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System Logic Description for Pretreatment Facility - Treated LAW Evaporation Process (TLP) System

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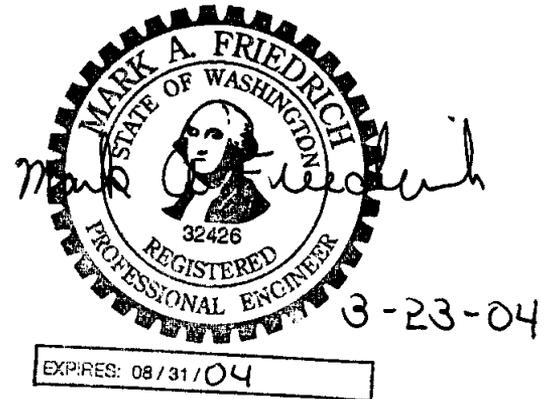
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Acronyms and Abbreviations

Reference the *P&ID Symbols and Legend Sheets*, as listed in the Applicable Documents section, for acronyms and abbreviations employed on the attached figures.

AEA	Atomic Energy Act of 1954
ASD	adjustable speed drive
CXP	cesium ion exchange process
DOE	US Department of Energy
LAH	level alarm high
LAHH	level alarm high-high
LAW	low-activity waste
LC	level controller
LI	level indication
LOL	lower operating limit
LOL	lower operating limit
LSH	level switch high
LSHH	level switch high-high
LT	level transmitter
PCS	process control system
PT	pretreatment
PWD	plant wash and disposal
RLD	radioactive liquid waste disposal
SBS	submerged bed scrubber
SHR	sodium hydroxide reagent addition
TCP	treated LAW concentrate storage process
TLP	treated LAW evaporation process
UOL	upper operating limit

Glossary

acquire	Acquire is a command under a batch control that reserves a group of equipment for that particular batch sequence.
actual volume	Actual volume is the amount, in US gallons, of the waste and process fluid in any vessel.
available space	Available space refers to the volume, in US gallons, of waste and process fluid that a vessel can receive and remain below its upper operating limit (UOL). Available space can be calculated as follows: <i>Available Space = UOL - Actual Volume</i>
available volume	Available volume refers to the volume, in US gallons, of waste and process fluid that any vessel can transfer to another vessel and remain above its lower operating limit (LOL). Available volume can be calculated as follows: <i>Available Volume = Actual Volume - LOL</i>
batch	This refers to material that is being produced or that has been produced by a single execution of a batch process.
batch control	This term refers to control activities and control functions that provide a means to process finite quantities of material over a finite period of time using one or more pieces of equipment and an ordered set of processing activities.
exception handling	This term refers to the functions that deal with plant or process contingencies, and other events, that occur outside the normal or desired behavior of batch control.
permissive	A permissive is an interlock that allows a device to change state or allows a sequence to start. Once a device has changed state or a sequence started, a permissive has no further effect on the device or sequence.
release	Release is a command under a batch control that opens up a group of equipment for any batch control to acquire.
trip	A trip is a conditional interlock that forces a device or a sequence to a defined state. A trip continues to have an effect on the device or sequence until the interlock condition no longer exist.

1 Introduction

This document describes the control logic for dangerous waste regulated systems and components for the treated low-activity waste (LAW) evaporation process (TLP) system within the pretreatment (PT) facility.

2 Applicable Documents

24590-PTF-3YD-TLP-00001, *System Description for Treated LAW Evaporation Process (TLP)*.

24590-PTF-M6-TLP-P0001, *P&ID - PTF Treated LAW Evaporation Process System LAW SBS Condensate Receipt TLP-VSL-00009A & 9B*.

24590-PTF-M6-TLP-P0002, *P&ID - PTF Treated LAW Evaporation Process System Condensers & Condensate Collection TLP-VSL-00002*.

24590-PTF-M6-TLP-P0003, *P&ID - PTF Treated LAW Evaporation Process System Separator TLP-SEP-00001*.

24590-WTP-M6-50-P0001, *P&ID Symbols and Legend Sheet 1 of 6*.

24590-WTP-M6-50-P0002, *P&ID Symbols and Legend Sheet 2 of 6*.

24590-WTP-M6-50-P0003, *P&ID Symbols and Legend Sheet 3 of 6*.

24590-WTP-M6-50-P0004, *P&ID Symbols and Legend Sheet 4 of 6*.

24590-WTP-M6-50-P0005, *P&ID Symbols and Legend Sheet 5 of 6*.

24590-WTP-M6-50-P0006, *P&ID Symbols and Legend Sheet 6 of 6*.

3 Description

3.1 System Requirement

The vessels (along with corresponding pumps, valves, and instruments) associated with dangerous waste management within the TLP system are the following:

TLP-VSL-00009A/B	LAW submerged bed scrubber (SBS) condensate receipt vessels
TLP-SEP-00001	treated LAW evaporator separator vessel
TLP-VSL-00002	condensate collection vessel

3.1.1 General Process

The TLP system primarily serves to evaporate the treated LAW condensate from the cesium ion exchange process (CXP) system and the process condensate that would otherwise accumulate in the plant radioactive liquid waste disposal (RLD) systems in the PT and LAW facilities.

The primary mode of operation has one LAW SBS condensate receipt vessel (TLP-VSL-00009A or TLP-VSL-00009B) receiving treated condensate from the RLD systems, while the other vessel feeds the treated LAW evaporator separator vessel (TLP-SEP-00001).

It is also possible for the treated LAW evaporator separator vessel (TLP-SEP-00001) to be filled from one of the LAW SBS condensate receipt vessels (TLP-VSL-00009A or TLP-VSL-00009B) and one of the treated LAW condensate vessels (CXP-VSL-00026A, CXP-VSL-00026B, or CXP-VSL-00026C) simultaneously.

Concentrated product from the evaporator is sent to the treated LAW concentrate storage process (TCP) system.

Instrumentation, alarms, control, and interlocks will be provided for all vessels in the TLP system to indicate or prevent the following conditions:

- Vessel contents overflow (level indication and passive overflow routes to the ultimate overflow vessel PWD-VSL-00033)
- Loss of system integrity (sump level indication)
- Inadvertent transfer (permissive signals to transfer)
- Vessel level

3.1.2 LAW SBS Condensate Receipt Vessels

The two LAW SBS condensate receipt vessels (TLP-VSL-00009A and TLP-VSL-00009B) are identical.

The two LAW SBS condensate receipt vessels (TLP-VSL-00009A and TLP-VSL-00009B) receive treated LAW condensate and recycle effluent. This condensate is transferred from the process condensate tanks in the PT facility (RLD-TK-00006A or RLD-TK-00006B), process condensate vessels in the LAW facility (RLD-VSL-00003 or RLD-VSL-00005), and the alkaline effluent vessels in the PT facility (RLD-VSL-00017A or RLD-VSL-00017B). The recycle effluent is routed from the condensate collection vessel (TLP-VSL-00002).

For neutralization purposes, either of the LAW SBS condensate receipt vessels (TLP-VSL-00009A or TLP-VSL-00009B) can receive a sodium hydroxide solution from the sodium hydroxide reagent addition (SHR) system. The LAW SBS condensate receipt vessels (TLP-VSL-00009A and TLP-VSL-00009B) are equipped with remote sampling capability.

The LAW SBS condensate receipt vessels (TLP-VSL-00009A and TLP-VSL-00009B) operate by alternating one vessel filling while the other vessel is discharging.

For better control of the transfer operation, transfers are limited by the batch control transfer-in or transfer-out operation per vessel. Once the batch control sequence acquires any of these vessels, no other batch control operation can acquire them until they are released from the initial operation. The acquiring and releasing steps ensure that a vessel cannot transfer or receive from multiple destinations at the same time.

When the correct vessels have been acquired, the transfer-in sequence is initiated. Under normal operating conditions, the transfer-in sequence will be completed when either of the following occurs:

- The required batch volume has been transferred and post-transfer flushing is complete.
- The receipt vessel reaches its upper operating limit (UOL).
- The transferring vessel reaches its lower operating limit (LOL).

When the vessels are released, the process control system (PCS) can then initiate a transfer-out sequence. Under normal operating conditions the transfer-out sequence can be stopped if any of the following occurs:

- The level in a LAW SBS condensate receipt vessel (TLP-VSL-00009A or TLP-VSL-00009B) reaches its lower operating limit (LOL).
- A specified volume is transferred.
- The destination vessel reaches its UOL.

For volume batch transfers, the operator, based on PCS information, confirms that the available space in the destination vessel and the available volume in the sending vessel are consistent with the target batch volume specified by the operator. That means that during the batch transfer the destination UOL and sending LOL are not exceeded.

During the entire transfer-in or transfer-out sequence, the PCS monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The operator can then manually stop the transfer or allow the batch control to switch to an exception handling logic.

Each step in the batch operation will be performed automatically with built-in operator prompts as dictated by the pre-transfer, during-transfer, and post-transfer operator-PCS interface and controls listed below.

Action	The Goal of the Action
Select receiving vessel (TLP-VSL-00009A or TLP-VSL-00009B).	This will allow proper valve alignment thereby preventing misrouting of feed within PT facility.
Specify the feed volume from each of the source vessels to the selected LAW SBS condensate receipt vessel, based on the available volume, including flush volume.	This will control vessel-filling level, vessel filling sequence, and prevent overflow.
Operator enables permissive to start transfer (for transfer from LAW facility only).	This will authorize initiation of the transfer operation.
Confirm receipt of feed from level in the vessel.	This ensures a controlled operation.

Action	The Goal of the Action
Secure valving.	This will ensure that the valves are in the proper position after the transfer.

The following are interlocks between the TLP system and other systems that are working all the time. These signals tie into the interlock logic performed within each of the control systems. These trips disable the transfer.

Interlock Signal	Usage
<ul style="list-style-type: none"> • “HIGH” level in any receiving vessel. 	This will prevent an overflow condition within TLP.
<ul style="list-style-type: none"> • Valves are not properly aligned in TLP for transfer from other system within PT facility. 	This signal will be used to avoid deadheading of the transfer pump and will prevent a misroute.
<ul style="list-style-type: none"> • Control valves or associated instrumentation is not functional. 	This will ensure that the transfer can be monitored and controlled.
<ul style="list-style-type: none"> • Operator disables transfer. 	This signal will be used as a trip to stop the transfer pump.

Figure 1 shows the interlocks and alarms for the level instruments associated with the LAW SBS condensate receipt vessels (TLP-VSL-00009A and TLP-VSL-00009B).

3.1.3 Treated LAW Evaporator Separator Vessel

The treated LAW evaporator separator vessel (TLP-SEP-00001) can receive waste or condensate from either the LAW SBS condensate receipt vessel (TLP-VSL-00009A or TLP-VSL-00009B) or from any of the cesium ion exchange treated LAW collection vessel (CXP-VSL-00026A, CXP-VSL-00026B, or CXP-VSL-00026C). Transfer to the separator vessel is a continuous process.

In the TLP system, treated LAW condensate transfer to the separator vessel occurs under level control via one of the treated LAW condensate feed ASD control pumps (TLP-PMP-00005A or TLP-PMP-00005B). In the CXP system, treated LAW condensate transfer to the separator vessel occurs via one of the treated LAW condensate feed pumps (CXP-PMP-00002A or CXP-PMP-00002B) at constant flow rate.

Selection of the transfer pump to be used for transferring is done by the operator before starting the evaporation process in the system.

The transferring process is based on the level control in the treated LAW evaporator separator vessel (TLP-SEP-00001). During the normal transfer process, the speed of the transfer pump (in the TLP system only) depends on the level in the vessel: the higher the level is in the vessel, the slower the transfer pump is running and vice versa. In addition, the transfer stops if the “HIGH-HIGH” level alarm in the vessel is activated. This PCS action stops the transfer pump and closes the feed inlet valves.

Each step in the continuous transfer process is performed automatically with built-in operator prompts as dictated by the pre-transfer, during-transfer, and post-transfer operator-PCS interface and controls listed below.

Action	The Goal of the Action
<ul style="list-style-type: none"> • Select treated LAW condensate feed pump (TLP-PMP-00005A or TLP-PMP-00005B in the TLP system, or CXP-PMP-00002A or CXP-PMP-00002B in the CXP system) to supply the separator vessel (TLP-SEP-00001). 	This will allow proper valve alignment thereby preventing misrouting of feed within PT facility.
<ul style="list-style-type: none"> • Operator enables permissive to start transfer and evaporation. 	This will authorize initiation of the transfer process.
<ul style="list-style-type: none"> • Confirm receipt of feed from level in the vessel. 	This ensures a controlled operation.
<ul style="list-style-type: none"> • Secure valving. 	This will ensure that the valves are in the proper position after the transfer.

The following are interlocks within the TLP system that are working all the time. These trips disable the transfer permissive thereby stopping the evaporation process.

Interlock Signal	Usage
<ul style="list-style-type: none"> • “HIGH-HIGH” level in treated LAW evaporator separator vessel (TLP-VSL-00001). 	This signal will be used as a trip to stop the transfer (stop transfer pump and close transfer valves), preventing overfilling of the treated LAW evaporator separator vessel (TLP-VSL-00001).
<ul style="list-style-type: none"> • Valves are not properly aligned in the TLP system for transfer by the selected transfer pump to the treated LAW evaporator separator vessel (TLP-SEP-00001). 	This signal will be used to avoid deadheading of the transfer pump and will prevent a misroute.
<ul style="list-style-type: none"> • Valves are not properly aligned in the CXP system for transfer by the selected transfer pump to the treated LAW evaporator separator vessel (TLP-SEP-00001). 	This signal will be used to avoid deadheading of the transfer pump and will prevent a misroute.
<ul style="list-style-type: none"> • Control valves or associated instrumentation are not functional. 	This will ensure that the transfer can be monitored and controlled.
<ul style="list-style-type: none"> • Operator disables transfer (evaporation process). 	This signal will be used as a trip to stop the transfer pump and change the operating mode.

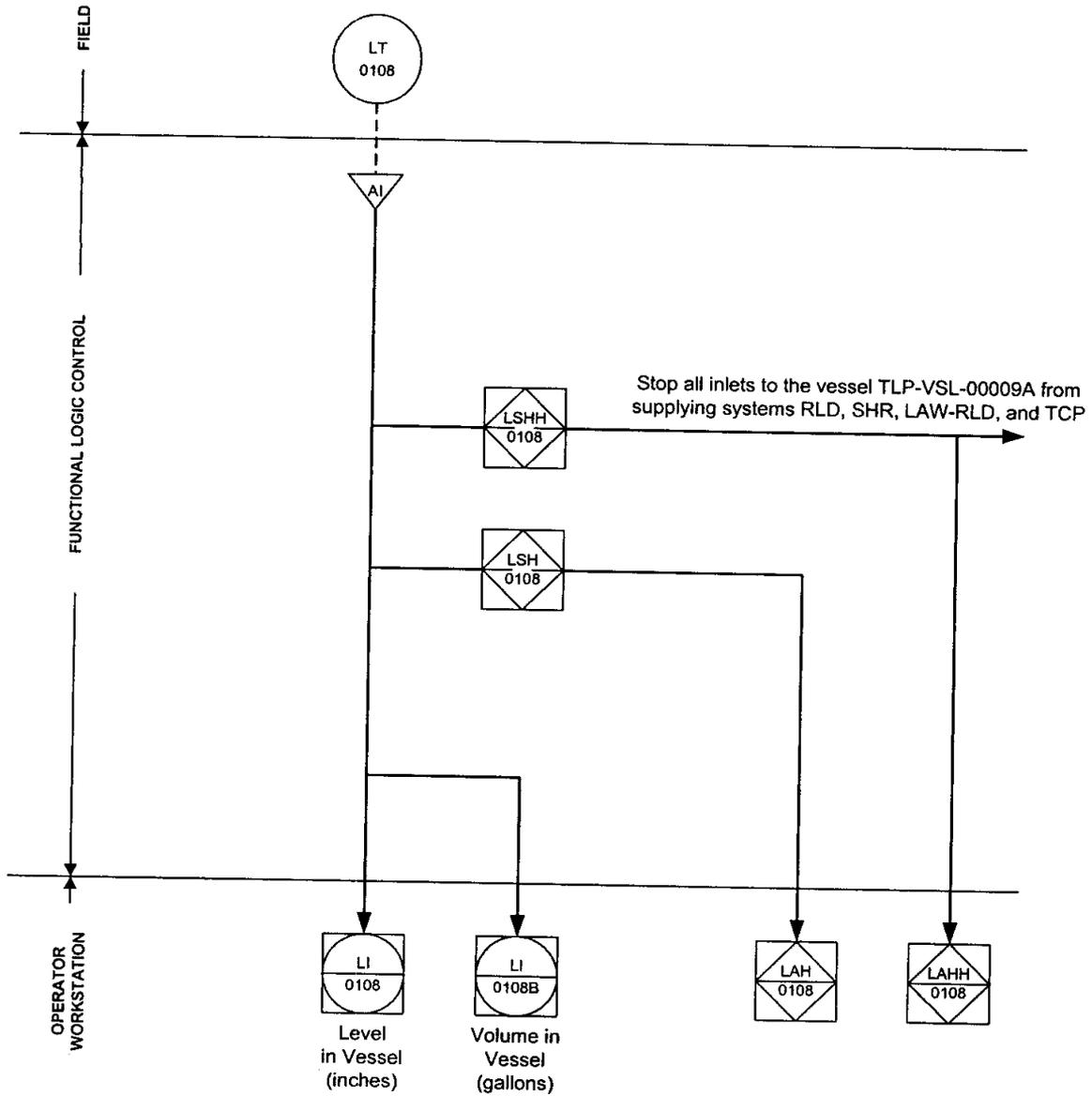
Figure 3 shows the interlocks and alarms for the level instruments associated with the treated LAW evaporator separator vessel (TLP-SEP-00001).

3.1.4 Condensate Collection Vessel

The condensate collection vessel (TLP-VSL-00002) collects condensate from the condensers (primary condenser, inter-condenser, and after-condenser). During normal operation, the clean condensate is directed to the process condensate vessels (RLD-TK-00006A and RLD-TK-00006B). At the same time, a portion of the condensate outlet is recycled back to the treated LAW evaporator separator vessel (TLP-SEP-00001) for spraying the demister pads. Condensate discharges are batch controlled by upper and lower liquid level setpoints.

Figure 2 shows the interlocks and alarms for level instruments associated with the condensate collection vessel (TLP-VSL-00002).

Figure 1 TLP-LI-0108 for LAW SBS Condensate Receipt Vessel (TLP-VSL-00009A)



Note: LAW SBS condensate receipt vessels TLP-VSL-00009A and TLP-VSL-00009B have identical logic.

Figure 2 TLP-LI-0217 for Condensate Collection Vessel (TLP-VSL-00002)

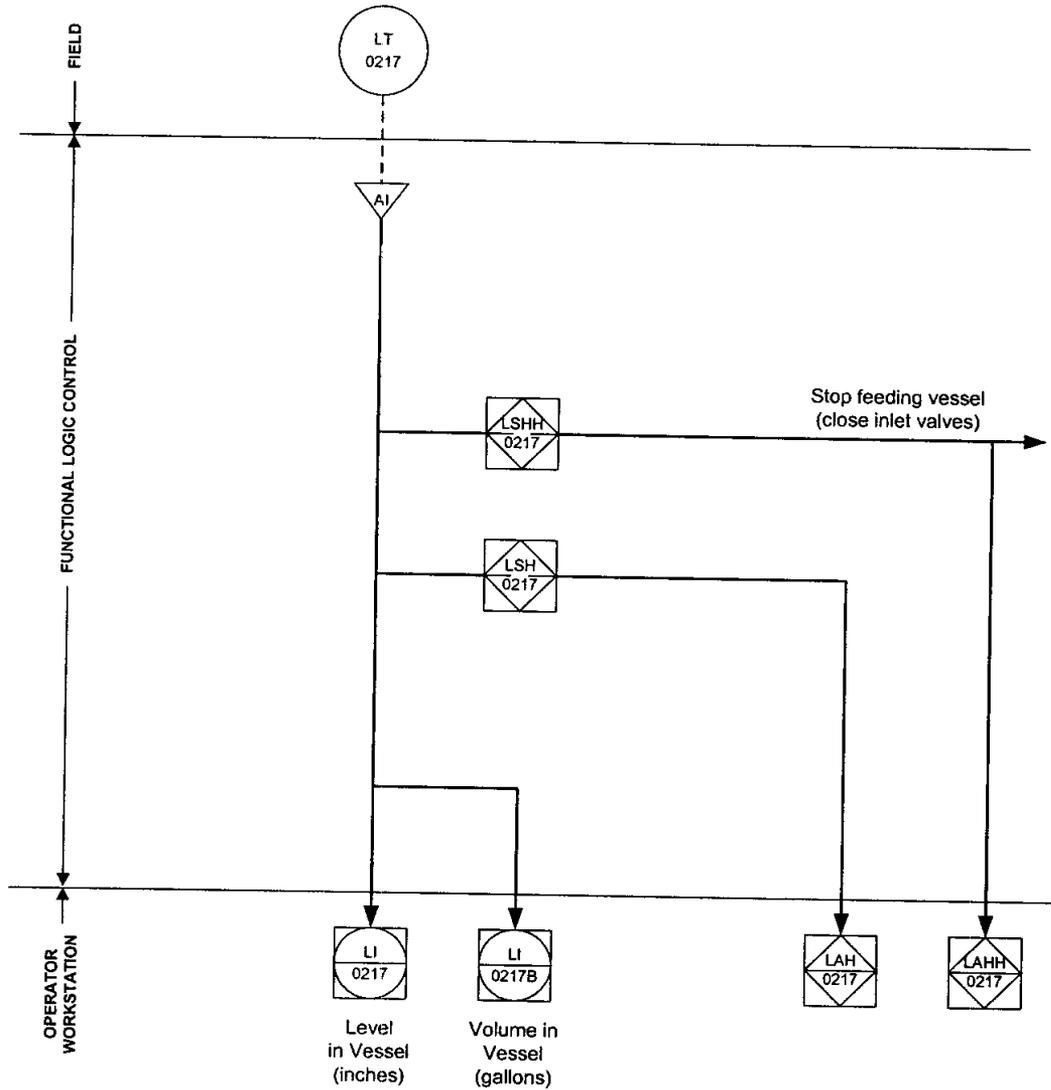


Figure 3 TLP-LI-0308 for Treated LAW Evaporator Separator Vessel (TLP-SEP-00001)

