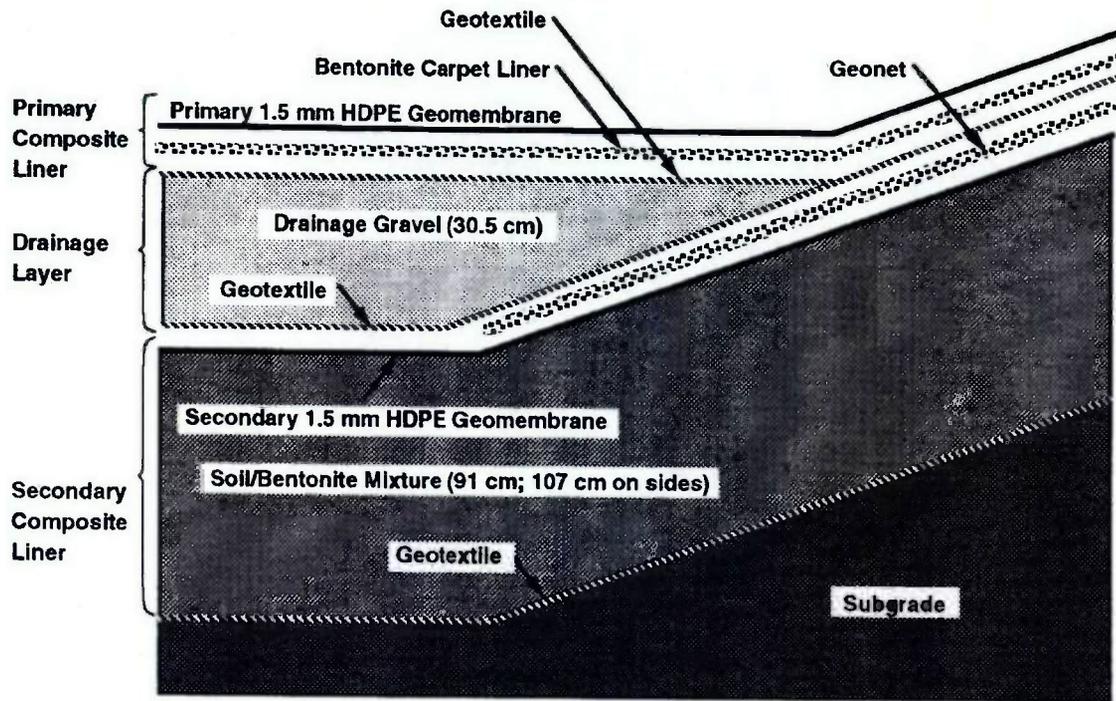
Figure C.16. Liner Anchor Wall and Cover Tension System



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© = Patented and licensed by CW Neal Corp, Santee, CA  
Not to Scale

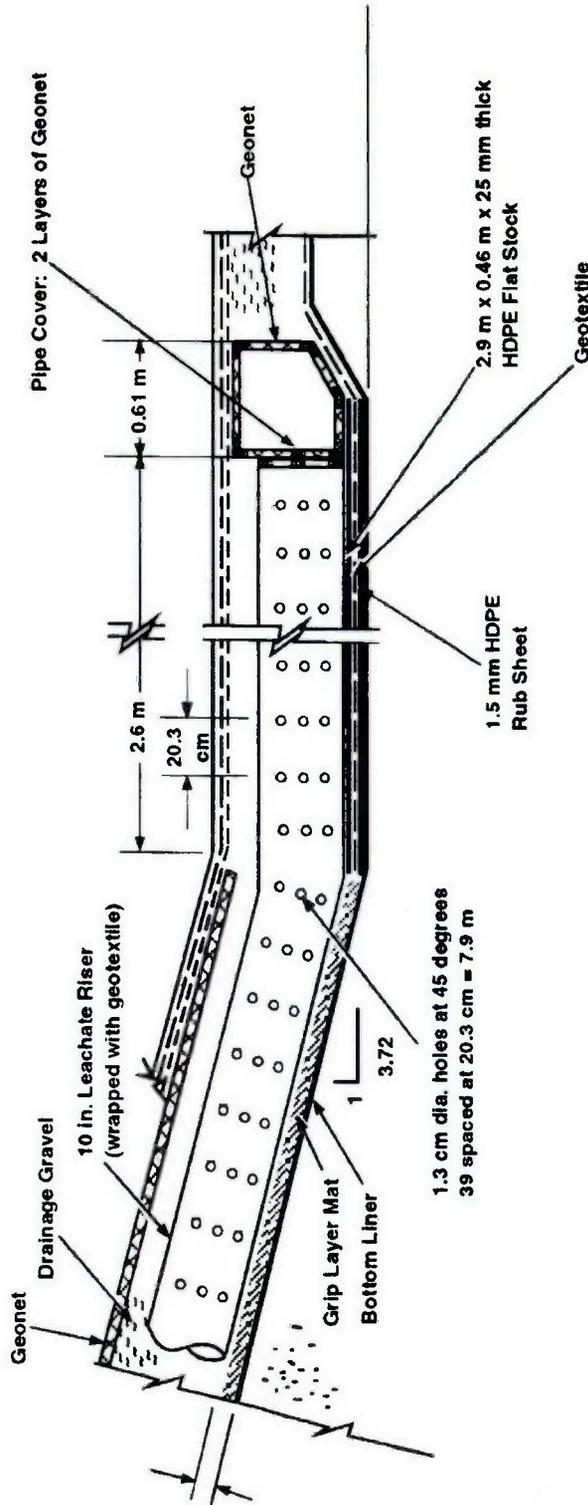
Figure C.17. Liner System Schematic



Not to Scale

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Figure C.18. Detail of Leachate Collection Sump



**Section View**

HDPE: High Density Polyethylene  
Not to Scale

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1 **Addendum F** **Preparedness and Prevention**

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2	F.	PREPAREDNESS AND PREVENTION.....	F.1
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5	F.1.2	Aisle Space Requirement.....	F.2
6	F.2	PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT.....	F.2
7	F.2.1	Unloading Operations, Spill Prevention, and Control.....	F.2
8	F.2.2	Runoff.....	F.2
9	F.2.3	Water Supplies.....	F.3
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12	F.3	PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE	
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## F. PREPAREDNESS AND PREVENTION

### F.1 PREPAREDNESS AND PREVENTION REQUIREMENTS

The following sections document the preparedness and prevention measures taken at LERF and 200 Area ETF.

#### F.1.1 Equipment Requirements

The following sections describe the internal and external communications systems and the emergency equipment required that could be activated by the LERF and 200 Area ETF Building Emergency Director(BED).

##### F.1.1.1 Internal Communications

When operators are present at the LERF, the operators carry two-way radios to maintain contact with 200 Area ETF personnel. The operators at LERF are informed of emergencies (e.g., building and/or area evacuations, take-cover events, high airborne contamination, fire, and/or explosion), and are provided with emergency instructions by several systems. These systems include the mobile two-way radios, and the telephone in the LERF instrument building.

The 200 Area ETF is equipped with an internal communication system to provide immediate emergency instruction to personnel. The onsite communication system at the 200 Area ETF includes telephones, mobile two-way radios, a public address system, and alarm systems. The telephone and radio systems provide for internal and external communication. Alarm systems exist to allow personnel to respond appropriately to various emergencies, including building evacuations, take cover events, and fire and/or explosion. Addendum J provides additional information on the response activities.

##### F.1.1.2 External Communications

The LERF and its operators are equipped with devices for summoning emergency assistance from the Hanford Fire Department, the Hazardous Materials Response Team, and/or Hanford patrol, as necessary. External communication to summon emergency assistance is made by a normal telephone system or mobile two-way radios. The LERF telephone is available in the instrumentation building. The 200 Area ETF uses fire alarm pull boxes and telephones for external communication and are located at numerous locations throughout the 200 Area ETF.

##### F.1.1.3 Emergency Equipment

The LERF and 200 Area ETF rely primarily on the Hanford Fire Department to respond to fires and other emergencies as described in Permit Attachment 4, *Hanford Emergency Management Plan*, (DOE/RL-94-02). All LERF and 200 Area ETF operators are familiar with the LERF and 200 Area ETF contingency plans (Addendum J) and are trained in the use of emergency pumping of LERF and 200 Area ETF systems, fire, and communications equipment.

Portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment is available at various locations in the 200 Area ETF.

The 200 Area ETF has fire extinguishers, automatic fire suppression systems (200 Area ETF control room and electrical room), fire alarm pull boxes, and a water spray system (200 Area ETF operating and administrative portions).

Respirators, hazardous material protective gear, and special work procedure clothing for 200 Area ETF personnel are kept in the change room at the 200 Area ETF. Safety showers are located in convenient

1 locations in the 200 Area ETF, and emergency eyewashes are available for use. Water for these devices  
2 is supplied from the 200 Area ETF sanitary water system.

### 3 **F.1.1.4 Water for Fire Control**

4 A water main is not provided to the LERF. The Hanford Fire Department is equipped with fire engines  
5 for fire control for fires requiring high water volume and pressure. The 200 Area ETF is serviced by two  
6 12-inch raw water lines that are tied into the 200 East Area raw water distribution grids. These lines  
7 provide a looped configuration that supplies two independent sources of raw water for fire protection and  
8 raw water uses. Connections from the 200 Area ETF raw water system supply fire hydrants and the wet  
9 pipe sprinkler system. In the event that water pressure is lost, the Hanford Fire Department is equipped  
10 with fire engines to provide needed water.

### 11 **F.1.2 Aisle Space Requirement**

12 The operation of the LERF does not involve aisle space. Nevertheless, the LERF and the individual  
13 basins are easily accessible to emergency response personnel and vehicles. A 6.1-meter-wide service  
14 road runs along the base of the basin area on the east, south, and west sides within the operational security  
15 fence.

16 Aisle spacing at 200 Area ETF is sufficient to allow the movement of personnel and fire protection  
17 equipment in and around the containers. This storage arrangement also meets the requirements of the  
18 National Fire Protection Association (NFPA 1996) for the protection of personnel and the environment.  
19 A minimum 30-inch aisle space is maintained between rows of containers as required by  
20 [WAC 173-303-630\(5\)\(c\)](#).

## 21 **F.2 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT**

22 The following sections describe preventive procedures, structures, and equipment.

### 23 **F.2.1 Unloading Operations, Spill Prevention, and Control**

24 Underground pipelines that transfer aqueous waste to and from the LERF are encased in a secondary pipe.  
25 If a leak is detected in a pipeline, flow in the pipeline will be stopped and the cause of the leak  
26 investigated and remediated.

27 If it is required to transfer aqueous waste from one LERF basin to another, existing transfer pumps are  
28 used as described in Addendum C.

29 The 200 Area ETF Load-in Station is monitored continuously during tank-filling operations and filling is  
30 stopped immediately if leaks occur. Care is taken to ensure that even minor leaks are cleaned up  
31 immediately and disposed of in accordance with approved management procedures. Any spill that is  
32 determined to be a dangerous waste will be managed according to the requirements of [WAC 173-303](#).

### 33 **F.2.2 Runoff**

34 The LERF is constructed and operated to ensure that all aqueous waste is contained within the basins.  
35 The basins are designed and operated to prevent overtopping. Furthermore, the basins are provided with  
36 very low-density polyethylene floating covers to prevent the introduction of precipitation into the basins.  
37 The basins also are graded to ensure that all precipitation outside the basins is directed away from the  
38 surface impoundments.

39 The basins are constructed so that the top of the basin dikes are approximately 3 meters above grade. The  
40 exterior side slopes of the basins have a 2.25 (horizontal) to 1 (vertical) slope. Run-on of precipitation to  
41 the basins from the surrounding area is not possible because the surrounding area slopes away from the  
42 LERF.

43 Dangerous waste and hazardous chemical handling areas at the 200 Area ETF are designed to contain  
44 spills, leaks, and wash water, thereby preventing run-off and subsequent releases. All dangerous and/or

1 mixed waste loading and unloading areas are provided with secondary containment structures as  
2 described in Addendum C, Process Information.

### 3 **F.2.3 Water Supplies**

4 The LERF uses operating practices, structures, and equipment to prevent the contamination of natural  
5 water supplies (i.e., groundwater and surface water). The LERF is monitored ~~closely~~ continuously during  
6 aqueous waste transfers and at least daily during operation to detect abnormal conditions (e.g., leaks), and  
7 regularly inspected to detect equipment and structural deteriorations that could allow possible water  
8 supply contamination. The basins are provided with a leachate collection system that is designed to  
9 contain any leachate generated. These systems, in conjunction with the double-composite liner system  
10 and underlying low permeable clay liner, ensure that should a release occur, the release will be fully  
11 contained within the basin configuration and, therefore, water supplies will be protected. Addendum J,  
12 Contingency Plan, provides information on procedures that are implemented if a release is detected at the  
13 LERF.

14 There are no drinking water wells near the 200 Area ETF. Therefore, a release would not immediately  
15 contaminate drinking water supplies. The 200 Area ETF uses operating practices, structures, and  
16 equipment to prevent the contamination of natural water supplies (i.e., groundwater and surface water).  
17 The 200 Area ETF is monitored during processing operations to detect abnormal conditions, and is  
18 inspected regularly to detect equipment and structural deteriorations that could allow spills to the  
19 environment. Areas in contact with dangerous and/or mixed waste are monitored continuously during  
20 Load-in Station and/or ETF processing operations through a series of level and pressure indicators, leak  
21 detection alarms, equipment failure alarms, and control panel readouts. In addition, the 200 Area ETF is  
22 inspected regularly for the presence of leaks or other off normal conditions wherever possible (in all areas  
23 that can be safely entered).

24 In addition to detailed operating practices, structures and equipment are used at the 200 Area ETF to  
25 prevent contamination of water supplies. The structures and equipment designed to prevent  
26 contamination of water supplies are the same as the structures and equipment used to prevent run-off from  
27 dangerous and/or mixed waste handling areas.

### 28 **F.2.4 Equipment and Power Failure**

29 The storage function of the LERF is not affected by loss of power and a temporary loss of power would  
30 not pose a threat to the environment. Loss of electrical power would not cause the storage of the waste to  
31 be jeopardized. For process condensate transferred from the 242-A Evaporator, appropriate valving  
32 procedures are followed to ensure a smooth restart of the flow to the LERF in the event of a power failure  
33 at the 242-A Evaporator.

34 The 200 Area ETF does not have a standby power source. Power to selected lighting, computers, and  
35 process controls is configured with an uninterruptible power supply. During partial loss of normal power,  
36 the effected pumps and subsystems will be shut down. Complete loss of power to the 200 Area ETF  
37 shuts down the entire 200 Area ETF except for the instruments in the control room connected to the  
38 uninterruptible power supply. Redundant pumps allow the process to continue to operate when only one  
39 component is out of service.

40 When power at the 200 Area ETF is lost, the valves assume a fail-safe position to allow the process to  
41 remain in a safe shutdown mode until restoration of power. This action allows the operators to perform  
42 equipment surveys during shutdown and to confirm that there are no safety issues because the 200 Area  
43 ETF is shut down. Because a power failure would also shutoff flow into the 200 Area ETF, there will not  
44 be any increase in volume in any of the holdup basins, tanks, or other systems.

45 A combination of reliability, redundancy, maintenance, and repair features are used in the 200 Area ETF  
46 equipment and systems to minimize random failure of equipment. For crucial systems such as ventilation  
47 filters, redundant trains are provided to mitigate equipment and system failure. Spare parts are  
48 maintained for essential production and safety equipment.

## 1 F.2.5 Personnel Exposure

2 At the LERF and 200 Area ETF, operating practices, structures, and equipment are used to prevent undue  
3 exposure of personnel to dangerous and/or mixed waste. All personnel handling waste use protective  
4 clothing and equipment. All operations are conducted so that exposure to dangerous and/or mixed waste  
5 and hazardous materials are maintained ALARA.

6 Protective clothing and equipment are prescribed for personnel handling chemicals or dangerous waste.  
7 Before the start of any operation that could expose personnel to the risk of injury or illness, a review of  
8 the operation is performed to ensure that the nature of hazards that might be encountered is considered  
9 and appropriate protective gear is selected. Personnel are instructed to wear personal protective  
10 equipment in accordance with training, posting, and instructions.

11 A change trailer at LERF is located between Basins 42 and 43. In addition, the change trailer has an  
12 operations office for working with procedures. Exits within the change trailer are clearly marked. A  
13 storage building is located within the perimeter fence, northwest of the basins. The LERF storage  
14 building also is provided with separate storage areas for clean and contaminated equipment. A  
15 decontamination shower and decontamination building is located at the 272-AW Building, approximately  
16 1.6 kilometers from the LERF or at the 200 Area ETF.

17 The 200 Area ETF has eyewash stations and safety showers in convenient locations for use by personnel.  
18 The following structures and equipment were incorporated into the 200 Area ETF design to minimize  
19 personnel exposure.

- 20 • Offices, control room, clean- and soiled-clothes storage areas, change rooms, and the lunchroom are  
21 situated to minimize casual exposure of personnel.
- 22 • Building exit pathways are located to provide rapid egress in emergency evacuations.
- 23 • Emergency lighting devices are located strategically throughout the 200 Area ETF.
- 24 • Audio and/or visual alarms are provided for all room air samplers, area alarms, and liquid monitors.  
25 Visual readouts for these alarm systems are located in less contaminated areas to minimize exposure  
26 to personnel.
- 27 • Areas for decontaminating and maintaining equipment are provided in contaminated areas to limit the  
28 spread of contamination to uncontaminated areas such as the control room.
- 29 • Instrument interlock systems automatically return process operations to a safe condition if an unsafe  
30 condition should occur.
- 31 • The 200 Area ETF ventilation systems are designed to provide airflow from uncontaminated zones to  
32 progressively more contaminated zones.

33 Whenever possible, exposures to hazards are controlled by accepted engineering and/or administrative  
34 controls. Protective gear is used where effective engineering or administrative controls are not feasible.

## 35 F.3 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE 36 WASTE

37 Typically, aqueous waste managed at the LERF or 200 Area ETF does not display the characteristics of  
38 reactivity or ignitability. Any aqueous waste streams exhibiting these characteristics are blended or  
39 mixed at LERF to a concentration where the waste no longer exhibits reactive or ignitable characteristics.

40 Incompatible aqueous waste is not expected to be stored or treated at the LERF or 200 Area ETF  
41 (Addendum B, Waste Analysis Plan). Therefore, the requirements of [WAC 173-303-806\(4\)\(a\)](#) are not  
42 applicable.

43

1 **Addendum I** **Inspection Requirements**

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2 I. INSPECTION REQUIREMENTS ..... I.1  
3 I.1 INSPECTION PLAN ..... I.1  
4 I.1.1 General Inspection Requirements ..... I.1  
5 I.1.2 Specific Process Inspection Requirements ..... I.1  
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8 **Tables**

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9 Table I.1. Visual Inspection Schedule for the LERF and 200 Area ETF ..... I.5  
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## I. INSPECTION REQUIREMENTS

### I.1 INSPECTION PLAN

This addendum describes the method and schedule for inspections of LERF and 200 Area ETF. The purpose of inspections is to help ensure that situations do not exist that might cause or lead to the release of dangerous and/or mixed waste that could pose a threat to human health and the environment.

Abnormal conditions identified by an inspection will be corrected on a schedule that prevents hazards to workers, the public, and the environment.

#### I.1.1 General Inspection Requirements

The content and frequency of inspections are described in this section. Inspection records are retained in the Hanford Facility Operating Record, LERF and 200 Area ETF file, or other approved locations, in accordance with Permit Condition II.I.1.

In certain areas of the 200 Area ETF, many inspections are performed remotely to maintain ALARA exposure. Monitoring instruments are connected to audible alarms and visual indicators track alarm status. The monitoring system provides trending of selected monitoring data, graphics, and equipment summary displays.

A preventive maintenance recall system is employed to direct preventive maintenance activities at the LERF and 200 Area ETF. Equipment requiring maintenance is checked as indicated by the maintenance history and the manufacturer's recommendations. The preventive maintenance of certain equipment might not be possible if the LERF or the 200 Area ETF is in an operational mode. Thus, the preventive maintenance could be performed slightly earlier or later than planned to minimize impact on operations.

Instrumentation at 200 Area ETF is calibrated regularly to ensure accuracy and reliability. All process control instrumentation is calibrated on a schedule depending on previous calibration experience. An instrument calibration and recall system is employed to manage calibrations.

##### I.1.1.1 Types of Problems

Key components of the LERF inspection program include the following areas:

- Structural integrity of the basins
- Catch basin secondary containment system integrity
- Evidence of release from basins
- Safety, communications, and emergency equipment

Key components of the 200 Area ETF inspection program include the following areas:

- Condition of tanks and ancillary piping
- Condition of containers
- Condition of the process control equipment
- Condition of emergency equipment
- Condition of secondary containment

Table I.1 and Table I.2 provide a description of LERF and 200 Area ETF items to be inspected.

##### I.1.1.2 Frequency of Inspections

The frequency of inspections is based on the rate of possible deterioration of equipment and the probability of a threat to human health or the environment.

The LERF and 200 Area ETF is inspected as indicated in Table I.1 and Table I.2.

#### I.1.2 Specific Process Inspection Requirements

The following sections describe the specific process inspections performed at LERF and 200 Area ETF.

1 **I.1.2.1 Container Inspections**

2 Containers are used at the 200 Area ETF to store solidified secondary waste, such as the powder waste  
3 from the thin film dryer and maintenance and operations waste. When containers are being held in  
4 container storage areas, the following inspection schedule is maintained:

- 5 • Daily visual inspection of container storage area for leaks, spills, accumulated liquids, and open or  
6 improperly sealed containers
- 7 • Weekly visual inspection of container labels to ensure labels are not obscured, removed, or otherwise  
8 unreadable
- 9 • Weekly visual inspection for deterioration of containers, containment systems, or cracks in protective  
10 coating or foundations caused by corrosion, mishandling, or other factors.

11 Following the inspections, an inspection datasheet is signed and dated by the inspector and supervisor.

12 **I.1.2.2 Tank Inspections**

13 A description of the tank systems and ancillary equipment at the 200 Area ETF is given in Addendum C.  
14 Inspections and frequencies are given in Table I.1 and Table I.2. This section includes a brief discussion  
15 of the inspections.

16 **I.1.2.2.1 Overfill Protection**

17 Tanks that have the possibility of being overfilled have level instrumentation that alarms before the tanks  
18 reach overflow. High tank level alarms annunciate ~~in the control room~~, allowing operating personnel to  
19 take immediate action to stop the vessels from overfilling. These alarms are monitored continuously ~~in~~  
20 ~~the control room~~ during solution transfers.

21 **I.1.2.2.2 Visual Inspections**

22 Visual inspections of tanks and secondary containments are performed to check for leaks, signs of  
23 corrosion or damage, and malfunctioning equipment. Inspections are performed on tanks, secondary  
24 containment within the 200 Area ETF, surge tank, and verification tank, and associated secondary  
25 containment.

26 **I.1.2.2.3 Secondary Containment Leak Detectors**

27 The surge tank and verification tank secondary containment systems have sloped floors that drain  
28 solutions to sumps equipped with leak detectors ~~that alarm in the control room~~. These alarms are  
29 monitored continuously ~~in the control room~~ during ETF processing operations and at least daily at other  
30 times. If an alarm is activated, further investigation is performed to determine if the source is a tank leak  
31 or other solution (i.e., precipitation).

32 **I.1.2.2.4 Integrity Assessments**

33 The initial integrity assessment was issued in 1995 (Addendum C). Consistent with the recommendations  
34 of the integrity assessment, a periodic integrity assessment program was developed for the 200 Area ETF  
35 tanks and is discussed in detail in Addendum C, Section C.4.2.

36 **I.1.2.2.5 Effluent Treatment Facility Piping**

37 The 200 Area ETF employs an extensive piping system. During inspections at the 200 Area ETF, any  
38 aboveground piping is inspected visually for signs of leakage and for general structural integrity. During  
39 the visual inspection, particular attention is paid to valves and fittings for signs of cracking, deformation,  
40 and leakage.

41 **I.1.2.3 Surface Impoundments and Condition Assessment**

42 The following describes the surface impoundment inspections performed at LERF.

1 **1.1.2.3.1 Overtopping Control**

2 Under current operating conditions, 1.34 meters of freeboard is maintained at each LERF basin, which  
3 corresponds to a normal operating level of 6.1 meters, or 24.6 million liters. Level indicators at each  
4 basin are monitored to confirm that this level is not exceeded.

5 Before an aqueous waste is transferred into a basin, administrative controls are implemented to ensure  
6 overtopping will not occur during the transfer. The volume of feed to be transferred is compared to the  
7 available volume in the receiving basin. The transfer is not initiated unless there is sufficient volume  
8 available in the receiving basin or a cut-off level is established. The transfer into the basin would be  
9 stopped when this cut-off level is reached.

10 The LERF basins also are provided with floating very low-density polyethylene covers that are designed  
11 and constructed to prevent overtopping by the introduction of precipitation and dust into the basins.  
12 Overtopping and flow control also are discussed in Addendum C.

13 **1.1.2.3.2 Impoundment Contents**

14 The LERF basins are inspected weekly to assess whether the contents are escaping from a basin. Level  
15 indicators are inspected weekly to check for unaccountable change in the level of the basins.

16 **1.1.2.3.3 Leak Detection**

17 The leachate detection, collection, and removal system is described in Addendum C. The leachate  
18 collection sump pump is activated ~~automatically~~ when the liquid level in the leachate sump reaches a  
19 preset level. A flow meter ~~and~~ totalizer measures the amount of leachate removed. In addition, the timer  
20 on the leachate pump tracks the cumulative pump run hours. The leak rate through the primary liner is  
21 calculated weekly using the leachate flow meter/totalizer readings or pump operating hours readings.  
22 Calculations using either method are sufficient for compliance. An inspection is performed weekly where  
23 the totalizer reading and basin level reading are used to determine the leak rate per wetted surface area.  
24 The leak rate is compared to previous rates to see if leakage has increased. If either the flow meter/  
25 totalizer or pump operating hours system is not functioning, this is identified as an abnormal condition  
26 (see I.1).

27 The LERF employs a double walled transfer piping between 242-A Evaporator and LERF and between  
28 LERF and 200 Area ETF. The WAC 173-303-650 regulations do not require a discussion of piping for  
29 surface impoundments. However, for the purposes of comprehensive coverage of the LERF, inspections  
30 and integrity assessments are performed on the piping system. Aqueous waste (e.g., process condensate)  
31 is transferred from the 242-A Evaporator to the LERF via a buried pipeline. Likewise, aqueous waste is  
32 transferred to the 200 Area ETF via buried pipelines. At the LERF dikes, aboveground piping serves to  
33 transfer waste from one basin to another.

34 The buried pipelines normally are continuously monitored during transfers by a leak detection system  
35 (Addendum C). ~~The alarms on the leak detection system are monitored in the 200 Area ETF control~~  
36 ~~rooms.~~ As an alternative to continuous leak detection, the transfer lines can be inspected daily during  
37 transfers by opening the secondary containment drain lines at the LERF catch basins (for  
38 242-A Evaporator transfers to LERF) and the surge tank (for LERF transfers to 200 Area ETF) to inspect  
39 for leakage. During the routine inspections at LERF, the aboveground piping system is inspected for  
40 signs of leakage and for general structural integrity. During the visual inspection, particular attention is  
41 paid to valves and fittings for signs of cracking, deformation, and leakage.

42 **1.1.2.3.4 Dike Erosion**

43 The LERF basins and dikes are visually inspected weekly and after significant precipitation events for  
44 run-on, run-off, cover integrity, erosion problems, or other signs of deterioration in the dikes from  
45 precipitation, wind, burrowing mammals, or vegetation.

1  
2 **I.1.2.3.5 Structural Integrity**

3 A written certification attesting to the structural integrity of the basin dikes, signed by a qualified,  
4 registered professional engineer, is provided in Addendum C.

5 **I.1.2.3.6 Container Inspection**

6 Normal operation of the LERF does not involve the storage of dangerous waste in containers. Therefore,  
7 the inspection requirements of this section normally are not applicable to the LERF. Any containerized  
8 dangerous waste generated at LERF will be brought to the 200 Area ETF and managed in accordance  
9 with WAC 173-303-630 and is discussed in Section I.1.3.

10 **I.1.3 Inspection Log**

11 Observations made and deficiencies noted during an inspection are recorded on inspection log sheets (also  
12 called turnover sheets). On completion, the log sheet includes the inspector's printed name, signature,  
13 date, and time; the log sheet is submitted for review and approval by LERF and 200 Area ETF  
14 management or their designee, as required by operating procedures. Once approved, the log sheet is kept  
15 in the Hanford Facility Operating Record, LERF and 200 Area ETF files. Inspection records are retained  
16 in the Hanford Facility Operating Record, LERF and 200 Area ETF files, or other approved locations, in  
17 accordance with Permit Condition II.1.1. The inspection records are used to help determine any necessary  
18 corrective actions. Problems identified during the inspections are prioritized and addressed in a timely  
19 fashion to mitigate health risks to workers, maintain integrity of the TSD units, and prevent hazards to  
20 public health and the environment.

21 If while performing an inspection, a leak or spill is discovered, facility operations responds per the  
22 emergency response procedures action is taken to stop the leak and determine the cause. The waste is  
23 removed from the secondary containment in a timely manner that prevents harm to human health and the  
24 environment.

25 **I.1.4 Storage of Ignitable or Reactive Wastes**

26 The LERF could receive an aqueous waste that is designated reactive or ignitable. Any aqueous waste  
27 exhibiting these characteristics is managed (e.g., through blending in LERF) such that the waste no longer  
28 exhibits the reactive or ignitable characteristics.

29 Though unlikely, the 200 Area ETF secondary wastes might have the characteristics of being reactive or  
30 ignitable. A qualified inspector performs annual fire inspections of the 200 Area ETF using a checklist  
31 developed specifically for facilities that handle dangerous and/or mixed waste.

**Table I.1. Visual Inspection Schedule for the LERF and 200 Area ETF**

Item	Inspection	Frequency
<b>Load-In Facility</b>		
Load-In tank system	Inspect area for leaks. Note any unusual noises or vibration from the system pumps. Inspect secondary containment system for signs of deterioration.	Daily
<b>Main Treatment Train</b>		
Surge tank system	Inspect area for leaks. Note any unusual noises or vibration from the system pumps. Inspect secondary containment system for signs of deterioration.	Daily
Rough filter	Inspect for leaks.	Daily <sup>±</sup>
Ultraviolet oxidation system	Inspect module for leaks Inspect peroxide storage tank, ancillary equipment for leaks.	Daily <sup>±</sup>
pH adjustment tank	Inspect tank and ancillary equipment for leaks	Daily <sup>±</sup>
H <sub>2</sub> O <sub>2</sub> decomposer	Inspect tank and ancillary equipment for leaks	Daily <sup>±</sup>
Fine filter	Inspect module for leaks	Daily <sup>±</sup>
Degasification system	Inspect module for leaks. Note any unusual noises or vibration from the degasification blower.	Daily <sup>±</sup>
Reverse osmosis system	Inspect tanks and ancillary equipment for leaks. Note any unusual noises or vibration from the system pumps.	Daily <sup>±</sup>
Polishers	Inspect tanks and ancillary equipment for leaks.	Daily <sup>±</sup>
Effluent pH adjustment tank	Inspect tank and ancillary equipment for leaks.	Daily <sup>±</sup>
Verification tanks	Inspect tanks and ancillary equipment for leaks. Note any unusual noises or vibration from the system pumps. Inspect secondary containment system for signs of deterioration.	Daily
<b>Secondary Treatment Train</b>		
Secondary waste receiving tank	Inspect tank and ancillary equipment for leaks	Daily
ETF evaporator	Inspect tank and equipment for leaks. Note any unusual noises or vibration from the system pumps or compressor.	Daily <sup>±</sup>
Concentrate tank	Inspect tank and ancillary equipment for leaks.	Daily <sup>±</sup>
Thin film dryer	Inspect tanks and ancillary equipment for leaks (viewed through camera). Note any unusual noises or vibration from the system pumps or blower.	Daily <sup>±</sup>
Container handling	Inspect area for spills, leaks, accumulated liquids.	Daily
Container handling	Inspect for deterioration of containers and secondary containment, including corrosion and cracks in secondary containment foundation and coating. Inspect container labels to ensure that they are readable.	Weekly
<b>Support Systems</b>		
Vessel ventilation system	Inspect filters (HEPA and pre-filters), check vessel off gas pressures, system flow, and discharge temperatures.	Daily
Sump tank system	Inspect sump trenches for unexpected liquids, which indicate spills or leaks from process equipment.	Daily
<b>Safety Systems</b>		
Eye wash stations	Check status; check for adequate pressure	Monthly
Safety showers	Check status; check for adequate pressure	Monthly
<b>Emergency Systems</b>		
Fire extinguishers	Check for adequate charge.	Monthly
Emergency lighting	Test operability.	Monthly
<b>Processing Area</b>		
Uninterruptible power supply	Check output voltage and visually inspect battery pack for corrosion and leakage. Check indicator lights for fault conditions.	Annually

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Item	Inspection	Frequency
<b>LERF (Surface Impoundment)</b>		
LERF basins and dikes	Check to overtopping controls and integrity of the basins and dikes	Weekly
LERF contents	Determine the leak rate per wetted surface area	Weekly
LERF basins	Check for run-on, run-off, cover integrity, and erosion problems	Daily & After significant precipitation events
<b>Ignitable and Reactive</b>		
Ignitable and reactive waste	Storage in compliance with Hanford Site fire protection standards and WAC 173-303-630(8)	Annually†
<b>Container Storage Areas Other Than Secondary Treatment Train</b>		
Container Storage	Container labels to ensure labels are not obscured, removed, or otherwise unreadable	Weekly
	Deterioration of containers, containment systems, or cracks in protective coating or foundations caused by corrosion, mishandling, or other factors	Weekly
	Leaks, spills, and accumulated liquids	Daily±

\* Stated inspection frequency to be performed only when system is in service during 200 Area ETF operations. HEPA – High efficiency particulate air

† When waste management activities occur

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**Table I.2. Inspection Plan for Instrumentation Monitoring**

Item	Inspection	Frequency
<b>Load-In Facility</b>		
Level alarm LAHH-59A-109/-117	Monitor liquid level in load-in tanks TK-109 and TK-117 to prevent overflow	Continuously
Level alarm LSH-59A-003	Monitor liquid level in load-in tanks TK-1 to prevent overflow	Continuously
Leak detector	Monitor for leakage in the load-in tank pit sump	Continuously
<b>Main Treatment Train</b>		
Leak detector LAH-20B009	Monitor for leakage in the surge tank drainage sump	Continuously
Level alarm LAH-60A013	Monitor surge tank level to prevent overflow	Continuously
Level alarm LAHL-60C-111	Monitor liquid levels in the pH adjustment tank to prevent overflow	Continuously
Level alarm LAHL-60F-101	Monitor liquid levels in the first RO feed tank to prevent overflow	Continuously
Level alarm LAHL-60F-201	Monitor liquid levels in the second RO feed tank to prevent overflow	Continuously
Level alarms LAHL-60F-211	Monitor liquid levels in the effluent pH adjustment tank to prevent overflow	Continuously
Level transmitter LAHX-60H001A/B/C	Monitor liquid level in verification tanks to prevent overflow	Continuously
Leak detector LAH-20B010	Monitor for leakage in the verification tank drainage sump	Continuously
<b>Secondary Treatment Train</b>		
Level alarm LAHL-60I-001A/B	Monitor liquid levels in secondary waste receiver tanks A and B to prevent overflow.	Continuously
Level alarm LAHL-60J-001A/B	Monitor liquid levels in concentrate tanks A and B to prevent overflow.	Continuously
Level alarm LAHL-60I-107	Monitor liquid levels in the evaporator tank to prevent overflow.	Continuously
Level alarm LAHL-60J-036	Monitor liquid levels in the spray condenser tank to prevent overflow.	Continuously
Level alarm LAHL-60I-108	Monitor liquid levels in the distillate flash tank to prevent overflow.	Continuously
Level alarm LAH-60I-119	Monitor liquid levels in the entrainment separator tank to prevent overflow.	Continuously
Level transmitter LAH-20B001	Monitor liquid level in sump tank No. 1 to prevent overflow.	Continuously
Level transmitter LAH-20B002	Monitor liquid level in sump tank No. 2 to prevent overflow.	Continuously
Leak detector LAH-20B003	Monitor for leakage to sump No. 1.	Continuously**
Leak detector LAH-20B005	Monitor for leakage to sump No. 2.	Continuously**
Leak detector	Monitor for leakage from pipeline between 200 Area ETF and load in station.	Continuously**
Leak detector	Monitor for leakage from pipeline between 200 Area ETF and LERF.	Continuously**
Leak detector	Monitor for leakage from pipeline between LERF and the 242-A Evaporator.	Continuously**

\* Frequency of "continuously" applies during ETF processing and/or Load-in Station transfers. Data from alarms, leak detectors, and level transmitters is monitored at least daily at other times, even though many of these instruments record continuously (see C.2.5.1). Emergency communications equipment and warning systems are included in addendum J, Contingency Plan. These do not rely upon continuous control room monitoring.

\*\* In the event of a malfunction of one of the electronic leak detectors, daily visual inspections will be performed while the facilities are in operation.

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## LERF/ETF Temporary Authorization Request

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The U.S. Department of Energy (DOE), Richland Operations Office (RL) and CH2M Hill Plateau Remediation Company (CHPRC) are requesting that the Washington State Department of Ecology (Ecology) grant a temporary authorization to approve the requested Class 2 modifications to the Liquid Effluent Retention Facility & 200 Area Effluent Treatment Facility (LERF/ETF) Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion (Permit), to allow for a change in the monitoring of alarms, leak detectors, and level/pressure indicators associated with permitted tank systems and surface impoundments during periods when ETF processing operations are NOT occurring. Until recently, LERF/ETF has been running fairly continuously since the RCRA permit was issued. Therefore, ETF established permit requirements when it went into final status to monitor effluent processing operations from the control room 24-hours a day. However, in recent years the flow of waste going to ETF has been reduced dramatically, primarily due to liquid waste being treated at the new 200-West Pump-And-Treat facility. As a result of these decreased liquid volumes, ETF will be going to an intermittent processing campaign mode, where ETF will process wastewater over a short time frame (typically 6-8 weeks) then go into standby mode where no waste is processed for several months.

These changes have been discussed with the Department of Ecology over the past few months, and the next ETF waste processing campaign is due to finish on approximately 1/28/2014. Due to shortages in resources and staff, by that time a temporary authorization is requested pursuant to the Washington Administrative Code (WAC) 173-303-830(4)(e) on this submitted permit modification. This TA would allow ETF to shift personnel over to activities associated with LERF cover cleanup during February thru April. These cleanup activities are a high priority for the Department of Ecology and DOE, as well as the Department of Health. After the initial cleanup is complete, these personnel will also be needed to maintain the LERF covers during the spring and summer months, when vegetation growth is the highest.

This attachment reiterates the temporary authorization requirements outlined in the WAC in bold and provides the required information. To support staffing changes at LERF/ETF, temporary authorization is requested by **February 1, 2014**

### **WAC 173-303-830(4)(e) Temporary authorizations.**

**(i) Upon request of the permittee, the director may, without prior public notice and comment, grant the permittee a temporary authorization in accordance with this subsection. Temporary authorizations must have a term of not more than one hundred eighty days.**

DOE RL and CHPRC are requesting a temporary authorization for a full term of 180-days. The temporary authorization is needed to support a change from continuous monitoring via personnel stationed in the ETF control room 24-hrs a day, to only monitoring continuously when ETF is receiving aqueous waste, transferring wastewater, or when ETF processing operations are occurring. At all other times, monitoring of alarms is proposed to be once every day.

## LERF/ETF Temporary Authorization Request

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**(ii)(A) The permittee may request a temporary authorization for:**

**(1) Any Class 2 modification meeting the criteria in (e)(iii)(B) of this subsection**

The Permittees (DOE RL and CHPRC) are requesting a temporary authorization request that meets the criteria of **WAC 173-303-830(e)(iii)(B)(IV) to prevent disruption of ongoing waste management activities**. A temporary authorization to implement the requested Class 2 modifications to the Permit will allow daily monitoring to proceed when no aqueous waste transfers or ETF processing operations are occurring. This will allow personnel to focus on more critical environmental and operational activities during the planned facility downtime in February thru April, 2014, specifically to focus on the LERF cover cleanup effort.

**(B) The temporary authorization request must include:**

**(I) A description of the activities to be conducted under the temporary authorization:**

The modification request proposes to revise three addenda of the LERF/ETF Hanford Facility RCRA Permit by updating the frequency at which specified alarms, leak detectors, and level/pressure indicators are monitored. Updates will be made in the Process Information, Preparedness and Prevention, and Inspection Requirements addenda.

Instead of continuous monitoring, these changes will allow once a day monitoring of specified alarms, leak detectors, and level/pressure indicators associated with permitted tank systems and surface impoundments during periods when no aqueous waste transfers or ETF processing operations are occurring. During aqueous waste transfers and during ETF processing operations, this monitoring will be continuous as described in the current LERF/ETF Permit language in Addenda C, F, and I.

The permit modification request includes conditions unrelated to monitoring and therefore not included in this temporary authorization request. A table is attached showing all modifications included in the temporary authorization.

**(C) The permittee must send a notice about the temporary authorization request to all persons on the facility mailing list maintained by the director and to appropriate units of state and local governments as specified in WAC 173-303-840 (3)(e)(i)(D). This notification must be made within seven days of submission of the authorization request.**

Permit Condition I.C.3 allows for the Tri-Party Agreement processes to be used at the Hanford Facility for temporary authorization notifications. The notice for the Class 2 modification and the temporary authorization will be made within 7-days after transmitting the request to Ecology.