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Acronyms and Abbreviations

AI	analog input
LAH	level alarm high
LAHH	level alarm high-high
LI	level indication
LKAH	level time alarm high
LKI	level time indication
LKSH	level time switch high
LKY	level time calculation
LOL	lower operating limit
LSH	level switch high
LSHH	level switch high-high
LT	level transmitter
P&ID	piping and instrumentation diagram
PT	pretreatment
PWD	plant wash and disposal
UOL	upper operating limit
WTP	Hanford Waste Tank Treatment and Immobilization Plant

Glossary

acquire	Acquire is a command under a batch control that reserves a group of equipment for that particular batch control operation.
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 an ordered set of processing activities to complete a batch process.
batch process	A batch process leads to the production of a finite quantity of material by subjecting quantities of input material, to an ordered set of processing activities, over a finite period using one or more pieces of equipment.
control system	This term refers to electronic processors that perform regulatory and logic control functions necessary for normal operation of the plant.
exception handling	This term refers to those functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
interlock	This term refers to a mechanism that automatically brings about or prevents the operation of another mechanism.
LOL	Lower operating limit. A vessel low-level set point used to stop a transfer-out batch operation from that vessel under normal plant operations.
permissive	A permissive is an interlock that allows a device to change state or a sequence to start. Once a device has changed state or a sequence has 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.
UOL	Upper operating limit. A vessel high-level setpoint used to stop a transfer-in batch operation to that vessel under normal plant operation.

1 Introduction

This document describes the instrument control logic for tank and ancillary equipment for the plant wash and disposal system (PWD) within the pretreatment (PT) facility that is associated with dangerous waste management. This document describes tank and ancillary equipment for the PWD system within the PT facility.

2 Applicable Documents

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

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

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

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

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

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

24590-PTF-M6-PWD-P0001, *P&ID-PTF Plant Wash and Disposal System Effluent Collection Tree*

24590-PTF-M6-PWD-P0002, *P&ID - PTF Plant Wash & Disposal System Effluent Collection
PWD-VSL-00033/00043/00044*

24590-PTF-M6-PWD-P0003, *P&ID - PTF Plant Wash & Disposal System Effluent Collection
PWD-VSL-00015 and 00016*

24590-PTF-M6-PWD-P0005, *P&ID-PTF Plant Wash & Disposal System Effluent Collection Headers
Drains*

24590-PTF-M6-PWD-P0006, *P&ID-PTF Plant Wash & Disposal System Effluent Collection Headers,
Overflows*

24590-PTF-M6-PWD-P0007, *P&ID-PTF Plant Wash & Disposal System Effluent Collection Header
Bulge & Rack Drains*

24590-PTF-M6-PWD-P0008, *P&ID - PTF Plant Wash & Disposal System C5/R5 Process Cell Sumps*

24590-PTF-M6-PWD-P0009, *P&ID - PTF Plant Wash & Disposal System C5/R5 Process Cell Sumps*

24590-PTF-M6-PWD-P0010, *P&ID - PTF Plant Wash & Disposal System C3/C5/R5 Process Cell
Sumps.*

24590-PTF-M6-PWD-P0011, *P&ID - PTF Plant Wash & Disposal System C3/C5 and C5 Area Floor
Drains*

24590-PTF-M6-PWD-P0012, *P&ID - PTF Plant Wash & Disposal System C3/R3 and C5/R5 Cell Sumps*

24590-PTF-M6-PWD-P0014, *P&ID - PTF Plant Wash & Disposal System C5/R5 Hot Cell Sumps.*

24590-PTF-M6-PWD-P0018, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack.*

24590-PTF-M6-PWD-P0019, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack*

24590-PTF-M6-PWD-P0020, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack*

24590-PTF-M6-PWD-P0021, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack*

24590-PTF-M6-PWD-P0023, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack*

24590-PTF-M6-PWD-P0024, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack*

24590-PTF-M6-PWD-P0025, *P&ID-PTF Plant Wash and Disposal System Utilities Services-PSA Rack*

24590-PTF-M6-PWD-P0026, *P&ID-PTF Plant Wash and Disposal System Utilities Service-Plant Wash Rack*

24590-PTF-M6-PWD-P0029, *P&ID-PTF Plant Wash and Disposal System Utilities Services-Plant Wash Rack*

24590-PTF-M6-PWD-P0033, *P&ID-PTF Plant Wash and Disposal System Utilities Services-Plant Wash Rack*

24590-PTF-M6-PWD-P0034, *P&ID-PTF Plant Wash and Disposal System Utilities Services-Plant Wash Rack*

24590-PTF-M6-PWD-P0041, *P&ID-PTF Plant Wash and Disposal System C2 Area Floor Drains Collection Vessel.*

24590-PTF-M6-PWD-P0043, *P&ID-PTF Plant Wash and Disposal System C3 Area Floor Drains.*

24590-PTF-M6-PWD-P0044, *P&ID-PTF Plant Wash and Disposal System C3 Area Floor Drains*

24590-PTF-M6-PWD-P0046, *P&ID-PTF Plant Wash & Disposal Utility Services Plant Wash Rack*

24590-PTF-M6-PWD-P0050, *P&ID-PTF Plant Wash & Disposal System Secondary Containment Leak Detection System*

24590-PTF-M6-PWD-P0051, *P&ID-PTF Plant Wash & Disposal System Secondary Containment Leak Detection System*

3 Description

The following tank and ancillary equipment are associated with dangerous waste management within the PWD system, which resides in the PT facility.

- Ultimate overflow vessel (PWD-VSL-00033)
- HLW effluent transfer vessel (PWD-VSL-00043)

- C3 floor drain collection vessel (PWD-VSL-00046)
- plant wash vessel (PWD-VSL-00044)
- acidic/alkaline effluent vessel (PWD-VSL-00015)
- acidic/alkaline effluent vessel (PWD-VSL-00016)
- all PWD PT facility sumps
- all PT facility leak detection boxes

3.1 Ultimate Overflow Vessel (PWD-VSL-00033)

The ultimate overflow vessel (PWD-VSL-00033) receives effluent from vessel overflows, drains, and the -45 ft sump (PWD-SUMP-00040) and then transfers it to the plant wash vessel (PWD-VSL-00044). For greater waste management reliability, the ultimate overflow vessel (PWD-VSL-00033) controlled transfers are limited by the control system to one transfer in or out at a time, by the batch control mechanism of acquiring and releasing. Drains and overflows are not considered controlled flows.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The ultimate overflow vessel (PWD-VSL-00033) is monitored by a rate of level change, calculated by the control system, in order to detect leaks and overflows. When transferring in, the rate of change alarm setpoint will be changed by the control system to prevent the alarm from occurring due to the expected level change from the transfer. The transfer is stopped by the control system when any of the following are true:

- The level in the ultimate overflow vessel (PWD-VSL-00033) reaches its upper operating limit (UOL)
- The level in the sending entity reaches its lower operating limit (LOL)
- A specified volume is transferred, based upon vessel level.

Once the transfer is stopped, the control system resets the rate of change alarm setpoint to its non-transferring value.

Once the ultimate overflow vessel (PWD-VSL-00033) is ready to transfer out, the operator will initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer is stopped by the control system when any of the following are true:

- The level in the ultimate overflow vessel (PWD-VSL-00033) reaches its LOL
- The plant wash vessel (PWD-VSL-00044) reaches its UOL.
- A specified volume is transferred, based upon vessel level

When the level is no longer within the normal operating range, due to an abnormality, interlocks along with alarms within the control system help prevent an overflow condition. Figure 1 shows the interlocks

and alarms for the level instrument associated with the ultimate overflow vessel (PWD-VSL-00033). The level instrument monitors the level and rate of level change within the ultimate overflow vessel (PWD-VSL-00033). If the rate of level change is greater than a predetermined setpoint, an alarm is generated. Upon reaching the high-alarm level setpoint, the control system generates a high alarm. Upon reaching the high-high setpoint, an alarm is generated and all controlled feeds into the ultimate overflow vessel (PWD-VSL-00033) are isolated. Isolation occurs by a combination of either stopping the motive force or closing valves by the control system.

3.2 HLW Effluent Transfer Vessel (PWD-VSL-00043)

The HLW effluent transfer vessel (PWD-VSL-00043) receives effluent from the high level waste vitrification facility (HLW) radioactive liquid waste disposal system, drains, and the -45 ft sump (PWD-SUMP-00040), and then transfers it to the plant wash vessel (PWD-VSL-00044). For greater waste management reliability, controlled transfers into the HLW effluent transfer vessel (PWD-VSL-00043) are limited by the control system to one transfer in or out at a time, by the batch mechanism of acquiring and releasing. Drains and overflows are not considered controlled flows.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer is stopped by the control system when any of the following are true:

- The level in the HLW effluent transfer vessel (PWD-VSL-00043) reaches its UOL
- The level of the sending equipment reaches its LOL
- A specified volume is transferred, based upon vessel level.

Once the HLW effluent transfer vessel (PWD-VSL-00043) is ready to transfer, the operator will initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that instruments, utilities, and equipment associated with the transfer are within operational parameters and remain as such throughout the transfer. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer will end when any of the following are true:

- The level in the HLW effluent transfer vessel (PWD-VSL-00043) reaches its LOL
- The plant wash vessel (PWD-VSL-00044) reaches its UOL
- A specified volume is transferred, based upon vessel level

When the level is no longer within the normal operating range due to an abnormality, interlocks along with alarms within the control system help prevent an overflow condition. Figure 2 shows the interlocks and alarms for the level instrument associated with the HLW effluent transfer vessel (PWD-VSL-00043). At the high alarm setpoint, an alarm is generated. At the high-high alarm setpoint, an alarm is generated and all dedicated controlled feeds are isolated. Isolation occurs by a combination of either stopping the motive force or closing valves.

3.3 C3 Floor Drain Collection Vessel (PWD-VSL-00046)

The C3 floor drain collection vessel (PWD-VSL-00046) receives effluent from the cell sump (PWD-SUMP-00071) and the C3 floor drains. Drains are uncontrolled flows and are not controlled by the control system.

When ready to transfer out of the C3 floor drain collection vessel (PWD-VSL-00046), the operator will sample, if necessary, and transfer to the appropriate location.

When the level is no longer within the normal operating range due to an abnormality, alarms within the control system help prevent an overflow condition. Figure 3 shows the alarms for the level instruments associated with PWD-VSL-00046. PWD-LI-4304 monitors the level of the C3 floor drain collection vessel (PWD-VSL-00046), whereas PWD-LI-4301 monitors the seal level in the overflow line. Upon detection of low level in the seal, the control system alarms. The operator is then responsible for adding water to maintain the seal. Upon reaching the high-alarm setpoint in the vessel, an alarm is generated and the operator is responsible for the appropriate action.

3.4 Plant Wash Vessel (PWD-VSL-00044)

Plant wash vessel (PWD-VSL-00044) receives effluent from multiple sources, adjusts the pH, and then recycles the effluent into the waste feed evaporator feed vessels (FEP-VSL-00017A or B). For greater waste management reliability, batch controlled transfers into PWD-VSL-00044 are limited by the control system to one transfer in or out at a time by the batch control mechanism of acquiring and releasing. The vessel vent caustic scrubber (PVP-SCB-00002) effluent is not considered a batch controlled effluent. Once acquired, no other batch control operation will be able to coordinate activities with the plant wash vessel (PWD-VSL-00044) until it is released.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer is stopped by the control system when any of the following are true:

- The level in the plant wash vessel (PWD-VSL-00044) reaches its upper operating limit (UOL)
- The level of the sending entity reaches its lower operating limit (LOL)
- A specified volume is transferred, based upon vessel level

The neutralizing sequence will add caustic until the pH of the vessel is confirmed to be within the desired alkaline conditions. Once the pH is confirmed to be in the desired operating range, the vessel contents will be ready to transfer to the appropriate vessel.

Once the plant wash vessel (PWD-VSL-00044) is ready to transfer its contents, the operator will initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that instruments, utilities, and equipment associated with the transfer are within operational parameters and remain as such throughout the transfer. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer will end when any of the following are true:

- The level in the plant wash vessel (PWD-VSL-00044) reaches its LOL
- The receiving entity reaches its UOL
- A specified volume is transferred, based upon vessel level.

When the level is no longer within the normal operating range due to an abnormality, interlocks along with alarms within the control system help prevent an overflow condition. Figure 4 shows the interlocks and alarms for the level instrument associated with the plant wash vessel (PWD-VSL-00044). At the high-alarm setpoint, an alarm is generated. At the high-high alarm setpoint, an alarm is generated and all dedicated controlled feeds are isolated. Isolation occurs by a combination of either stopping the motive force, closing valves, or a combination of both.

3.5 Acidic/Alkaline Effluent Vessel (PWD-VSL-00015)

The acidic/alkaline effluent vessel (PWD-VSL-00015) receives effluent from multiple sources, adjusts the pH, and then recycles the effluent into the waste feed evaporator feed vessels (FEP-VSL-00017A or B). For greater waste management reliability, batch controlled transfers into the acidic/alkaline effluent vessel (PWD-VSL-00015) are limited by the control system to one transfer in or out at a time by the batch control mechanism of acquiring and releasing. The Cs evaporator primary/inter/final condensers (CNP-HX-00002/3/4) effluent is not considered a batch controlled effluent. Once acquired, no other batch control operation will be able to coordinate activities with the acidic/alkaline effluent vessel (PWD-VSL-00015) until it is released.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer is stopped by the control system when any of the following are true:

- The level in the acidic/alkaline effluent vessel (PWD-VSL-00015) reaches its UOL
- The level of the sending entity reaches its LOL
- A specified volume is transferred, based on vessel level.

The neutralizing sequence will add caustic until the pH of the vessel is confirmed to be within the desired alkaline conditions. Once the pH is confirmed to be in the desired operating range, the vessel contents will be ready to transfer to the appropriate vessel.

Once the acidic/alkaline effluent vessel (PWD-VSL-00015) is ready to transfer its contents, the operator will initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that instruments, utilities, and equipment associated with the transfer are within operational parameters and remain as such throughout the transfer. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer will end when any of the following are true:

- The level in the acidic/alkaline effluent vessel (PWD-VSL-00015) reaches its LOL
- The receiving entity reaches its UOL
- A specified volume is transferred, based on vessel level

When the level is no longer within the normal operating range due to an abnormality, interlocks along with alarms within the control system help prevent an overflow condition. Figure 5 shows the interlocks and alarms for the level instrument associated with the acidic/alkaline effluent vessel (PWD-VSL-00015). At the high-alarm setpoint, an alarm is generated. At the high-high alarm setpoint, an alarm is generated and all dedicated controlled feeds are isolated. Isolation occurs by a combination of either stopping the motive force or closing valves.

3.6 Acidic/Alkaline Effluent Vessel (PWD-VSL-00016)

The acidic/alkaline effluent vessel (PWD-VSL-00016) receives effluent from multiple sources, adjusts the pH, and then recycles the effluent into the waste feed evaporator feed vessels (FEP-VSL-00017A or B). For greater waste management reliability, batch controlled transfers into PWD-VSL-00016 are limited by the control system to one transfer in or out at a time by the batch control mechanism of acquiring and releasing. The Cs evaporator primary/inter/final condensers (CNP-HX-00002/3/4) effluent is not considered a batch controlled effluent. Once acquired, no other batch control operation will be able to coordinate activities with the acidic/alkaline effluent vessel (PWD-VSL-00016) until it is released.

When the vessel is available to receive effluent, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer is stopped by the control system when any of the following are true:

- The level in the acidic/alkaline effluent vessel (PWD-VSL-00016) reaches its UOL
- The level of the sending entity reaches its LOL
- A specified volume is transferred, based on vessel level.

The neutralizing sequence will add caustic until the pH of the vessel is confirmed to be within the desired alkaline conditions. Once the pH is confirmed to be in the desired operating range, the vessel contents will be ready to transfer to the appropriate vessel.

Once the acidic/alkaline effluent vessel (PWD-VSL-00016) is ready to transfer, the operator will initiate the transfer-out sequence within the control system. Once initiated, the control system verifies that instruments, utilities, and equipment associated with the transfer are within operational parameters and remain as such throughout the transfer. If any of the monitored parameters are not within the specified limits during the transfer, the control system will switch to exception handling logic. The transfer will end when any of the following are true:

- The level in the acidic/alkaline effluent vessel (PWD-VSL-00016) reaches its LOL
- The receiving entity reaches its UOL
- A specified volume is transferred, based on vessel level

When the level is no longer within the normal operating range due to an abnormality, interlocks along with alarms within the control system help prevent an overflow condition. Figure 6 shows the interlocks and alarms for the level instrument associated with the acidic/alkaline effluent vessel (PWD-VSL-00016). At the high-alarm setpoint, an alarm is generated. At the high-high alarm setpoint, an alarm is generated

and all dedicated controlled feeds are isolated. Isolation occurs by a combination of either stopping the motive force or closing valves.

3.7 All PT PWD Facility Sumps

All PT PWD facility sumps operate in a typical manner. All of the sumps are maintained dry. Upon detection of a high liquid level in the sump, the control system alarms and the operator must take the necessary action to empty the sump. Figure 7 shows the high alarm for the level instrument associated with the feed receipt C5 cell sump (PWD-SUMP-00001), which serves as a typical method of operation for all PT PWD sumps.

3.8 Leak Detection Boxes

Leak detection boxes with leak detection instrumentation are available for every inter-facility transfer line. The term inter-facility transfer lines also includes any transfers to or from outside the physical boundary of the WTP project. When a leak is detected in the transfer line being used, an alarm is generated and the transfer is stopped by the control system. Figure 8 shows the level instrument associated with a leak detection box (PWD-LDB-00001). This serves as a typical for all leak detection boxes in the PT facility.

Figure 1. Level Measurement for the Ultimate Overflow Vessel (PWD-VSL-00033)

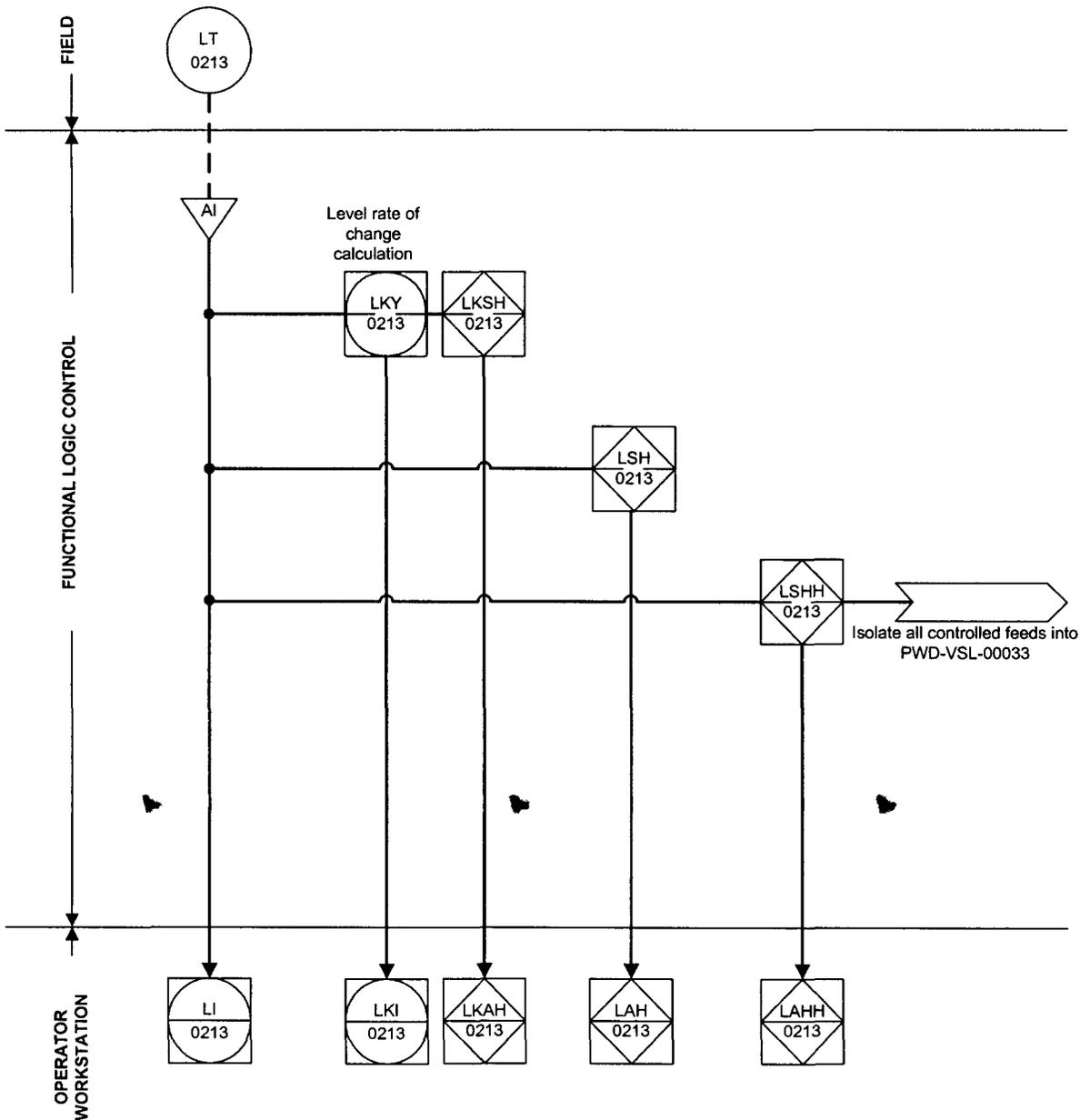


Figure 2. Level Measurement for the HLW Effluent Transfer Vessel (PWD-VSL-00043)

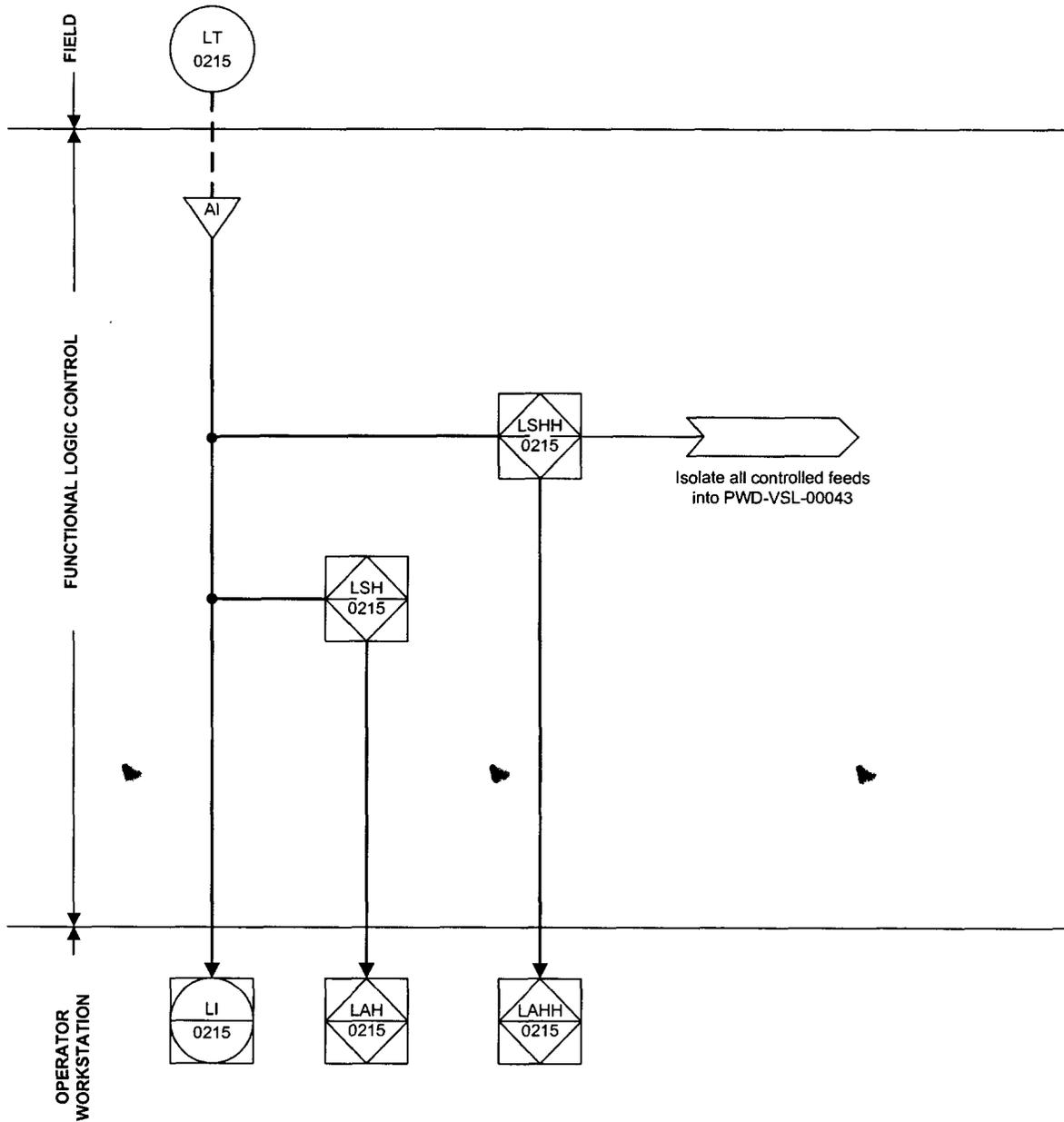


Figure 3. Level Measurement for the C3 Floor Drain Collection Vessel (PWD-VSL-00046)

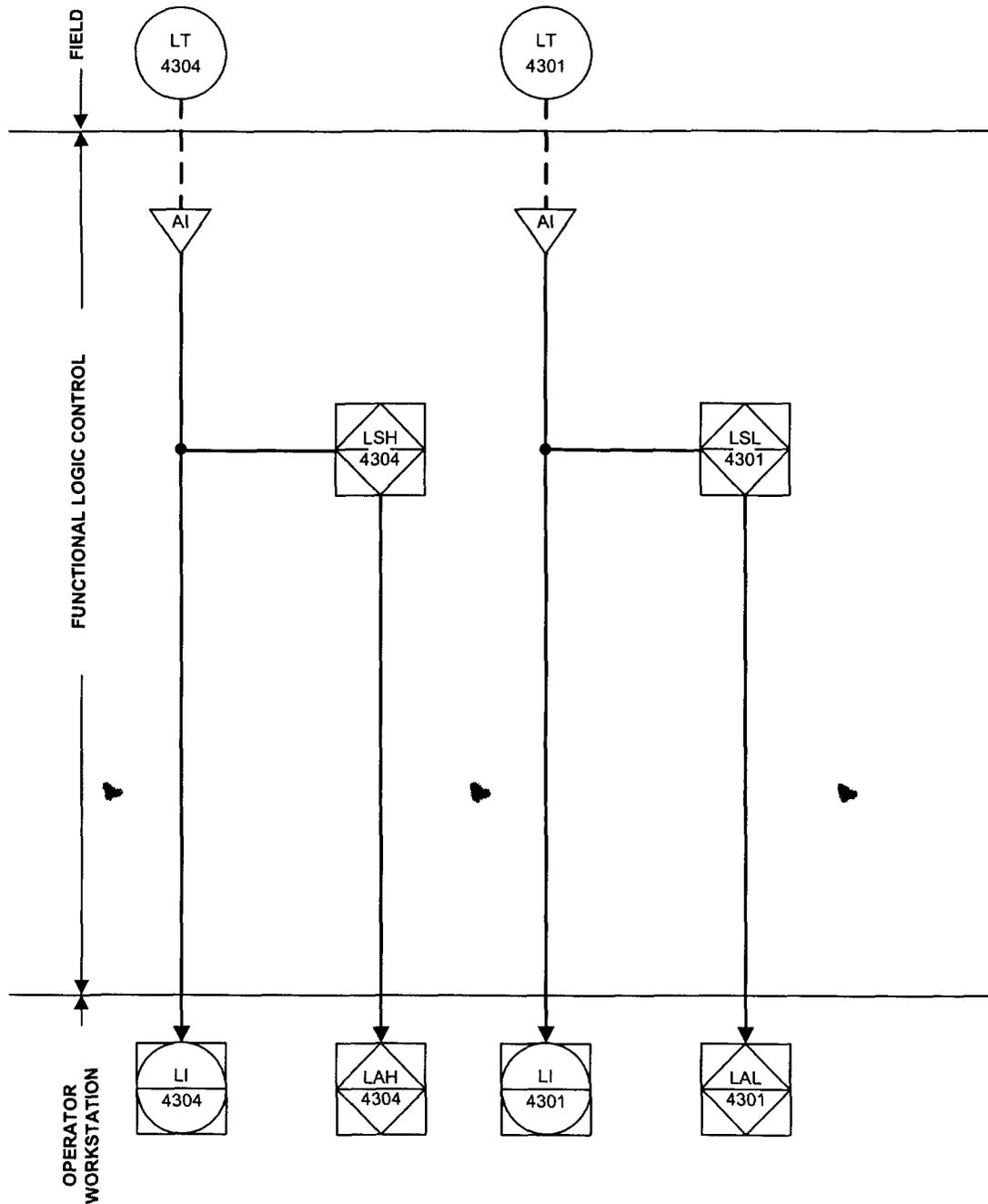


Figure 4. Level Measurement for Plant Wash Vessel (PWD-VSL-00044)

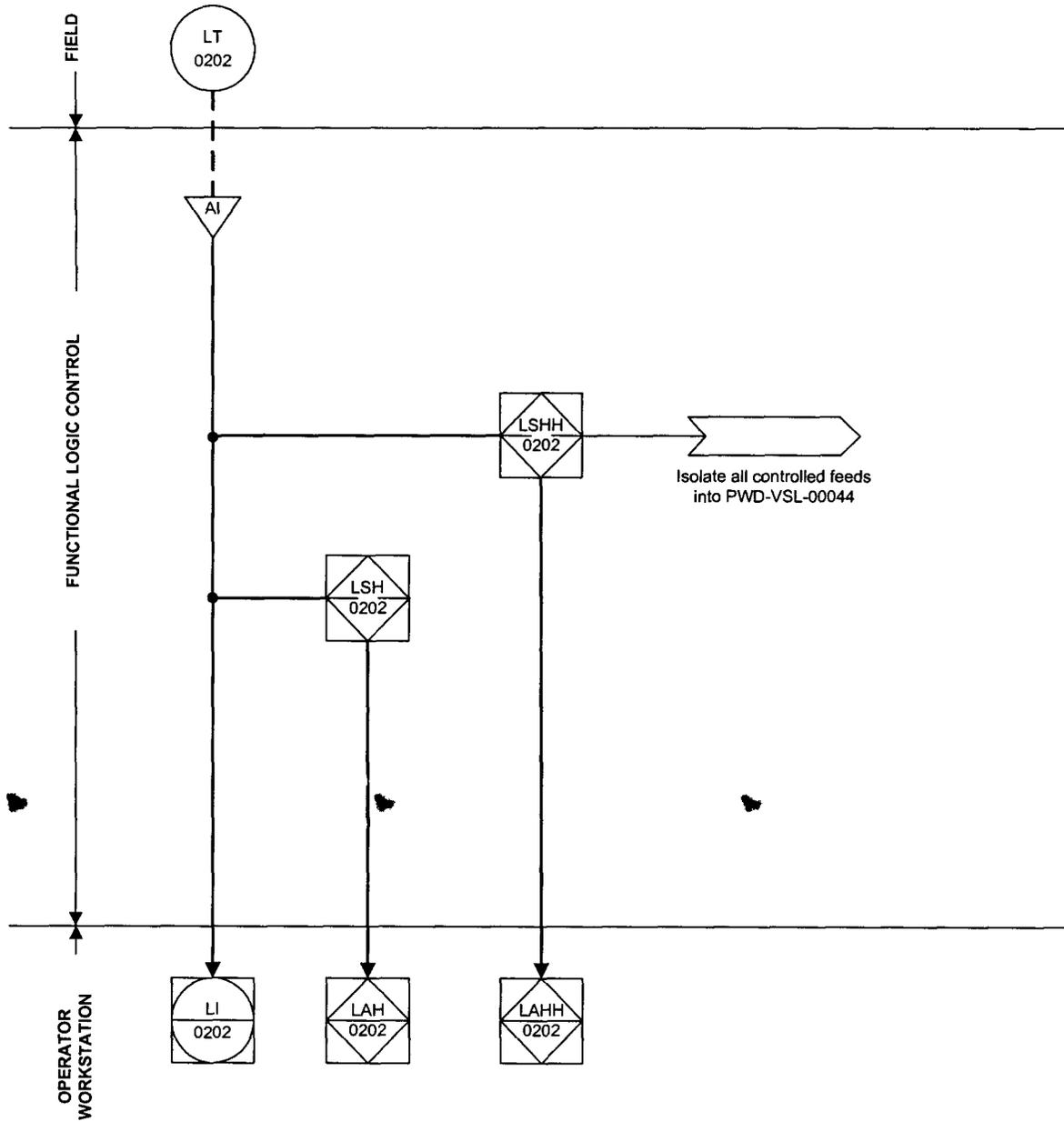


Figure 5. Level Measurement for Acidic/Alkaline Effluent Vessel (PWD-VSL-00015)

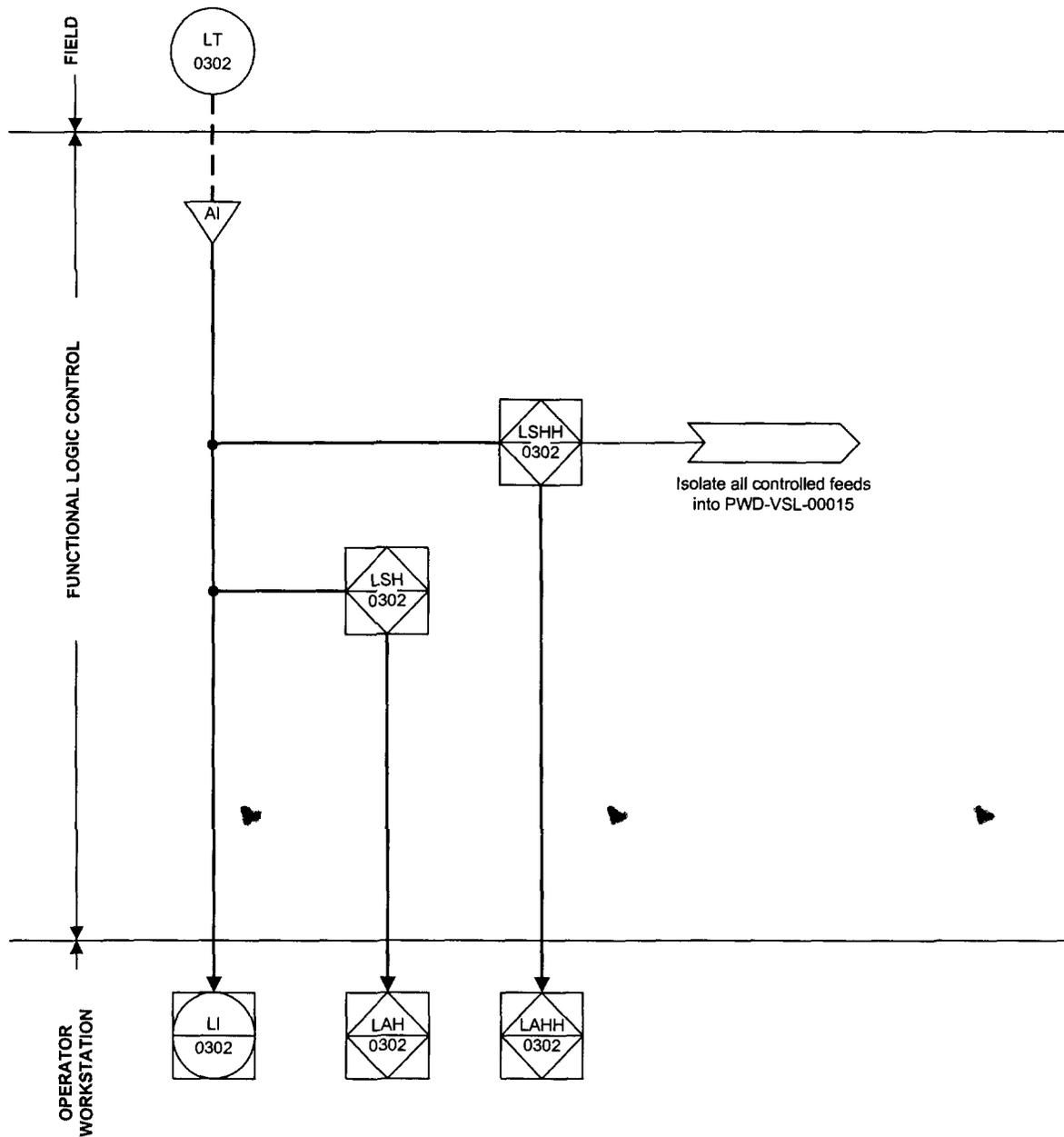


Figure 6. Level Measurement for Acidic/Alkaline Effluent Vessel (PWD-VSL-00016)

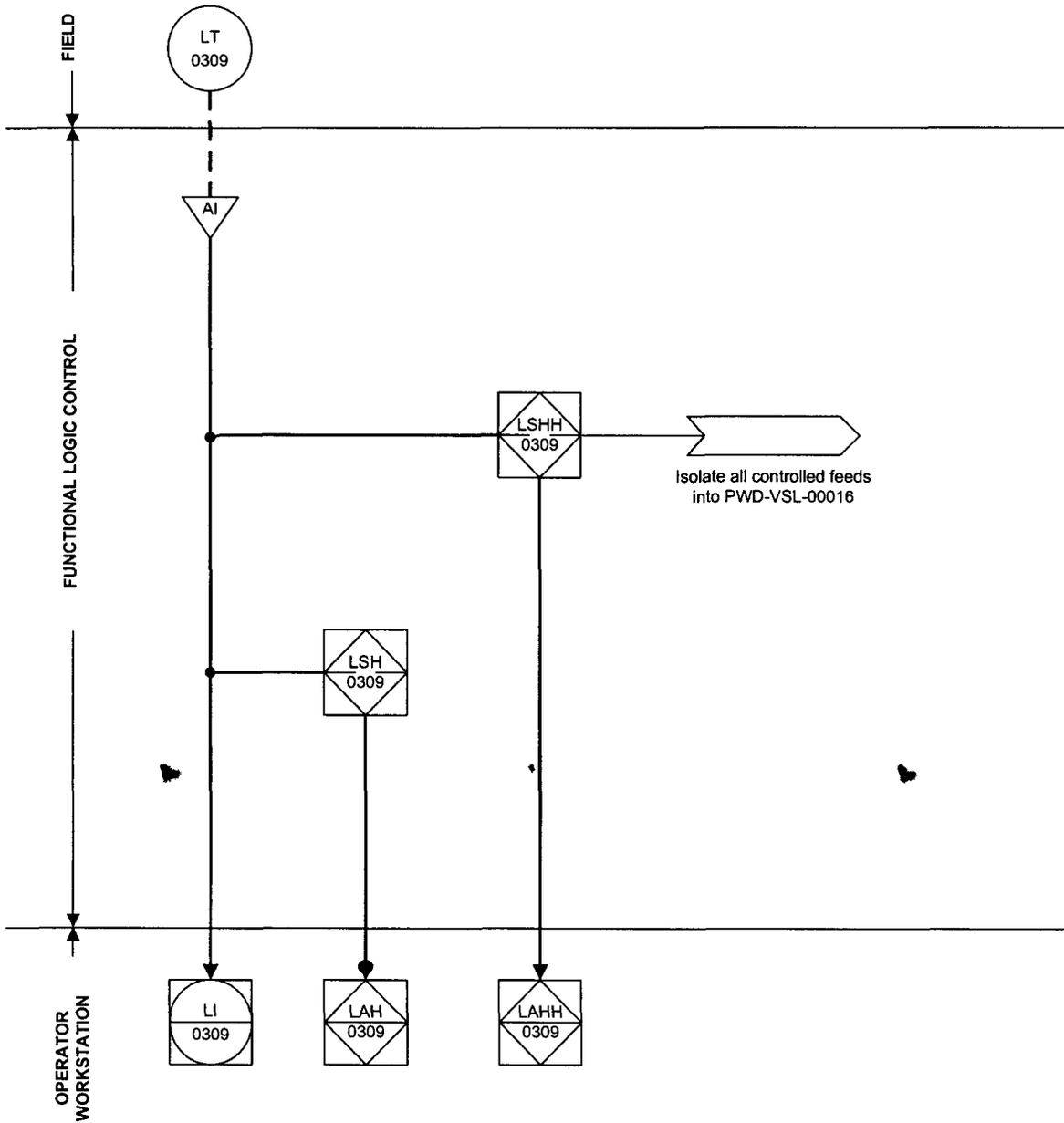
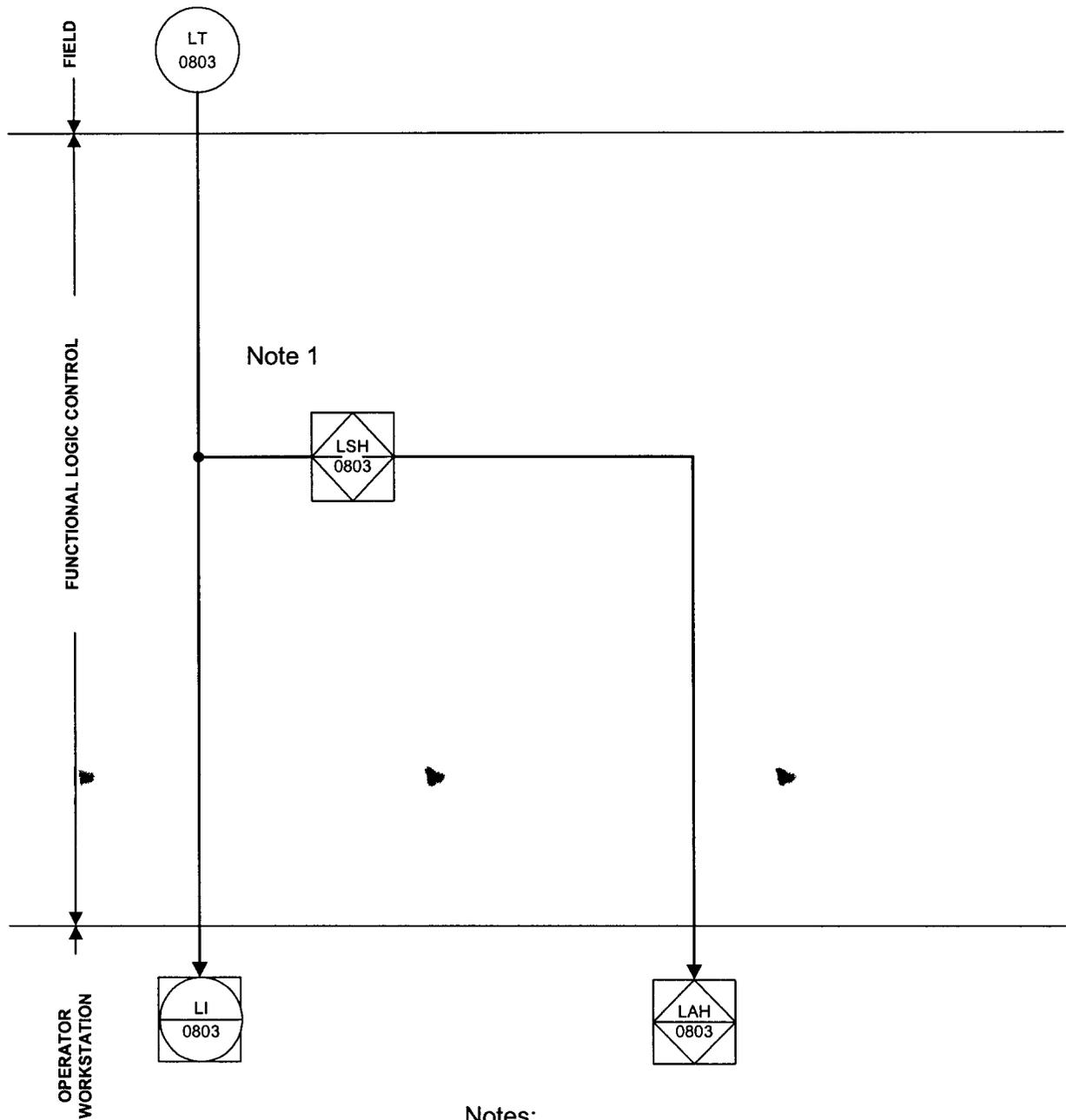
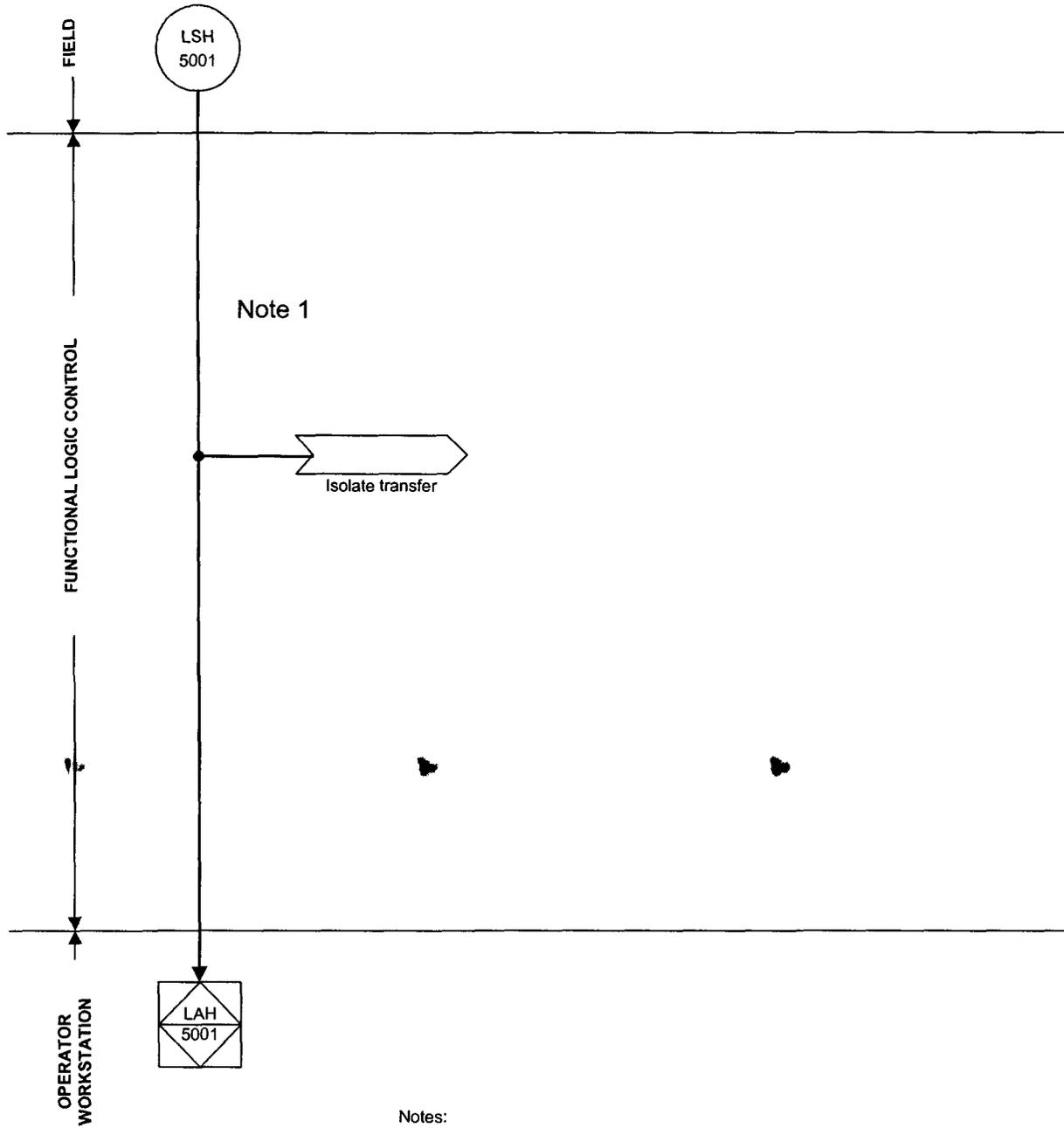


Figure 7. Level Measurement for Feed Receipt C5 Cell Sump (PWD-SUMP-00001)



Notes:
1. Typical for all PWD sumps
in the PT facility

Figure 8. Level Measurement for Leak Detection Box (PWD-LDB-00001)



Notes:
1. Typical of all leak detection boxes in the PT facility