

S

## ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 652480

Proj.  
ECN

2. ECN Category (mark one)		3. Originator's Name, Organization, MSIN, and Telephone No.		4. USQ Required?	5. Date
Supplemental <input type="radio"/>		K. H. Morris, S1800, G1-54, 376-8843		<input checked="" type="radio"/> Yes <input type="radio"/> No	6/21/99
Direct Revision <input checked="" type="radio"/>		6. Project Title/No./Work Order No.		7. Bldg./Sys./Fac. No.	8. Approval Designator
Change ECN <input type="radio"/>		241-SY-101 Expedited Response		241-SY	SO
Temporary <input type="radio"/>		HN920201/CACN108968/COA BA10			
Standby <input type="radio"/>		9. Document Numbers Changed by this ECN (includes sheet no. and rev.)		10. Related ECN No(s).	11. Related PO No.
Supersedeure <input type="radio"/>		HNF-4531, Rev 0, complete revision		NA	NA
Cancel/Void <input type="radio"/>					
12a. Modification Work		12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)	
<input type="radio"/> Yes (fill out Bk. 12b)		NA	NA	NA	
<input checked="" type="radio"/> No (NA Bks. 12b, 12c, 12d)		Design Authority/Cog. Engineer Signature & Date		Design Authority/Cog. Engineer Signature & Date	
13a. Description of Change					
13b. Design Baseline Document? <input checked="" type="radio"/> Yes <input type="radio"/> No					
This change incorporates updates to the SEL as determined by the Control Decision meetings held in June 1999. The following summarizes these changes:					
1) Add the FTIR ammonia detector for SY-101 as SS per the control decision record (CDR)					
2) Add the waste flow totalizer as SC per the CDR and SS per BIO accident 5.3.2.18					
3) Remove the drop leg as SS for ammonia mitigation					
4) Remove the ENRAF as SC (replaced by the waste flow totalizer's function)					
14a. Justification (mark one)		14b. Justification Details			
Criteria Change <input checked="" type="radio"/>		The changes are required to update the safety classification of the components described in 13a to match the evolving design.			
Design Improvement <input type="radio"/>					
Environmental <input type="radio"/>					
Facility Deactivation <input type="radio"/>		The design will not result in an exposure change greater than 1 person REM (whole body) or greater than 10 person-REM (extremities) for the installation, maintenance, and operation of the life of the modification.			
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Facilitate Const. <input type="radio"/>					
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1. ECN (use no. from pg. 1)

652480

## 16. Design Verification Required

☒ Yes

☒ No

## 17. Cost Impact

### ENGINEERING

Additional ☐ \$ \_\_\_\_\_

Savings ☐ \$ \_\_\_\_\_

### CONSTRUCTION

Additional ☐ \$ \_\_\_\_\_

Savings ☐ \$ \_\_\_\_\_

## 18. Schedule Impact (days)

Improvement ☐ \_\_\_\_\_

Delay ☐ \_\_\_\_\_

## 19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	<input checked="" type="checkbox"/>	Seismic/Stress Analysis	<input type="checkbox"/>	Tank Calibration Manual	<input type="checkbox"/>
Functional Design Criteria	<input type="checkbox"/>	Stress/Design Report	<input type="checkbox"/>	Health Physics Procedure	<input type="checkbox"/>
Operating Specification	<input type="checkbox"/>	Interface Control Drawing	<input type="checkbox"/>	Spares Multiple Unit Listing	<input type="checkbox"/>
Criticality Specification	<input type="checkbox"/>	Calibration Procedure	<input type="checkbox"/>	Test Procedures/Specification	<input type="checkbox"/>
Conceptual Design Report	<input type="checkbox"/>	Installation Procedure	<input type="checkbox"/>	Component Index	<input type="checkbox"/>
Equipment Spec.	<input type="checkbox"/>	Maintenance Procedure	<input type="checkbox"/>	ASME Coded Item	<input type="checkbox"/>
Const. Spec.	<input type="checkbox"/>	Engineering Procedure	<input type="checkbox"/>	Human Factor Consideration	<input type="checkbox"/>
Procurement Spec.	<input type="checkbox"/>	Operating Instruction	<input type="checkbox"/>	Computer Software	<input type="checkbox"/>
Vendor Information	<input type="checkbox"/>	Operating Procedure	<input type="checkbox"/>	Electric Circuit Schedule	<input type="checkbox"/>
OM Manual	<input type="checkbox"/>	Operational Safety Requirement	<input type="checkbox"/>	ICRS Procedure	<input type="checkbox"/>
FSAR/SAR	<input type="checkbox"/>	IEFD Drawing	<input type="checkbox"/>	Process Control Manual/Plan	<input type="checkbox"/>
Safety Equipment List	<input checked="" type="checkbox"/>	Cell Arrangement Drawing	<input type="checkbox"/>	Process Flow Chart	<input type="checkbox"/>
Radiation Work Permit	<input type="checkbox"/>	Essential Material Specification	<input type="checkbox"/>	Purchase Requisition	<input type="checkbox"/>
Environmental Impact Statement	<input type="checkbox"/>	Fac. Proc. Samp. Schedule	<input type="checkbox"/>	Tickler File	<input type="checkbox"/>
Environmental Report	<input type="checkbox"/>	Inspection Plan	<input type="checkbox"/>	HNF-3737	<input checked="" type="checkbox"/>
Environmental Permit	<input type="checkbox"/>	Inventory Adjustment Request	<input type="checkbox"/>		<input type="checkbox"/>

## 20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision

Document Number/Revision

Document Number/Revision

HNF-4559, SDD (draft)

HNF-SD-WM-SEL-040, TWRS SEL

HNF-3737, SY-101 Safety Basis (draft)

## 21. Approvals

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Date

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Design \_\_\_\_\_

Environ. \_\_\_\_\_

Other \_\_\_\_\_

## DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

## ADDITIONAL

J

## Safety Equipment List for the 241-SY-101 RAPID Mitigation Project

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for Lockheed Martin Hanford Company  
Richland, WA 99352  
U.S. Department of Energy Contract DE-AC06-96RL13200

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**Abstract:** This document provides the safety classification for the safety (safety-class and safety-significant) structures, systems, and components (SSCs) associated with the 241-SY-101 RAPID Mitigation Project. The information contained herein will be included in the TWRS SEL upon implementation of the supporting authorization basis documentation.

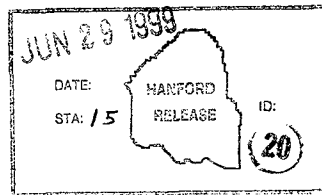
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6-29-99

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**LIST OF TERMS**

ASSD	Anti-Siphoning Slurry Distributor
BIO	Basis for Interim Operation
DST	Double Shell Tank
ENRAF	ENRAF Corporation (surface level measurement device)
EPDM	Ethylene Propylene Diene Monomer
GS	General Service
HNF	Hanford
in wg	inches water gauge
NA	Not Applicable
NGTP	New Generation Transfer Pump
OGT	Overground Transfer
ppm	parts per million
PPP	Prefabricated Pump Pit
psig	pounds per square inch gauge
RAPID	Respond And Pump In Days
SC	Safety Class
SD	Supporting Document
SEL	Safety Equipment List
SS	Safety Significant
SSCs	Systems, Structures, and Components
TBD	To Be Determined
TWRS	Tank Waste Remediation System

## 1.0 INTRODUCTION

This document provides the safety classification for the safety (safety class and safety significant) structures, systems, and components (SSCs) associated with the 241-SY-101 RAPID Mitigation Project.

This document is being issued as the project SEL until the supporting authorization basis documentation is finalized. Upon implementation of the authorization basis documentation, this document will be superseded by the TWRS SEL (LMHC 1999), which will be updated to include the information contained herein.

## 2.0 SUMMARY

The BIO (HNF 1999g) identifies safety SSCs and their safety functions. Hazard assessment and control development was pursued for the 241-SY-101 RAPID Mitigation Project, as documented in the Control Decision Record (Appendix B). This resulted in the designation of several safety class and safety significant systems, most of which are generally required for transfer systems in the TWRS. Using safety functions as the selection criteria, each system was reviewed to identify the components that are required to ensure that the SSCs are operational. The review also involved using the past established requirements for similar SSCs identified in the BIO (HNF 1999g) and TWRS SEL (LMHC 1999). Each component has been assigned a safety classification based on the effect of its failure on the safety function of the system. The combined safety classification of all the components support the final SSC safety classification.

Table 1 summarizes the results of the safety classification for the 241-SY-101 RAPID Mitigation Project SSCs as determined in Section 5.0.

**Table 1. Summary of TWRS SSC Safety Classifications**

System	SSC Designation	Justification	
		Document, Section	TWRS BIO Section (Unless otherwise noted)
Transfer Systems			
Transfer Leak Detection	SC	LHMC 1999, 6.8.1	5.3.2.18
Transfer System Covers	SC	LHMC 1999, 6.8.4	5.3.2.18 5.3.2.20
OGT Encasements, Connections, and Above Ground Transfer Structures	SC	This Document, 6.1.1	5.3.2.18 5.3.2.20
Pressure Switch Alarm	SC	LHMC 1999, 6.18.1	5.3.2.18 5.3.2.20
Waste Transfer Control	SC	This Document, 6.1.2	This Document, App. B
Ventilation System	SS	This Document, 6.2.1	This Document, App. B
Ammonia Detection Systems	SS	This Document, 6.2.3	This Document, App. B
Video Monitoring	DID	This Document, 3.0	This Document, App. B
Drop Leg	DID	This Document, 3.0	This Document, App. B
PPP and ASSD Drains	DID	This Document, 3.0	This Document, App. B



### **3.0 SAFETY CLASSIFICATION APPROACH**

The approach for determining the safety classification for each SSC is based on applying the criteria and methodology identified in the TWRS SEL, Section 3 (LMHC 1999).

In addition to identifying safety SSCs, the Control Decision Record (Appendix B) also identified three unique Defense-in-Depth SSCs for the project. The 241-SY-101 Video Camera Monitoring is identified as a Defense-in-Depth SSC. This is due to the value of observing crust behavior during mitigation activities. Specific controls are not in place because of the difficulty associated with defining criteria that would prompt ceasing operations. The 241-SY-102 Anti-siphoning Slurry Distributor (ASSD or Drop Leg in Appendix B) is identified as a Defense-in-Depth SSC. This is because the presence of the ASSD minimizes the surface area of 241-SY-101 waste exposed to air in 241-SY-102 caused by falling waste, splashing, waste surface disturbance, and poor mixing with 241-SY-102 waste. The control associated with this is to maintain the 241-SY-102 waste surface above the discharge of the ASSD by the minimum distance specified in a process memo or the process control plan. The PPP and Riser 241-SY-102-007 ASSD drains are identified as Defense-in-Depth SSCs by allowing leakage to drain back to 241-SY-101 and 241-SY-102 respectively. This is a passive engineering feature without a specific control. See Appendix B for detailed discussions of these DID SSCs.

### **4.0 SCOPE**

This document provides the SEL for the SSCs provided by the 241-SY-101 RAPID Mitigation Project. The safety classifications are based on the BIO (HNF 1999g) and the Control Decision Record (Appendix B). In addition this SEL describes existing SSCs that have additional safety functions as a result of this project.

The safety classification designation is the basis for confirming the appropriate Quality, Safety, and Environmental assurance is used for design work, procurement, installation, maintenance, and operation of the project SSCs.

### **5.0 SAFETY SSC DETERMINATION**

Safety SSCs contained within this document were derived from the system descriptions provided in the BIO (HNF 1999g), TWRS SEL (LHMC 1999), Functional Requirements Document (HNF 1999a), and the Control Decision Record (Appendix B).

#### **5.1 SUMMARY DESCRIPTION**

Section 6.0 describes the safety SSCs unique to this project. Project SSCs that are similar to those currently used in TWRS facilities are as defined in the BIO (HNF 1999g) and TWRS SEL (LMHC 1999) and no description is provided herein.

## **5.2 SAFETY SSCs**

Safety (SC and SS) SSCs prevent or mitigate the effects of an uncontrolled release of radioactive and/or chemical material so that onsite and offsite doses and effluent concentrations are maintained within recommended guidelines during operations of all TWRS facilities. The descriptions of these safety SSCs, unique to the SY-101 RAPID Mitigation Project, are also provided in Section 6.0.

Appendix A contains the SEL for all safety SSCs associated with this project.

## **6.0 SAFETY SYSTEM DESCRIPTIONS**

### **6.1 WASTE TRANSFER SYSTEM**

#### **6.1.1 OVERGROUND TRANSFER ENCASEMENTS, CONNECTIONS, AND ABOVE GROUND TRANSFER STRUCTURES**

##### **6.1.1.1 Safety Classification: SC**

The Overground Transfer System (OGT) Encasement, Connections, and Above Ground Transfer Structures are identified as Safety Class (SC) SSCs based on the "Surface Leak Resulting in Pool and Spray Leak in Structure or From Overground Waste Transfer Lines" accidents (Reference Sections 5.3.2.18 and Section 5.3.2.20 in HNF 1999g).

##### **6.1.1.2 Location**

241-SY Tank Farm

##### **6.1.1.3 Safety Function(s)**

The safety function is to provide secondary confinement for leaks from the primary line and route the leak back to a waste transfer associated structure, where it will be detected.

##### **6.1.1.4 Functional Requirements**

The OGT Encasement, Connections, and Above Ground Transfer Structures system shall confine waste leaked from the primary transfer line and divert the leaked waste to a leak detection system.

##### **6.1.1.5 Description**

The OGT system is a temporary system that is used to transfer waste from 241-SY-101 to 241-SY-102. The design of this OGT system is traceable to engineering design documents, which will be kept current until the system is disassembled.

This system consists of a Prefabricated Pump Pit, an Overground Transfer Line, and an Anti-Siphoning Slurry Distributor (ASSD) Riser Extension Assembly, which are described in the following sections.

##### **6.1.1.5.1 Prefabricated Pump Pit (PPP)**

The PPP is a prefabricated, above ground, stainless steel enclosure that provides the interface between a number of the key components and subsystems of the SY-101

**RAPID Mitigation System.** The design of the PPP permits installation of a New Generation Transfer Pump (NGTP) in an available 42-inch riser. It also includes piping and control valves necessary to allow flushing of the transfer line, pump bearings, and pump internals. Ports on the PPP allow connection of the OGT, dilution/flush water, and monitoring equipment. The PPP provides the typical shielding, confinement, drain functions, and leak detection provided by typical below grade process pits.

### **Safety Features**

The design of the PPP includes features that ensure the safety class function is maintained. These features include: 1) the PPP internal volume is sized to completely contain a design basis leak, 2) the PPP is equipped with a cover which does not allow a direct path to atmosphere for aerosols or sprays to be released, and 3) the PPP is equipped with a safety class leak detection system that will alarm if a leak is detected within the enclosure.

#### **6.1.1.5.2 Overground Transfer Line (OGT)**

The OGT Line is approximately 150 feet long and consists of a 2" static dissipative reinforced EPDM hose encased by a 4" reinforced EPDM hose. One end of the inner (primary) hose is equipped with a stainless steel flange for connection to the PPP piping and the other end is equipped with a PUREX style nozzle for connection to the drop leg. The rated working pressure for the primary hose meets or exceeds the maximum discharge pressure of the NGTP. The 4" encasement (secondary) hose is equipped with a flange on each end for connection to the PPP and the ASSD Riser Extension encasements, and has a minimum working pressure which exceeds the anticipated pressure/vacuum conditions during field operations. The exterior of the OGT Line is heat traced and insulated to reduce the chance of plugging during the transfer.

### **Safety Features**

The OGT Line used for this project is unique in that the transfer line encasement is constructed using reinforced EPDM hose. The design of the OGT line includes passive features that ensure the safety class function is maintained. These features include: 1) the OGT line is equipped with a secondary encasement hose assembly, which jackets and provides a confinement for the primary waste transfer hose, 2) the encasement will route leaked waste to either the ASSD Riser Extension Assembly or the PPP, and 3) the secondary encasement hose is designed to withstand the anticipated conditions associated with a failed primary transfer line combined with a plugged ASSD Riser Extension Assembly floor drain.

#### **6.1.1.5.3 ASSD Riser Extension Assembly**

The ASSD Riser Extension Assembly is a prefabricated, above ground, stainless steel enclosure that permits the installation of the ASSD in a 42-inch, 241-SY-102 riser. The secondary containment portion of the assembly is constructed using 24-in. diameter, Schedule 40, stainless steel pipe capped with a 150 lb blind flange. Ports on the assembly allow connection of the OGT Line.

## **Safety Features**

The design of the ASSD Riser Extension Assembly includes features that ensure the safety class function is maintained. These features include, 1) three large vent/drain ducts which provide a direct path to 241-SY-102 for drainage of leaked waste, 2) the secondary containment is designed and tested to withstand the maximum pressure resulting if the ducts plug, backing the waste up the OGT encasement to the PPP, and 3) the secondary containment is equipped with a safety class leak detection system that will alarm if a leak is detected within the enclosure.

### **6.1.1.6 System Evaluation**

The OGT Line could be damaged if driven over with a vehicle. This type of damage may be difficult to detect due to the flexible exterior insulation. The PPP and the ASSD could also be damaged by vehicular traffic. Administrative Control 5.12.2, *Program Key Elements* (HNF 1999b) requires that either vehicle restrictions or concrete shielding systems are in place to protect OGT systems during a waste transfer. To prevent undetected damage from occurring prior to the transfer, access controls shall be in place before the OGT system is installed. After installation but prior to the first transfer, the PPP and ASSD will be internally inspected for signs of damage that could compromise the safety function. In addition, a walk down of the OGT Line will be performed with the lead blankets removed.

### **6.1.1.7 Design Codes and Standards**

As required by the Hazard and Accident Analysis Process (HNF 1997), Functional Requirements Document (HNF 1999a), PPP Specification (HNF 1999c), ASSD Riser Extension Specification (HNF 1999d), and the OGT Line Specification (HNF 1999e).

## **6.1.2 WASTE TRANSFER CONTROL SYSTEM**

### **6.1.2.1 Safety Classification: SC & SS**

The Waste Transfer Control System consists of the ASSD, Dilution Water Flow Totalizer, and Waste Flow Totalizer. This system is identified as a Safety Class (SC) SSC for the "Flammable Gas Deflagration – Buoyant Displacement Gas Release Event plus Additional Gas Release from the Crust" accident defined in the Control Decision Record (Appendix B).

The Waste Flow Totalizer is identified as a Safety Significant (SS) SSC for the "Surface Leak Resulting in Pool" accident (Reference Section 5.3.2.18 in HNF 1999g) as identified in the Control Decision Record (Appendix B, Attachment 7).

### **6.1.2.2 Location**

241-SY Tank Farm

### **6.1.2.3 Safety Function**

The SC function of this system is to provide the data necessary to maintain the liquid waste level in 241-SY-101 above the minimum required for proper mixer pump operation and to prevent inadvertent waste transfers from 241-SY-101 due to siphoning.

The SS function of the Waste Flow Totalizer is to provide the volume of material transferred from 241-SY-101 to 241-SY-102 (waste plus dilution water) for implementation of material balance requirements found in TSR AC 5.12, "Transfer Controls" (HNF-1999b).

#### **6.1.2.4 Functional Requirements**

The system is required to (1) continuously totalize the volume of material (waste plus dilution water) transferred to 241-SY-102, (2) continuously totalize the quantity of dilution water added during a transfer, and (3) prevent inadvertent waste transfers due to siphoning.

#### **6.1.2.5 Description**

The Waste Transfer Control System provides the data necessary to calculate the waste volume being transferred from 241-SY-101. This data will consist of the total volume of dilution water added during a waste transfer along with the total volume of material (waste plus dilution water) transferred to SY-102. This information, along with crust growth data, mixer pump performance, and previously calculated 241-SY-101 tank levels, is used to determine the volume and the duration of the waste transfer. To prevent continuation of waste transfer after pump shut down, the ASSD is installed in 241-SY-102.

The Waste Transfer Control System consists of the ASSD, Dilution Water Flow Totalizer, and Waste Flow Totalizer. These components are described in the following sections.

##### **6.1.2.5.1 Anti-Siphon Slurry Distributor (ASSD)**

The ASSD consists of a nozzle that discharges into a dome space vented diffuser pipe. This nozzle is located at a higher elevation than the 241-SY-101 liquid waste level, providing a passive siphon break.

The diffuser pipe discharges waste below the 241-SY-102 liquid level and is designed to maximize the horizontal component of the stream velocity without significantly increasing the potential for plugging in the diffuser or nozzle. This facilitates mixing of the discharge stream with the contents of 241-SY-102 while minimizing the production of aerosols.

#### **Safety Features**

The ASSD siphon break function is to prevent the inadvertent transfer of waste from SY-101 due to siphoning. This feature helps maintain the waste mixed slurry volume in SY-101 above a minimum to prevent the crust from encroaching on the mixer pump suction inlet. The passive design of the ASSD reduces the response time over manually operated valves and is not prone to failure. These features will ensure the safety functions are maintained.

### 6.1.2.5.2 Waste and Dilution Water Flow Totalizers

The waste flow totalizer measures the volume of material (waste plus dilution water) transferred from 241-SY-101 and the dilution water flow totalizer measures the quantity of water added to the 241-SY-101 waste transfer. Each totalizer consists of a magnetic flow element. The dilution water flow totalizer is installed in the dilution water valve and instrumentation stand, combined with an integrally mounted transmitter. The waste flow totalizer is installed such that the flow element is in the PPP and the transmitter and indicator are in the SY-101-WT-CP-350A instrumentation stand.

The dilution water flow transmitter provides local indication of the total volume of dilution water added to the transfer. In addition, the dilution water flow transmitter for the dilution line provides a signal that will shut down the transfer pump when dilution water flows exceed set operating parameters. The water support skid flow meter is utilized for process information during RAPID operations and is not required to perform a safety function.

The waste flow transmitter provides local indication of the total volume of material transferred to 241-SY-102 from the PPP. The waste flow meter is utilized for process information during RAPID operations (e.g., flow monitoring in gallons per minute) and is not required to perform a safety function.

#### Safety Features

These instruments are not connected to safety related interlocks and require that: 1) an operator record the data from each instrument, 2) perform the waste transfer calculation, and 3) stop the transfer pump if limits are approached, to complete the Waste Transfer Control System safety function.

The duration of time between performing the waste transfer calculations will be such that the volume of waste transferred during any given interval, should not render the 241-SY-101 mixer pump inoperable. If the supply power to the dilution flow instrument or the dilution hose/piping between the flow totalizer and PPP were to fail during one of these intervals, the failure would be easily detected during operator rounds at the subsequent interval. If the supply power to the waste flow instrument were to fail during one of these intervals, the failure would be easily detected during operator rounds at the subsequent interval. At this point the system would be deemed INOPERABLE and the waste transfer stopped.

The only failure mode that could affect the safety function of these instruments is an **undetected** failure which resulted in inaccurate data. This would cause erroneous 241-SY-101 waste transfer calculations and potentially compromise the mixer pump safety function. Each flow totalizer design includes a self-diagnostic feature, which automatically displays an error message if a problem is detected, thereby minimizing the possibility of an undetected failure.

A loss of power to either instrument or the failure of the downstream dilution hose/piping is readily detectable and will result in termination of the waste transfer, thus maintaining the safety function of the Waste Transfer Control System.

The safety-significant function of the flow totalizer (measure total waste transferred) is the same as the safety-class function described above. This function is used in conjunction with level detection per AC 5.12 (HNF-1999b) to detect transfer line leaks.

#### **6.1.2.6 System Evaluation**

The flow totalizers will be verified to be within current calibration prior to starting the waste transfer. The dilution hose/piping between the dilution water flow totalizer and the PPP will be visually verified to not be leaking throughout the waste transfer per approved operator rounds. The safety-class leak detector in the PPP would detect a leak from the PPP valve manifold.

The ASSD will be inspected prior to installation in 241-SY-102 and is not anticipated to fail during the short duration of waste transfers from 241-SY-101 to 241-SY-102.

#### **6.1.2.7 Design Codes and Standards**

As required by the Hazard and Accident Analysis Process (HNF 1997), Functional Requirements Document (HNF 1999a), ASSD Specification (HNF 1999d), the PPP Piping Specification (HNF 1999h), and the Flow Totalizer Specification (HNF-1999f).

### **6.2 MISCELLANEOUS SSCs**

The SSCs contained in this section are contained within the TWRS SEL (LMHC 1999), but are also included here due to additional safety functions that have been added by this project. These safety functions, and the associated requirements, are only applicable during 241-SY-101 RAPID operations.

#### **6.2.1 241-SY Ventilation System**

##### **6.2.1.1 Safety Classification: SS**

The 241-SY Ventilation System is identified as a Safety Significant (SS) SSC for the "Mixing of Incompatible Material – Toxic Vapor Generation" accident identified in the Control Decision Record (Appendix B).

##### **6.2.1.2 Location**

241-SY Tank Farm

##### **6.2.1.3 Safety Function(s)**

The SS function of the 241-SY Ventilation System is to provide an elevated discharge path for ammonia releases.

#### **6.2.1.4 Functional Requirements**

The 241-SY Ventilation System shall be operable per HNF 1999b, LCO 3.2.1 and discharging through the ventilation exhaust stack.

#### **6.2.1.5 Description**

See LMHC 1999, Section 6.1.3.5.

#### **6.2.1.6 System Evaluation**

The equipment important to the SS function of the 241-SY ventilation system shall be verified to have preventative maintenance completed.

#### **6.2.1.7 Design Codes and Standards**

See LMHC 1999, Section 6.1.3.6.

### **6.2.2 241-SY-101 Tank Level Detection Systems**

#### **6.2.2.1 Safety Classification: GS**

The Waste Transfer Control System (Section 6.1.2) is used, instead of the existing level detection systems, to determine the 241-SY-101 liquid waste level during waste transfers from 241-SY-101 to 241-SY-102.

#### **6.2.2.2 Location**

Tank 241-SY-101

#### **6.2.2.3 Safety Function(s)**

N/A

#### **6.2.2.4 Functional Requirements**

N/A

#### **6.2.2.5 Description**

See LMHC 1999, Section 6.6.1.5.

#### **6.2.2.6 System Evaluation**

The existing 241-SY-101 level detection systems are not required for waste transfers from 241-SY-101 to 241-SY-102.

#### **6.2.2.7 Design Codes and Standards**

See LMHC 1999, Section 6.6.6.6.

### **6.2.3 Ammonia Detection Systems**

#### **6.2.3.1 Safety Classification: SS**

The 241-SY stack Ammonia Detection System and the 241-SY-101 vapor space ammonia monitor are identified as Safety Significant (SS) SSCs for the "Mixing of



Incompatible Material – Toxic Vapor Generation” accident identified in the Control Decision Record (Appendix B).

**6.2.3.2 Location**

241-SY Tank Farm

**6.2.3.3 Safety Function(s)**

The SS function of the 241-SY stack ammonia monitor is to monitor for ammonia in 241-SY ventilation exhaust stack during 241-SY-101 waste transfer operations and alarm if concentrations exceed 1000 ppm.

The SS function of the 241-SY-101 vapor space ammonia monitor is to measure the ammonia concentration in the vent header from 241-SY-101 during globally waste disturbing activities (except waste transfers - see above) and when water sources are connected to equipment for operations and activities that could add water to 241-SY-101 and alarm if concentrations exceed 3000 ppm.

**6.2.3.4 Functional Requirements**

See LMHC 1999, Section 6.42.1.4.

**6.2.3.5 Description**

See LMHC 1999, Section 6.42.1.5, Bruel & Kjaer (B&K) photo-acoustic detector and the Fourier Transform Infrared (FTIR) spectrometer.

**6.2.3.6 System Evaluation**

The instrumentation/equipment important to the SS function of the 241-SY ammonia monitoring system shall be verified to have calibration and preventative maintenance completed.

**6.2.3.7 Design Codes and Standards**

See LMHC 1999, Section 6.42.1.6.

## 7.0 REFERENCES

- HNF 1997, *Hazard and Accident Analysis Process*, HNF-PRO-704, Rev. 0, Fluor Daniel Hanford, Inc., Richland, Washington.
- LMHC 1998, *High Radiation Areas Physical Access Controls*, HNF-IP-0842, Volume VII, Section 2.2, Rev. 0b, Lockheed Martin Hanford Corporation, Richland, Washington.
- LMHC 1999, *TWRS Facility Safety Equipment List*, HNF-SD-WM-SEL-040, Rev. 1A, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999a, *Functional Requirements and Technical Criteria for the 241-SY-101 RAPID Mitigation System*, HNF-3885, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999b, *Tank Waste Remediation System Technical Safety Requirements*, HNF-SD-WM-TSR-006, Rev. 0-S, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999c, *SY-101 RAPID Mitigation Prefabricated Pump Pit*, HNF-4169, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999d, *Specification for the SY-101 RAPID Mitigation System Anti-Siphoning Slurry Distributor Assembly*, HNF-4216, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999e, *Specification for the SY-101 RAPID Mitigation System Hose and Hose Assembly*, HNF-4407, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999f, *Specification for the SY-101 RAPID Mitigation Mobile Water Support Skid*, HNF-4043, Rev. 1A, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999g, *Tank Waste Remediation System Basis for Interim Operation*, HNF-SD-WM-BIO-001, Rev. 1D, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF 1999h, *Specification for the SY-101 RAPID Mitigation Transfer Pump Piping*, HNF-4170, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

**Appendix A**  
**Transfer Equipment Safety Classification**

A-1

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**Table A-1 Leak Detection System**

<p>Intrinsically Safe Leak Detector Modules</p> <p>SY101-WT-LDSTA-365 (POR23-WST-LDSTA-101)</p> <p>LD1</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p> <p>SY102-WT-LDSTA-366 (POR24-WST-LDSTA-101)</p> <p>LD1</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p>	<p>Activate local alarm strobe if tripped by the leak detector element.</p> <p>Activate relay K if tripped by the leak detector element.</p>	Fail energized	Spurious alarms  No effect on the safety function.	<p><u>Potential effects of component failure:</u> Failure to activate alarm if pit flooding occurs, leading to possible overflow of pit with associated releases.</p> <p><u>Critical functional requirements:</u> Close contact LD1-2 and open contact LD1 when tripped by the leak detector element or the leak detector station test switch.</p> <p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detector systems, (2) test operability of leak detector systems prior to the start of transfer operations, and (3) provide surveillance of leak detector system during transfer operations to ensure leak/trouble alarm is not activated.</p>	SC
		Fail de-energized	Loss of ability to detect liquid waste in pit.  Loss of safety function.		
<p>MTL 2313A Trip Amplifiers</p> <p>SY101-WT-LDSTA-365 (POR23-WST-LDSTA-101)</p> <p>LD3</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p> <p>SY102-WT-LDSTA-366/ (POR24-WST-LDSTA-101)</p> <p>LD3</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p>	<p>Monitor continuity in leak detector leads and leak detector circuit in LD1.</p> <p>Activate relay LD2 if continuity is lost.</p>	Fail with LD3 output energized	Loss of ability to detect loss of continuity in leak detector circuit.	<p><u>Potential effects of component failure:</u> Possible loss of leak detector safety function.</p> <p><u>Critical functional requirements:</u> Open both sets of normally open contacts when relay is de-energized.</p> <p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detector systems and (2) test operability of leak detector systems prior to the start of transfer operations.</p>	SC
		Fail with LD3 output de-energized	Spurious alarms.  No effect on the safety function.		

**Table A-1 Leak Detection System**

<p>Loss of Power Alarm Relays</p> <p>SY101-WT-LDSTA-365 (POR23-WST-LDSTA-101)</p> <p>LD2</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p> <p>SY102-WT-LDSTA-366 (POR24-WST-LDSTA-101)</p> <p>LD2</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p>	<p>Activate local alarm strobe on loss of power signal from LD3.</p> <p>Activate remote alarm relay K on loss of power signal from LD3.</p>	<p>Relay fails in energized position.</p>	<p>Loss of ability to detect loss of continuity in leak detector circuit.</p>	<p><u>Potential effects of component failure:</u> Possible loss of leak detector safety function.</p>	<p>SC</p>
		<p>Relay fails in de-energized position.</p>	<p>Spurious alarms.</p> <p>No effect on the safety function.</p>	<p><u>Critical functional requirements:</u> Close normally closed contact LD2-1 and open normally open contact LD2 when relay is de-energized.</p> <p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detector systems and (2) test operability of leak detector systems prior to the start of transfer operations.</p>	
<p>Remote Alarm Relays</p> <p>SY101-WT-LDSTA-365 (POR23-WST-LDSTA-101)</p> <p>K</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p> <p>SY102-WT-LDSTA-366/ (POR24-WST-LDSTA-101)</p> <p>K</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p>	<p>Propagates leak detection signal to the leak detector relay.</p>	<p>Relay fails in energized position.</p>	<p>Loss of ability to detect loss of continuity in leak detector circuit and/or detect liquid waste in pit.</p>	<p><u>Potential effects of component failure:</u> Possible loss of leak detector safety function.</p>	<p>SC</p>
		<p>Relay fails in de-energized position.</p>	<p>Spurious alarms.</p> <p>No effect on the safety function.</p>	<p><u>Critical functional requirements:</u> Open normally open contact when relay is de-energized.</p> <p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detector systems and (2) test operability of leak detector systems prior to the start of transfer operations.</p>	

**Table A-1 Leak Detection System**

<p>Leak Detector Relays (SY101-WT-CP-350A)</p> <p>LDK-365 (1K1) H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103654, Sht 1 H-14-103653, Sht 2 H-14-103641, Sht 5</p> <p>(SY101-WT-CP-350A)</p> <p>LDK-366 (1K2) H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103654, Sht 1 H-14-103653, Sht 2 H-14-103641, Sht 5</p>	<p>Propagates leak detection signal to the SY101-WT-ANN-350A annunciator panel.</p>	<p>Relay fails in energized position.</p>	<p>Loss of ability to detect loss of continuity in leak detector circuit and/or detect liquid waste in pit.</p>	<p><u>Potential effects of component failure:</u> Failure to activate alarm if pit flooding occurs, leading to possible overflow of pit with associated releases.</p> <p><u>Critical functional requirements:</u> Open normally open contact 1K1 when relay is de-energized.</p>	<p>SC</p>
		<p>Relay fails in de-energized position.</p>	<p>Spurious alarms.</p> <p>No effect on the safety function.</p>	<p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detector systems, (2) test operability of leak detector systems prior to the start of transfer operations, and (3) provide surveillance of leak detector system during transfer operations to ensure leak/trouble alarm is not activated.</p>	
<p>120/8/16/24 VAC Transformer</p> <p>SY101-WT-LDSTA-365 (POR23-WST-LDSTA-101)</p> <p>XFMR</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p> <p>SY102-WT-LDSTA-366 (POR24-WST-LDSTA-101)</p> <p>XFMR</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p>	<p>Provide power to local strobe light on alarm condition or loss of continuity in leak detector circuit.</p>	<p>Fail to function.</p>	<p>Loss of ability to energize strobe light on alarm condition.</p> <p>SY101-WT-ANN-350A provides a redundant, local indication of leak detection activation or loss of power at the leak detector station.</p>	<p><u>Potential effects of component failure:</u> Failure of alarm to activate, leading to possible overflow of pit with associated releases.</p> <p><u>Critical functional requirements:</u> Provide 24 VAC at the secondary side of the transformer when 120 VAC is applied to the primary side.</p> <p><u>Component failure detection:</u> Procedures will be in place to: (1) periodically test the leak detection system, (2) test operability of the leak detection system prior to the start of the waste transfer, and (3) provide surveillance of leak detector system during transfer operations to ensure leak/trouble alarm is not activated.</p>	<p>SC</p>

**Table A-1 Leak Detection System**

<p>Local Alarm Strobe Light</p> <p>SY101-WT-LDSTA-365 (POR23-WST-LDSTA-101)</p> <p>W</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p> <p>SY102-WT-LDSTA-366 (POR24-WST-LDSTA-101)</p> <p>W</p> <p>H-2-34965 (ECN 652131) (H-14-103656, Sht 1)</p>	<p>Provide local indication of alarm condition or loss of continuity in leak detector circuit</p>	<p>Fail to function.</p>	<p>Leak detection system activation not recognized by Operator.</p> <p>SY101-WT-ANN-350A provides a redundant, local indication of leak detection activation or loss of power at the leak detector station.</p>	<p><u>Potential effects of component failure:</u> Failure of alarm to activate, leading to possible overflow of pit with associated releases.</p> <p><u>Critical functional requirements:</u> Actuate when 24 VAC is applied.</p> <p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detection system, (2) test operability of the leak detection system prior to the start of the waste transfer, and (3) provide surveillance of leak detector system during transfer operations to ensure leak/trouble alarm is not activated.</p>	<p>SC</p>
<p>Annunciator Panel</p> <p>(SY101-WT-CP-350A)</p> <p>SY101-WT-ANN-350A</p> <p>H-14-103656, Sht 1</p> <p>H-14-103655, Sht 1</p> <p>H-14-103653, Sht 2</p> <p>H-14-103641, Sht 5</p>	<p>Indicating light, (350A-4) illuminated on leak being detected in the SY101-WT-ENCL-350 pump pit.</p> <p>Indicating light, (350A-3) illuminated on leak being detected in the Drop Leg Enclosure.</p>	<p>Failure of indicator bulb.</p> <p>Failure of annunciator electronics.</p>	<p>Leak detection system activation not recognized by Operator.</p> <p>The alarm strobe light provides a redundant, local indication of leak detection activation.</p>	<p><u>Potential effects of component failure:</u> Failure of alarm to activate, leading to possible overflow of pit with associated releases.</p> <p><u>Critical functional requirements:</u> Actuate annunciator window, SY101-WT-LDA-365A when 24 VDC signal is removed.</p> <p>Actuate annunciator window, SY101-WT-LDA-366A when 24 VDC signal is removed.</p> <p><u>Component failure detection:</u> Procedures will be in place to (1) periodically test the leak detection system, (2) test operability of the leak detection system prior to the start of the waste transfer, and (3) provide surveillance of leak detector system during transfer operations to ensure leak/trouble alarm is not activated.</p>	<p>SC</p>



**Table A-2 Transfer System Covers**

Identification	Safety Function(s)	Functional Requirements	System Safety Classification	Safety Classification Justification	
System: Transfer System Covers	Mitigate the effect of a spray leak within the transfer structure.	Covers must be installed prior to waste transfer operations.  Critical Characteristics: The cover assembly for a structure must confine spray leaks to the inside of the structure.  Transfer system covers must eliminate direct spray leakage paths.	SC	HNF-SD-WM-BIO-001, Section 5.3.2.20, "Spray Leak in Structure or From Overground Waste Transfer Lines"	
	Limit release of aerosols generated by splatter inside the structure; limit shine and skyshine dose to the onsite receptor.	Covers must fit their supporting structure.	SS	HNF-SD-WM-BIO-001, Section 5.3.2.18, "Surface Leak Resulting in Pool"	
THE ITEMS LISTED BELOW ARE THE UNIQUE COMPONENTS THAT MAKE UP THE SAFETY SSC					
Component Description (Location) EIN Reference Dwg(s)	Component Function	Component Failure Mode	Component Failure Effect on SSC Safety Function	Component Safety Classification Justification	Component Safety Class
Prefabricated Pump Pit Cover  (241-SY-101, Riser 7)  H-14-103574, Sht 1	Contain spray stream from a breach in the transfer line.  Limit release of aerosols to the environment.  Limit shine or skyshine dose to the onsite receptor.	Cover not correctly installed or not installed.  Cover damaged.	Direct path to atmosphere for aerosols or sprays to be released.	Potential effects of component failure: Unmitigated spray leak in a the PPP could result in radiological doses above onsite and offsite risk guidelines.  Critical functional requirements: Cover properly installed and not physically damaged.  Cover fits the PPP (No direct spray leakage path).  Component failure detection: Procedures will be in place to visually inspect cover for signs of damage prior to waste transfer.	SC

**Table A-3 Overground Transfer Encasements, Connections, and Above Ground Transfer Structures**

Identification	Safety Function(s)	Functional Requirements	System Safety Classification	Safety Classification Justification	
<b>System: Over-ground Transfer (OGT) Encasements, Connections, and Above Ground Transfer Pits</b>	Ensures leak in primary transfer piping is directed to a waste transfer associated structure.  Confine a leak from the primary piping and ensure that a leak is directed to a leak detection system.	Shall be verified operable prior to waste transfer operations.  Critical Characteristics: Encasement must provide containment and an unobstructed flow path to route waste leaking from primary pipe to transfer structure, where the leak can be detected and contained.	SC	HNF-SD-WM-BIO-001, Section 5.3.2.20, "Spray Leak in Structure or From Overground Waste Transfer Lines"  HNF-SD-WM-BIO-001, Section 5.3.2.18, "Surface Leak Resulting in Pool"	
<b>THE ITEMS LISTED BELOW ARE THE UNIQUE COMPONENTS THAT MAKE UP THE SAFETY SSC</b>					
Component Description (Location) EIN Reference Dwg(s)	Component Function	Component Failure Mode	Component Failure Effect on SSC Safety Function	Component Safety Classification Justification	Component Safety Class
Prefabricated Pump Pit (PPP)  (241-SY-101, Riser 7)  SY101-WT-ENCL-350  H-14-103571 H-14-103661	The PPP must confine the majority of a spray leak.  The PPP must contain leaks drained back from the OGT line encasement.  Limit release of leakage to the environment.  Limit shine or skyshine dose to the onsite receptor.  Withstand natural phenomena hazards.  Accumulate waste in bottom of pit prior to draining to 241-SY-101 to allow activation of leak detection system.	PPP damaged.  Cover plates not installed.  Seal loop dam not installed.	Failure of the PPP could disable the safety function of this component.  Failure of the PPP would not, by itself, cause a release.	<u>Potential effects of component failure:</u> Unmitigated spray leak in the PPP could result in radiological doses above onsite and offsite risk guidelines.  <u>Critical functional requirements:</u> PPP not physically damaged and all covers/plugs installed.  Seal Loop Dam (H-14-103661) installed.  Accumulate 2.2 cm (7/8 in.) minimum level of liquid in bottom of pit prior to overflowing the Seal Loop Dam.  <u>Component failure detection:</u> Component failure is unlikely unless damaged during installation or by vehicular traffic.  The PPP is leak tested by the manufacturer.  Access controls will be in place prior to installation of PPP.  The PPP will be inspected (visual or leak test) for signs of damage after installation and prior to waste transfer.	SC

**Table A-3 Overground Transfer Encasements, Connections, and Above Ground Transfer Structures**

<p>OGT Encasement</p> <p>(241-SY-101, PPP to 241-SY-102, ASSD Riser Extension Assembly)</p> <p>H-14-103610, Sht 1</p>	<p>Contain any leakage from primary transfer line and drain to the ASSD Riser Extension.</p> <p>Withstand the maximum pressure resulting if the ASSD Riser Extension drain plugs and waste backs up the encasement to the PPP.</p> <p>Withstand natural phenomena hazards, but not the associated missile.</p>	<p>Breach of encasement line which could permit leakage from a failed primary line to escape into the environment.</p> <p>Hose and Hose system is susceptible to single point, common mode failure.</p>	<p>Failure of the encasement could disable the safety function of this component.</p> <p>Failure of the encasement would not, by itself, cause a release.</p>	<p><u>Potential effects of component failure:</u> Possible release of waste into the ground or formation of a pool.</p> <p>Note - The encasement would not be significantly pressurized as a result of a leak.</p> <p><u>Critical functional requirements:</u> Encasement must not leak when a 60 psig internal pressure is applied.</p> <p><u>Component failure detection:</u> The OGT Line is a temporary structure that will be in service for &lt; 1 year. Failure is unlikely unless damaged during installation or by vehicular traffic.</p> <p>Pressure test performed by the manufacturer.</p> <p>Access controls will be in place prior to installation of the OGT Line.</p> <p>The OGT Line will be inspected (visual or leak test) for signs of damage after installation and prior to waste transfer.</p>	<p>SC</p>
<p>ASSD Riser Extension Assembly</p> <p>(241-SY-102, Riser 7)</p> <p>H-14-103592</p>	<p>The assembly must confine spray leaks to the inside of its structure.</p> <p>The assembly must contain leaks drained back from the OGT line encasement.</p> <p>Limit release of leakage to the environment.</p> <p>Limit shine or skyshine dose to the onsite receptor.</p> <p>Withstand design basis natural phenomena hazards.</p> <p>Withstand the maximum pressure resulting if the ASSD Riser Extension drains plug and waste backs up the encasement to the PPP</p> <p>Accumulate a minimum level of waste in bottom of encasement prior to draining to 241-SY-102 to allow activation of leak detection system.</p>	<p>Assembly damaged .</p> <p>Cover plates not installed correctly.</p> <p>Drain pipe dam not installed.</p>	<p>Failure of the assembly could disable the safety function of this component.</p> <p>Failure of the assembly would not, by itself, cause a release.</p>	<p><u>Potential effects of component failure:</u> Unmitigated spray leak in the Riser Extension Assembly could result in radiological doses above onsite and offsite risk guidelines.</p> <p><u>Critical functional requirements:</u> Riser extension not physically damaged and all covers/plugs installed.</p> <p>Drain Pipe Dam (H-14-103592, Sht 3) installed.</p> <p>Accumulate 5 cm (2 in.) minimum level of liquid in bottom of enclosure prior to overflowing the vent pipes or the Drain Pipe Dam.</p> <p>Riser Extension designed to withstand a minimum pressure of -6 in wg to 60 in wg. (241-SY tank design pressure).</p> <p>Cover plates (flanges) installed per approved bolt torquing procedures.</p> <p><u>Component failure detection:</u> Component failure is unlikely unless damaged during installation or by vehicular traffic.</p> <p>Access controls will be in place prior to installation of PPP.</p> <p>The PPP will be inspected (visual or leak test) for signs of damage after installation and prior to waste transfer.</p>	<p>SC</p>

**Table A-4 Pressure Switch Alarm**

Identification	Safety Function(s)	Functional Requirements		System Safety Classification	Safety Classification Justification
<b>System: Pressure Switch Alarm</b>	Provide an alarm when pressure, due to a waste transfer misroute or leaking valve, is detected in the flush water manifold.	Shall be verified operable prior to waste transfer operations.  Critical Characteristics: The pressure switch is required to actuate an alarm when a pressure of 15 psig maximum is detected in the flush water manifold.		SC	HNF-SD-WM-BIO-001, Section 5.3.2.18, "Surface Leak Resulting in Pool"  HNF-SD-WM-BIO-001, Section 5.3.2.20, "Spray Leak in Structure or From Overground Waste Transfer Lines"
<b>THE ITEMS LISTED BELOW ARE THE UNIQUE COMPONENTS THAT MAKE UP THE SAFETY SSC</b>					
Component Description (Location) EIN Reference Dwg(s)	Component Function	Component Failure Mode	Component Failure Effect on SSC Safety Function	Component Safety Classification Justification	Component Safety Class
Pressure Switches (SY101-WT-ENCL-350)  SY101-WT-PS-370  H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103643, Sht 2  (SY101-WT-ENCL-350)  SY101-WT-PS-371  H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103643, Sht 2	Pressure switch senses pressure in flush manifold and opens contacts.	Open circuit     Mechanical failure of switch (short circuit).  Failure to detect pressure in manifold (plugged pressure port)	Spurious alarms     Undetected loss of safety function.	<u>Potential effects of component failure:</u> Failure to activate alarm if waste is inadvertently routed into the flush manifold, leading to possible overflow of the service water tank with associated releases. Note - Failure of the pressure switch would not, by itself, cause a release.  <u>Critical functional requirements:</u> Open normally closed contact when pressure exceeds 15 psig.  <u>Component failure detection:</u> Procedures will be in place to (1) periodically test the pressure switch system, (2) test operability of the pressure switch system prior to the start of the waste transfer, and (3) provide surveillance of pressure switch system during transfer operations to ensure high pressure alarm is not activated.  SY101-WT-PS-370 and SY101-WT-PS-371 provide redundant pressure detection capability.	SC

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**Table A-4 Pressure Switch Alarm**

Pressure Switch Alarm Relays (SY101-WT-CP-350A) PSK-370 (1K3) H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103653, Sht 2 H-14-103641, Sht 4 (SY101-WT-CP-350A) PSK-371 (1K4) H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103653, Sht 2 H-14-103641, Sht 4	Activate local and remote alarms on high pressure signal from pressure switch.	Contacts fail open	Spurious alarms	<u>Potential effects of component failure:</u> Failure to activate alarm if waste is inadvertently routed into the flush manifold, leading to possible overflow of the service water tank with associated releases.  <u>Critical functional requirements:</u> Open normally open contact when relay is de-energized.  <u>Component failure detection:</u> Procedures will be in place to (1) periodically test the pressure switch system, (2) test operability of the pressure switch system prior to the start of the waste transfer, and (3) provide surveillance of pressure switch system during transfer operations to ensure high pressure alarm is not activated.	SC
		Contacts fail closed	Undetected loss of safety function.		
Annunciator Panel (SY101-WT-CP-350A) SY101-WT-ANN-350A H-14-103656, Sht 1 H-14-103655, Sht 1 H-14-103653, Sht 2	Provide local alarm on detection of pressure in the flush manifold.	Failure of indicator bulb.	Undetected loss of safety function.	<u>Potential effects of component failure:</u> Failure of local alarm if waste is inadvertently routed into the flush manifold, leading to possible overflow of the service water tank with associated releases.  <u>Critical functional requirements:</u> Actuate annunciator window SY101-WT-PAH-370A or SY101-WT-PAH-371A when 24 VDC signal is removed from the associated annunciator input.  <u>Component failure detection:</u> Procedures will be in place to (1) periodically test the pressure switch system, (2) test operability of the pressure switch system prior to the start of the waste transfer, and (3) provide surveillance of pressure switch system during transfer operations to ensure high pressure alarm is not activated.	SC
		Failure of annunciator electronics.			

**Table A-5 Waste Transfer Control**

Identification	Safety Function(s)	Functional Requirements	System Safety Classification	Safety Classification Justification	
System: 241-SY-101 Waste Transfer Control	Provide the information necessary to calculate the waste volume transferred from 241-SY-101 and prevent inadvertent waste transfers due to siphoning.	Shall be verified operable prior to waste transfer operations.  Critical Characteristics: The system is required to (1) continuously totalize waste transferred to SY-102 , (2) continuously totalize the quantity of dilution water added during a transfer, and (3) prevent inadvertent waste transfers due to siphoning.	SC	Control Decision Record (Appendix B), Section 3.3, "Flammable Gas Deflagration – Buoyant Displacement Gas Release Event plus Additional Gas Release from the Crust"	
	Provide information necessary to calculate material balance between SY-101 and SY-102 to detect a transfer line leak.	Shall be verified operable prior to waste transfer operations. Critical Characteristics: Continuously totalize waste transferred to SY-102	SS	HNF-SD-WM-BIO-001, Section 5.3.2.18, "Surface Leak Resulting in Pool"	
THE ITEMS LISTED BELOW ARE THE UNIQUE COMPONENTS THAT MAKE UP THE SAFETY SSC					
Component Description (Location) EIN Reference Dwg(s)	Component Function	Component Failure Mode	Component Failure Effect on SSC Safety Function	Component Safety Classification Justification	Component Safety Class
Anti –Siphoning Slurry Distributor (ASSD)  (241-SY-102, Riser 7)  H-14-103597, Sht 1	Prevent siphoning of waste from 241-SY-101 to 241-SY-102 when the transfer pump is not operating.	This is a passive safety feature and not prone to failure.	Failure of the ASSD could disable the safety function of this system.	<u>Potential effects of component failure:</u> Uncontrolled transfer of waste from 241-SY-101, which could render the mixer pump inoperable.  <u>Critical functional requirements:</u> Siphon break (air gap) is located a maximum of 193 in. below the bottom of the drop leg shield plug flange.  <u>Component failure detection:</u> Design attributes and short duration of use of this component make failure extremely unlikely.	SC

**Table A-5 Waste Transfer Control**

<p>Flow Totalizer <sup>(a,b)</sup></p> <p>(Valve and Instrumentation Stand)</p> <p>POR32-RW-FQIT-419</p> <p>H-14-103657, Sht 1 H-14-103612, Sht 1 H-14-103641, Sht 2</p>	<p>Measures and stores information on the quantity of dilution water being added to the waste transfer.</p>	<p>1) Gives erroneous reading (high or low) due to internal failure.</p> <p>2) Gives erroneous reading (low) due to disruption in power.</p> <p>3) Fails open (no signal) due to loss of power.</p> <p>4) Failure of piping/hose between flow totalizer and PPP.</p> <p>5) Gives no indication of failure when power lost and restored.</p>	<p>Failure of the flow totalizer could result in inaccurate accounting of waste transferred from SY-101 to SY-102.</p> <p>Note - If failure results in underestimation of dilution water added, transfer will be stopped prematurely, satisfying the Waste Transfer Control safety function.</p>	<p><u>Potential effects of component failure:</u> Loss of mass balance information results in an inaccurate accounting of waste transferred from SY-101 to SY-102, which could render the mixer pump inoperable.</p> <p><u>Critical functional requirements:</u> Indicate the total volume of water added with an accuracy of +/- 5%.</p> <p><u>Component failure detection:</u></p> <p>1) Failure detected by self diagnostic feature or during periodic maintenance/ calibration.</p> <p>2) Failure detected when operator attempts to obtain data - "GROSS" reading different than "NET" reading. Failure results in underestimation of dilution water added. (safety function not compromised).</p> <p>3) Failure detected when operator attempts to obtain data - Display screen is blank. Failure results in underestimation of dilution water added (safety function not compromised).</p> <p>4) Failure detected by operator surveillance of the piping/hose between flow totalizer and PPP.</p> <p>5) Upon loss of power to the dilution flow totalizer, the transfer pump is shut down. When power is restored, the transfer pump will remain off.</p>	<p>SC</p>
<p>Flow Totalizer</p> <p>(SY101-WT-CP-350A)</p> <p>SY101-WT-FQIT-367 SY101-WT-FE-367</p> <p>H-14-103656, Sht 1 H-14-103652, Sht 1 H-14-103641, Sht 3</p>	<p>Measures and stores information on the quantity of waste being transferred.</p>	<p>1) Gives erroneous reading (high or low) due to internal failure.</p> <p>2) Gives erroneous reading (low) due to disruption in power.</p> <p>3) Fails open (no signal) due to loss of power.</p> <p>4) Gives no indication of failure when power lost and restored.</p>	<p>Failure of the flow totalizer could result in inaccurate accounting of waste transferred from SY-101 to SY-102.</p>	<p><u>Potential effects of component failure:</u> Loss of mass balance information results in an inaccurate accounting of waste transferred from SY-101 to SY-102, which could render the mixer pump inoperable.</p> <p><u>Critical functional requirements:</u> Indicate the total volume of waste transferred with an accuracy of +/- 5%.</p> <p><u>Component failure detection:</u></p> <p>1) Failure detected by self diagnostic feature or during periodic maintenance/ calibration.</p> <p>2) Failure detected when operator attempts to obtain data - "GROSS" reading different than "NET" reading. Failure results in underestimation of waste transferred. (safety function not compromised).</p> <p>3) Failure detected when operator attempts to obtain data - Display screen is blank. Failure results in underestimation of dilution water added (safety function not compromised).</p> <p>4) Upon loss of power to the waste flow totalizer, the transfer pump is shut down. When power is restored, the transfer pump will remain off.</p>	<p>SC (SS for BIO 5.3.2.18)</p>

<sup>(a)</sup> The water support skid flow meter is utilized for process information during RAPID operations and is not required to perform a safety function.

<sup>(b)</sup> The instrument supply power and the downstream dilution hose/piping are designated as GS SSCs.

Table A-6 241-SY Ventilation System

Identification	Safety Function(s)	Functional Requirements	System Safety Classification	Safety Classification Justification	
System: Active Ventilation for 241-SY Tank Farm	Provide an elevated release path for ammonia.	The 241-SY Ventilation System shall be OPERABLE per HNF 1999b, LCO 3.2.1.  The 241-SY Ventilation System shall discharge through the exhaust stack.	SS <sup>(a)</sup>	Control Decision Record (Appendix B), "Mixing of Incompatible Material – Toxic Vapor Generation" accident.	
THE ITEMS LISTED BELOW ARE THE UNIQUE COMPONENTS THAT MAKE UP THE SAFETY SSC					
Component Description (Location) EIN Reference Dwg(s)	Component Function	Component Failure Mode	Component Failure Effect on SSC Safety Function	Component Safety Classification Justification	Component Safety Class
Primary Exhauster (includes exhaust stack)  (241-SY)  K1-4-1  H-2-37744, Sht 1, Rev 15 H-14-020131, Sht 1, Rev 1	Provide forced flow of release out the exhaust stack.	Fan or motor failure.  Stack failure.	Possible loss of safety function.	<u>Potential effects of component failure:</u> Failure to dilute ammonia and discharge the release through the ventilation exhaust stack.  <u>Critical functional requirements:</u> Provide flow which will result in a tank vacuum of 0.06 to 1.49 kPa (.25 to 6.0 in wg).  <u>Component failure detection:</u> The ventilation ductwork is a passive system and not prone to failure. The exhauster will be verified to have all applicable preventative maintenance completed prior to waste transfer operations from 241-SY-101 to 241-SY-102.  241-SY-101 is equipped with SC pressure and flow monitoring systems that will alarm if 241-SY ventilation is disrupted.	SS
Electrical Power Supply	Provide power for the exhaust fan operation.	Fails to supply power.	Possible loss of safety.	<u>Potential effects of component failure:</u> Failure to dilute ammonia and discharge the release through the ventilation exhaust stack.  <u>Critical functional requirements:</u> Provide 480 VAC, 3 phase power with sufficient capacity for the associated exhauster motor.  <u>Component failure detection:</u> Loss of power would be indicated by exhauster shutdown.	SS

<sup>(a)</sup> 241-SY Ventilation System also serves a SC function for flammable gas mitigation as defined in HNF-SD-WM-SEL-040, *TWRS Facility Safety Equipment List*.



Table A-7 Ammonia Detection System

Identification	Safety Function(s)	Functional Requirements		System Safety Classification	Safety Classification Justification
System: Ammonia Detection Systems	Detect ammonia levels in the 241-SY ventilation stream and alarm when concentrations exceed 1000 ppm (stack).  Detect ammonia levels in the 241-SY-101 vapor space and alarm at 3000 ppm	The Ammonia Detection Systems shall be capable of sensing ammonia concentrations up to 3000 ppm and must be capable of operation during gas release events. The system shall alarm when setpoint is exceeded.		SS <sup>(4)</sup>	Control Decision Record, "Mixing of Incompatible Material – Toxic Vapor Generation" accident.
THE ITEMS LISTED BELOW ARE THE UNIQUE COMPONENTS THAT MAKE UP THE SAFETY SSC					
Component Description (Location) EIN Reference Dwg(s)	Component Function	Component Failure Mode	Component Failure Effect on SSC Safety Function	Component Safety Classification Justification	Component Safety Class
B&K Ammonia Monitor NE/NT-01.M.SY-29-1  (241-SY)  H-2-815220, Sht 1, Rev 6  H-14-020131, Sht 4, Rev 0	Sense ammonia concentration in the 241-SY ventilation stream. Send signal to alarm module.	Reading too high    Fails to read or reading too low	Spurious alarms.  No effect on the safety function.   Possible undetected loss of safety function.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Sense ammonia concentrations between 10 – 3000 ppm and send a representative signal to the alarm module.  <u>Component failure detection:</u> The ammonia monitor will be calibrated/serviced within 14 days of waste transfer operations from 241-SY-101 to 241-SY-102.  Operating experience indicates that the 241-SY ammonia monitor provides reliable service throughout the calibration cycle (6 months). The most common failure results in an alarm at the DACS system.	SS
B&K Alarm Module YAL-01.M.SY-29-1  (241-SY)  H-2-815220, Sht 1, Rev 6	Actuate alarm when input signal exceeds preset values.	Alarm set too low	Spurious alarms.  No effect on the safety function.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Provide an alarm when a signal, representing an ammonia concentration of 1000 ppm or less, is applied.  <u>Component failure detection:</u> The alarm module will be calibrated within 14 days of waste transfer operations from 241-SY-101 to 241-SY-102.	SS
Sample Line Tubing/Piping  (241-SY)  H-2-815220, Sht 1, Rev 6	Transport gas sample from exhaust duct to ammonia monitor.	Fails by plugging.  Fails by partial or complete leak on vacuum side of suction pump.	Non-representative sample. Possible undetected loss of safety function.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Provide representative sample to the ammonia detector.  <u>Component failure detection:</u> System is equipped with a low flow alarm, which will detect vacuum pump failure or plugged sample line.	SS

**Table A-7 Ammonia Detection System**

FTIR ammonia detector NE-01.M.SY-14-1 241-SY-101 H-2-815220, Sht 1, Rev 6	Sense ammonia concentration in exhaust stream coming out of SY-101.	Reading too high	Spurious alarms.  No effect on the safety function.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Sense ammonia concentrations between 10 – 3000 ppm and send a representative signal to the computer controller.  <u>Component failure detection:</u> The system provides no data Operating experience indicates that the 241-SY-101 ammonia monitor provides reliable service throughout its service life (since 1992).	SS
		Fails to read or reading too low	Possible undetected loss of safety function.		
Infrared Laser Chiller E-01.M.SY-18-1 241-SY-101 H-2-815220, Sht 1, Rev 6	Cools Infrared Spectrometer laser used to measure gases.	Fails to cool the laser.	Loss of infrared source therefore loss of ammonia data.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Sense ammonia concentrations between 10-3000 ppm and send a representative signal to the computer controller.  <u>Component failure detection:</u> The system provides no data.	SS
Vacuum Pump P-01.M.SY-1-1 241-SY-101 H-2-815220, Sht 1, Rev 6	Draws sample gas from ventilation system.	Fails mechanically or due to loss of power.	Loss of sample source therefore loss of ammonia data.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Sense ammonia concentrations between 10-3000 ppm and send a representative signal to the computer controller.  <u>Component failure detection:</u> The system provides no data.	SS
FTIR Ammonia Concentration Transmitter NT-01.M.SY-14-1 241-SY-101 H-2-815220, Sht. 1, Rev 6	Controls FTIR and transmits sample cell information to computer controller.	Optics bench failure	Loss of infrared source therefore loss of ammonia data.	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Sense ammonia concentrations between 10-3000 ppm and send a representative signal to the computer controller.  <u>Component failure detection:</u> The system provides no data.	SS
		Michelson Interferometer failure			
		Circuit board failure			
FTIR Ammonia Concentration Computer Controller PC-01.M.SY-14-1 241-SY-101 H-2-815220, Sht 1, Rev 6	Ammonia concentration display analyzer and electronic information relay to multiplexer.	Power failure	Loss of data (no readout)	<u>Potential effects of component failure:</u> Failure of system to alarm when ammonia concentrations exceed limits.  <u>Critical functional requirements:</u> Sense ammonia concentrations between 10-3000 ppm and send a representative signal to the computer controller.  <u>Component failure detection:</u> The system provides no data.	SS
		Software lockup			

<sup>(a)</sup> 241-SY Ammonia Detection System also serves a SC function for flammable gas mitigation as defined in HNF-SD-WM-SEL-040, *TWRS Facility Safety Equipment List*.

## **Appendix B**

### **Draft Control Decision Record Tank 241-SY-101 Waste Transfer**

#### **PREFACE**

Appendix B contains the draft Control Decision Record that was used during the preparation of this SEL. It is included here only as a reference and is not intended to be part of the review and approval process for this SEL. Page numbering in this appendix follows that of the draft as Appendix F to an unreleased document (i.e., pages are numbered as App F-1, App F-2, App F-3, App F-4, etc.).

**APPENDIX F**  
**CONTROL DECISION RECORD**  
**TANK 241-SY-101 WASTE TRANSFER**

L. J. Kripps

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## CONTROL DECISION RECORD TANK 241-SY-101 WASTE TRANSFER

### F1.0 INTRODUCTION

Control decision meetings for the transfer of waste from Tank 241-SY-101 to Tank 241-SY-102 were held on March 15 and 16, 1999. The agenda for the control decision meetings is included in Enclosure 1, and a list of meeting attendees is included in Enclosure 2.

The purpose of the control decision meetings was to identify existing controls and/or select new controls to protect the public, onsite workers, facility workers, and the environment from potential hazardous conditions and postulated accidents for a Tank 241-SY-101 waste transfer. Controls include Safety-Class and Safety-Significant structures, systems, and components (SSCs); technical safety requirements (TSRs)<sup>a</sup>; and other controls that provide defense-in-depth or environmental protection.

The scope of the control decision meetings covered waste transfers from Tank 241-SY-101 to Tank 241-SY-102 that are planned to remediate the Tank 241-SY-101 surface-level-rise condition (see HNF-3824, *Tank 241-SY-101 Surface-Level-Rise Remediation Project Plan*). The first waste transfer will move approximately 380,000 to 570,000 liters (100,000 to 150,000 gal) of waste and is scheduled for September 1999. The possible back dilution of Tank 241-SY-101 waste with water following the waste transfer was not within the scope of the control decision meetings.

The control decision meetings were conducted in accordance with the established and approved process and criteria described in the Tank Waste Remediation System (TWRS) Basis for Interim Operation (HNF-SD-WM-BIO-001). A summary of the control decision process and criteria was presented at the start of the control decision meetings and is included in Enclosure 3. Control decisions were based on the best available information from the waste transfer hazard and accident analyses and on the technical expertise and experience of the meeting participants. Decisions were made by consensus.

Subsequent to the March 15 and 16, 1999 control decision meetings, several revisions to controls occurred. Control revisions were based on the results of actions assigned at the meetings (i.e., a subsequent design decision to provide a passive siphon break and a subsequent decision on the specific instrument systems that will be used to measure the quantity of waste transferred from Tank 241-SY-101). A revision also resulted from the resolution of a subsequent SSC classification issue raised by the TWRS Design Authority (i.e., Safety-Class versus Safety-Significant SSC instrument systems to measure the quantity of waste transferred from

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<sup>a</sup> As a result of direction received from the U.S. Department of Energy, Office of River Protection (French 1999), new TSR-level controls for Tank 241-SY-101 remediation activities, including waste transfers, will be imposed as prudent contractor controls necessary for safe operation.



Tank 241-SY-101). These control revisions and their bases are specifically identified in the summary of the control decision discussions in Section 3.

In addition, control decisions were reviewed against the final waste transfer design and the final documented hazard and accident analyses since these were not completed until after the March 15 and 16, 1999 meetings. This review identified that the final analysis of ammonia releases during Tank 241-SY-101 waste transfers without controls could result in exposures to onsite workers above risk evaluation guidelines. To select controls for the protection of onsite workers from postulated ammonia releases, another control decision meeting was held on May 18, 1999. A control revision because of a new ethylene propylene diene monomer (EPDM) hose-in-hose design for the overground transfer line and a control revision based on the completed riser 241-SY-102 drop leg enclosure leak detection system design were also considered at the May 18, 1999 meeting. The agenda and list of attendees for the May 18, 1999 control decision meeting are included in Enclosure 14. The control decisions and control revisions and their bases from the May 18, 1999 meeting are included in the Section 3 summary of control decision discussions.

Section 2 is an overview of the control decision meeting presentations on March 15 and 16, 1999 and on May 18, 1999. The presentations described the Tank 241-SY-101 waste transfer system design and operation and the results of the waste transfer hazard and accident analyses. The presentations provided the background and the basis for the subsequent control decision discussions. Copies of the presentations are included in the enclosures to this Control Decision Record.

Section 3 is a summary of the control decision discussions on the representative accidents and the associated represented hazardous conditions that were considered at the March 15 and 16, 1999 meetings and at the subsequent May 18, 1999 meeting. The discussion summary identifies the controls that were considered, and the reasons why specific controls were selected or not selected.

Attachment 1 is a summary of new controls for the Tank 241-SY-101 waste transfer. Attachments 2 through 8 contain the individual control decision records of the selected safety SSCs, TSRs (or prudent contractor controls necessary for safe operation), and defense-in-depth controls for each representative accident, and the associated represented hazardous conditions, considered at the control decision meetings.

## **F2.0 OVERVIEW OF PRESENTATIONS ON THE WASTE TRANSFER SYSTEM DESIGN AND OPERATION AND THE HAZARD AND ACCIDENT ANALYSES**

### **F2.1 PRESENTATIONS AT THE MARCH 15 AND 16, 1999 CONTROL DECISION MEETINGS**

The first technical presentation described the current design and planned operation of the Tank 241-SY-101 waste transfer system (see Enclosure 4). This design and operation information was used as the basis for the control decisions at the March 15 and 16, 1999 meetings. Subsequent to the control decision meetings, the waste transfer system design was finalized (i.e., the waste transfer system final design review was held on April 29 and 30, 1999). The final design of the waste transfer system was reviewed to determine whether any design revisions occurred subsequent to March 15 and 16, 1999 that could affect the control decisions. The results of this review are included in the Section 3.0 control decision discussion summary (see also Section F2.2).

The next presentations provided an overview (Enclosure 5) and the results (Enclosure 6) of the hazard analysis performed on the Tank 241-SY-101 waste transfer. The hazardous conditions resulting from the hazard analysis included the following.

1. Hazardous conditions having potential onsite or offsite consequences addressed by the Authorization Basis, but presenting control allocation concerns (i.e., hazardous conditions that after the allocation of existing controls were either a) judged to potentially require additional controls or b) determined to pose issues with respect to the application of existing controls). (See Enclosure 6, Part 1)
2. Hazardous conditions having potential onsite or offsite consequences addressed by the Authorization Basis (i.e., hazardous conditions that, after the allocation of existing controls, were judged to be acceptably prevented or mitigated). (See Enclosure 6, Part 2)
3. Hazardous conditions having no consequences, or consequences impacting only the facility worker. (See Enclosure 6, Part 3)

Analyses demonstrating that existing controls acceptably prevent or mitigate hazardous conditions for the Tank 241-SY-101 waste transfer (i.e., hazardous conditions in the second group above) were presented (see Enclosures 7 and 8). These analyses were finalized subsequent to the control decision meeting and are documented in Appendixes B and E. The final analyses in Appendixes B and E were reviewed to determine whether any revisions occurred subsequent to the control decision meetings that could affect the control decisions. The results of this review are included in the Section 3.0 control decision discussion summary. (See also Section F2.2).

Note: Prior to the March 15 and 16, 1999 control decision meetings, a group of individuals with knowledge of the existing TWRS Authorization Basis and the Tank 241-SY-101 waste transfer hazard analysis met to review all of the hazardous

conditions with potential onsite or offsite consequences (S2 and S3, respectively). At this meeting, existing controls were allocated to these hazardous conditions and the hazardous conditions were placed in either the first or second group above. This enabled the control decision meetings to focus on hazardous conditions that required control determinations. Subsequent to the control decision meetings, another group of knowledgeable individuals reviewed all of the hazardous conditions with facility worker consequences that are anticipated (S1, F3), and all of the hazardous conditions with potentially significant environmental consequences (E2 and E3). The purpose of this review was to identify the need for additional controls to protect facility workers or the environment for the Tank 241-SY-101 waste transfer. No new facility worker or environmental controls were identified from this review (i.e., existing controls in the TWRs Authorization Basis and new Tank 241-SY-101 controls acceptably provide for protection of facility workers and environment).

Presentations were then made providing the results of accident analyses of representative flammable gas accidents for the Tank 241-SY-101 waste transfer. These included presentations on the following.

- The estimated risk (i.e., frequency and consequences) of representative flammable gas accidents from the existing TWRs Authorization Basis (Enclosure 9)
- Postulated gas release mechanisms from the Tank 241-SY-101 crust, and gas release models developed for estimating potential crust gas releases from waste transfer operations and activities (Enclosure 10)
- Tank 241-SY-101 waste transfer flammable gas accident results from the Refined Safety Analysis Tool (Enclosure 11)

The above accident analyses were finalized subsequent to the control decision meetings and are documented in Appendix C. The final analyses in Appendix C were reviewed to determine whether any revisions occurred subsequent to the control decision meetings that could affect the control decisions. No control revisions resulted from this review.

## **F2.2 PRESENTATIONS AT THE MAY 18, 1999 CONTROL DECISION MEETING**

The first presentation at the May 18, 1999 meeting was a review of the control decision process and criteria. This review used the Enclosure 3 presentation from the March 15 and 16, 1999 meetings.

Technical presentations were then provided on potential ammonia release mechanisms, the methods used to calculate ammonia exposures, and the results of possible ammonia exposures to onsite and facility workers from Tank 241-SY-101 crust disturbing activities and from Tank 241-SY-101 waste transfers (Enclosure 14, Parts 3 and 4). The analyses presented on ammonia releases and exposures were all new since the March 15 and 16, 1999 control decision meetings. Based on the information presented, controls were selected to protect onsite and facility workers from postulated ammonia releases (see Section F3.7).

Information was also presented to support the re-consideration of control decisions on:

1. The SSC classification of the leak detection system in the riser 241-SY-102-007 drop leg enclosure (Enclosure 14, Part 5), and
2. The requirement that the safety function of the overground transfer encasement and connections be maintained following the impact of missiles generated by high wind (Enclosure 14, Part 6).

Control revisions resulting from the May 18, 1999 control decision discussions are included in Section 3.

### F3.0 CONTROL DECISION DISCUSSION SUMMARY

Based on the Tank 241-SY-101 waste transfer hazard and accident analyses, control decisions were required for the following three new representative flammable gas accident scenarios, and the potential hazardous conditions that these accident scenarios represented.

- Flammable gas deflagration - induced gas release from crust disturbance
- Flammable gas deflagration - induced gas release from crust dissolution
- Flammable gas deflagration - buoyant displacement gas release event plus additional gas release from the crust

In addition, control decisions were required for potential hazardous conditions that were represented by the following existing representative accidents, but where issues were identified concerning whether existing controls acceptably prevented and/or mitigated the hazardous conditions.

- Flammable gas deflagration – general
- Spray leak in structure or from overground transfer line
- Surface leak resulting in pool
- Mixing of incompatible material - toxic vapor generation

A summary of the March 15 and 16, 1999 and the May 18, 1999 control decision meeting discussions (and subsequent reviews and revisions, as appropriate) for these representative accidents, and the potential hazardous conditions that they represented, is presented in this section.

#### F3.1 FLAMMABLE GAS DEFLAGRATION – INDUCED GAS RELEASE FROM CRUST DISTURBANCE

The representative accident is a flammable gas deflagration due to an induced gas release caused by operations and activities that disturb the Tank 241-SY-101 crust (e.g., waste transfer pump installation, crust disturbance as the waste level falls during the transfer) with subsequent ignition. A list of existing controls that may prevent or mitigate this representative accident was made, and then possible new controls were identified and evaluated. Following the selection of controls for the representative accident, the potential hazardous conditions represented by this accident (see Enclosure 6, Part 1) were reviewed and additional controls were selected, if necessary. The control decision discussions are summarized below, and the selected controls are presented in Attachment 2.

## Existing Controls

Safety SSCs - Safety-Class (SC): DST/AWF Ventilation

SC: Tank 241-SY-101 Hydrogen Monitor (7500 ppm\*)

SC: Tank 241-SY-101 Ammonia Monitor (3000 ppm\*)

\* Maximum gas concentrations in the LA-UR-92-3196 Level I controls for mixer pump operation

TSRs - Limiting Condition for Operation (LCO) 3.2.1: DST and AWF Ventilation System  
Administrative Control (AC) 5.9: Flammability Controls (LA-UR-92-3196 Level I mixer pump controls)  
Supplemental Controls (Wagoner 1998)

Note: For this representative accident, the mixer pump controls were assumed to effectively control gas retention at depth and, therefore, the only postulated gas releases are from the crust.

## Possible New Controls

Waste level – This control was proposed to protect accident analysis assumptions. This control was not selected based on a consensus that the accident analysis should include sensitively studies for expected waste levels, and if the waste levels assumed in the accident analysis were exceeded, an Unreviewed Safety Question (USQ) evaluation would be triggered.

Minimum Ventilation System Flowrate (400 cfm or higher) – The LA-UR-92-3196 Level II controls include a 400 cfm minimum ventilation system flowrate requirement. The Refined Safety Analysis Tool analysis showed that the risk from a flammable gas deflagration was not very sensitive to ventilation flowrate (analyses performed for 400 and 600 cfm – see Enclosure 11 and Appendix C). The consensus was that this control should remain as a Level II control.

Flammable gas monitoring (during tank operations and activities that could disturb the crust) – The existing TSR AC 5.11 flammable gas monitoring controls are not applicable to Tank 241-SY-101, and the LA-UR-92-3196 Level I controls on hydrogen and ammonia monitoring are associated with mixer pump operation. The consensus was that flammable gas monitoring be selected as a TSR-level control (i.e., to expand the applicability of AC 5.11 to include Tank 241-SY-101 and/or elevate and augment the LA-UR-92-3196 Level II flammable gas monitoring controls). There was some discussion on whether there should be an LCO on the hydrogen and ammonia monitoring systems, but the consensus was for a flammable gas monitoring program (i.e., an AC) consistent with other TWRS facilities.

Ignition Controls – The existing TSR AC 5.10 ignition controls are not applicable to Tank 241-SY-101. Ignition controls were selected by consensus as a TSR-level control (i.e., to expand the applicability of AC 5.10 to include Tank 241-SY-101 and/or elevate and augment the LA-UR-92-3196 Level II ignition controls).

Water Addition Controls (location, rate, volume, temperature) – The consensus was that water addition controls should remain as LA-UR-92-3196 Level II controls. Flammable gas monitoring was the preferred control because it provides a direct measure of the gas release hazard and addresses all gas release mechanisms from the crust. There was some discussion of an interlock to automatically stop water addition on high hydrogen concentration, but the discussion was deferred to the representative flammable gas deflagration crust dissolution accident (see Section 3.2).

Mixer Pump Not Operating (during operations and activities that could disturb the crust) - This control was proposed to protect accident analysis assumptions. This is a LA-UR-92-3196 Level II control, and the consensus was that it should remain as a Level II control because flammable gas monitoring, which was selected as a control, addresses cumulative gas release mechanisms.

Waste Disturbance Size Limits – The difficulty in limiting the size of a waste disturbance, and the impracticality of monitoring for compliance, led to a consensus not to select this control.

Inerting – Although the information on the feasibility of inerting Tank 241-SY-101 included in Enclosure 12 was not formally presented at the meeting, the cost and time to implement an inerting system for Tank 241-SY-101 were recognized as significant factors to consider with respect to this possible control. The cost estimate for an inerting system is close to \$2 million dollars, and implementation of an inerting system would add significant complexity and risk to the efforts to remediate the Tank 241-SY-101 surface-level-rise condition. In addition, the Refined Safety Analysis Tool analysis showed that an inerted tank does not significantly reduce the risk of a flammable gas deflagration (see Enclosure 11 and the Appendix C). Based on these considerations, the consensus was that inerting Tank 241-SY-101 not be selected as a control.

Video Camera Monitoring – The consensus was that video camera monitoring should be implemented as a defense-in-depth control recognizing the value of observing crust behavior, but the difficulty of defining criteria that would prompt ceasing operations and activities.

Time Delay from Mixer Pump Operation - The LA-UR-92-3196 Level II controls include an intrusive control that requires that there be at least a 4 hour waiting period following the last activity that can induce a gas release. The consensus was that this control should remain as a Level II control, because flammable gas monitoring, which was selected as a control, addresses the potential for overlapping gas release events.

Dome Pressure Monitoring – This is a LA-UR-92-3196 Level II control to detect large, rapid gas release events [i.e., a buoyant displacement gas release event (BD GRE)]. While dome pressure monitoring provides a faster indication of a BD GRE than flammable gas monitoring, the consensus was that it would likely not detect gas releases due to crust disturbances since these would not be expected to significantly increase the tank dome pressure.

Attachment 2 is the control decision record of the safety SSCs, TSRs (or prudent contractor controls necessary for safe operation), and defense-in-depth controls selected to prevent potential flammable gas deflagration hazardous conditions and postulated accidents caused by induced gas releases from crust disturbance.

### **F3.2 FLAMMABLE GAS DEFLAGRATION – INDUCED GAS RELEASE FROM CRUST DISSOLUTION**

The representative accident is a flammable gas deflagration due to an induced gas release caused by dissolution of the Tank 241-SY-101 crust from planned or inadvertent water addition with subsequent ignition. A list of existing controls that may prevent or mitigate this representative accident was made (including the controls selected above for the flammable gas deflagration crust disturbance accident), and then possible new controls were identified and evaluated. Following the selection of controls for the representative accident, the potential hazardous conditions represented by this accident (see Enclosure 6, Part 1) were reviewed and additional controls were selected, if necessary. The control decision discussions are summarized below, and the selected controls are presented in Attachment 3.

#### **Existing Controls**

Safety SSCs - SC: DST/AWF Ventilation

SC: Tank 241-SY-101 Hydrogen Monitor (7500 ppm\*)

SC: Tank 241-SY-101 Ammonia Monitor (3000 ppm\*)

\*Maximum gas concentrations in the LA-UR-92-3196 Level I controls for mixer pump operation

TSRs - LCO 3.2.1: DST and AWF Ventilation System

AC 5.9: Flammability Controls (LA-UR-92-3196 Level I mixer pump controls)

Supplemental Controls (Wagoner 1998)

Tank 241-SY-101 Ignition Controls

Tank 241-SY-101 Flammable Gas Monitoring Controls

Note: For this representative accident, the mixer pump controls were assumed to effectively control gas retention at depth and, therefore, the only postulated gas releases are from the crust.

#### **Possible New Controls**

Maximum Dilution Flow Rate – Based on the developed gas release model, the maximum water addition flow rate would have to be limited to less than around 30 gpm to ensure that the Lower Flammability Limit (LFL) would not be exceeded. (The actual flow rate is dependent on several factors including crust bubble slurry void fraction – see Appendix C.) This low dilution water flow rate would place a significant constraint on the Tank 241-SY-101 waste transfer. The consensus was that flammable gas monitoring was the preferred control because it provides a direct measure of the gas release hazard and addresses all gas release mechanisms from the crust.



**Maximum Dilution Quantity without Waste Flow** – This control was to limit the total quantity of dilution water that could inadvertently be added to Tank 241-SY-101. The control was based on the developed gas release model that showed it takes at least around 1500 gallons of water added under the crust to reach the LFL. (The actual quantity of water is dependent on several factors including the water flow rate and the crust bubble slurry void fraction – see Appendix C.) The concept for this control was to make the capacity of the water reservoir on the waste transfer dilution water skid the same as the maximum quantity of dilution water that could be added without waste transfer flow, and to provide an automatic interlock that shut off the service water supply to the dilution water skid on detecting loss of waste transfer flow. The design for this control would have been complex to address all of the postulated inadvertent water addition scenarios. It would also have required bypass of the interlock to refill the dilution skid water reservoir prior to each waste transfer pump startup. This would have introduced the opportunity for human errors. The consensus was that flammable gas monitoring with operator action to isolate water sources to Tank 241-SY-101 on high flammable gas concentration was the preferred control (see below).

**Flammable Gas Monitoring** – This selected control requires flammable gas monitoring whenever there is a planned water addition or whenever there is a potential for an inadvertent water addition to Tank 241-SY-101. If high flammable gas concentrations are detected (i.e., > 25% of the LFL), water sources that are or could be adding water to Tank 241-SY-101 would be isolated (i.e., valves closed and/or lines disconnected). There was considerable discussion on whether isolation of the waste transfer dilution water line should be automatic or could be done by operator action. The gas release model showed that there should be around 30 minutes between when 25% of the LFL is reached and when 100% of the LFL is reached. (The actual time is dependent on several factors including the water flow rate and the crust bubble slurry void fraction – see Appendix C.) Based on these conservative gas release model results, the consensus was that operator action to isolate the dilution water line was acceptable. Operator action also allowed the ability to backflush the waste transfer line into Tank 241-SY-102 while still isolating the dilution water line to Tank 241-SY-101. The Tank 241-SY-101 Surface-Level-Rise Remediation Project, however, assigned an action to develop a parallel path for the possible incorporation of an automatic dilution water line isolation interlock. Work on an automatic dilution water isolation interlock was subsequently terminated following receipt of French 1999 and TWRS Plant Review Committee (PRC) approval of the flammable gas monitoring control with operator action to isolated connected water sources.

**Minimum Ventilation System Flowrate (400 cfm or higher)** – See the discussion for the flammable gas deflagration crust disturbance accident.

Attachment 3 is the control decision record of the safety SSCs, TSRs (or prudent contractor controls necessary for safe operation), and defense-in-depth controls selected to prevent potential flammable gas deflagration hazardous conditions and postulated accidents caused by induced gas releases from crust dissolution.

### **F3.3 FLAMMABLE GAS DEFLAGRATION – BUOYANT DISPLACEMENT GAS RELEASE EVENT PLUS ADDITIONAL GAS RELEASE FROM THE CRUST**

The representative accident is a flammable gas deflagration due to an operation or activity that causes the mixer pump to become inoperable (e.g., waste transfer lowers waste below mixer pump suction) with a resulting subsequent BD GRE and ignition. A list of existing controls that may prevent or mitigate this representative accident was made (including controls selected above for the flammable gas deflagration crust disturbance and dissolution accidents), and then possible new controls were identified and evaluated. Following the selection of controls for the representative accident, the potential hazardous conditions represented by this accident (see Enclosure 6, Part 1) were reviewed and additional controls were selected, if necessary. The control decision discussions are summarized below, and the selected controls are presented in Attachment 4.

#### **Existing Controls**

Safety SSCs - SC: DST/AWF Ventilation

SC: Tank 241-SY-101 Hydrogen Monitor

SC: Tank 241-SY-101 Ammonia Monitor

TSRs - Tank 241-SY-101 Ignition Controls

Tank 241-SY-101 Flammable Gas Monitoring Controls

#### **Possible New Controls**

**Waste Volume Transfer** – This control was selected by consensus. The control requires the calculation of the quantity of waste that can be transferred and maintain mixer pump operability (i.e., maintain a sufficient distance between the bottom of the crust and the mixer pump suction to ensure that the mixer pump continues to perform its safety function of controlling gas retention at depth and preventing BD GREs). Based on analysis presented at the control decision meeting (Enclosure 13 – see also Appendix D), mixer pump operability should not be affected as long as the bottom of the crust is at least one (1) foot above the mixer pump suction. However, there are uncertainties in measuring the bottom of the crust, including level monitoring system accuracy, and downward growth of the crust subsequent to the waste transfer that must be considered in calculating the maximum permissible waste transfer. The Tank 241-SY-101 waste transfer must then be monitored, and the transfer of waste limited to the maximum calculated quantity.

**Tank 241-SY-101 Waste Level** – This control has the same objective as the selected control on calculating, monitoring, and limiting waste transfer volume. However, the consensus was that the selected control was preferred versus simply establishing a lower limit on the level of the crust bottom.

**Mixer Pump Performance** – Since it was judged as providing significant defense-in-depth with respect to ensuring mixer pump operability, the consensus was to elevate the monitoring of mixer performance to a TSR-level control. The control requires monitoring of mixer pump performance, including monitoring parameters such as pump motor current, pump

discharge pressure, and the response of waste thermocouples to mixer pump operation. The monitoring results are to be reviewed periodically (at least quarterly) by the Test Review Group (TRG) for signs of mixer pump performance degradation (i.e., loss of mixer pump capability to control gas retention at depth and the prevent BD GREs). If signs of degraded mixer pump performance are detected, the TRG would direct corrective action to restore mixer pump performance, such as the addition of water to Tank 241-SY-101.

**Instrument Systems** – At the March 15 and 16, 1999 control decision meetings, instrument systems required to implement the selected TSR-level control on calculating, monitoring, and limiting waste transfers from Tank 241-SY-101 to Tank 241-SY-102 (see above) were identified as Safety-Significant SSCs. Subsequent to the control decision meetings, the Safety-Significant classification was questioned by the TWRS Design Authority. On the basis that these instrument systems are essential to implement a control that protects against an accident with consequences that could exceed offsite risk evaluation guidelines, the instrument system classification was revised to Safety-Class. Also, the selection of the specific instrument systems to implement the control was made by cognizant design and operations personnel subsequent to the meeting (i.e., the Tank 241-SY-101 waste transfer flow totalizer<sup>b</sup> and the dilution water flow totalizer). Because there is no installed system that can directly measure the bottom of the crust, no specific instrument system was identified as Safety-Class for this measurement. However, existing TSR AC 5.19 on process instrumentation and measuring and test equipment will ensure the performance of whatever instrument system(s) is (are) used to measure the level of the bottom of the crust.

**Siphon Break** – Siphoning of waste from Tank 241-SY-101 to Tank 241-SY-102 is a concern since it could lead to the inadvertent transfer of waste and mixer pump inoperability. At the time of the control decision meetings, the waste transfer system design required operator action to initiate a siphon break following shutdown of the waste transfer pump. With this design, the time to initiate the siphon break (30 minutes) was required to be accounted for in the implementation of the selected waste volume transfer control (see above). The Tank 241-SY-101 Surface-Level-Rise Remediation Project was assigned an action to assess the possibility of including a passive siphon break in the waste transfer system design. Based on the Project assessment, the waste transfer system design was revised to incorporate a passive siphon break in the Tank 241-SY-102 drop leg. The passive siphon break was designated Safety-Class since its failure could lead to inoperability of the mixer pump which could cause the representative accident whose consequences could exceed offsite risk evaluation guidelines.

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<sup>b</sup> Originally the Tank 241-SY-102 tank level detection system and the dilution water flow totalizer were selected as the instrument systems to implement the Tank 241-SY-101 waste transfer controls. However, when the Tank 241-SY-101 waste transfer flow totalizer was later selected to implement the TSR AC 5.12 Transfer Control material balanced requirements (see Section F3.6), the decision was made to use it also for implementing the waste transfer controls instead of the Tank 241-SY-102 tank level detection system.

Attachment 4 is the control decision record of the safety SSCs, TSRs (or prudent contractor controls necessary for safe operation), and defense-in-depth controls selected for this representative accident and the potential hazardous conditions represented by this accident.

### **F3.4 FLAMMABLE GAS DEFLAGRATION – GENERAL**

The Tank 241-SY-101 waste transfer hazard analysis resulted in a hazardous condition that was represented by the existing representative flammable gas deflagration accident for double-shelled tanks (DSTs) (see Enclosure 6, Part 1). However, because the existing TSR AC 5.10 ignition controls and AC 5.11 flammable gas monitoring controls do not apply to Tank 241-SY-101, this hazardous condition was identified for consideration at the control decision meetings. With the existing flammability controls and the new Tank 241-SY-101 TSR-level ignition and flammable gas monitoring controls selected above for other Tank 241-SY-101 flammable gas deflagration accident scenarios, the control decision meeting consensus was that these controls (see Attachment 5) were sufficient to control this potential hazardous condition.

### **F3.5 SPRAY LEAK IN STRUCTURE OR FROM OVERGROUND TRANSFER LINE**

The Tank 241-SY-101 waste transfer hazard analysis resulted in a number of hazardous conditions that were represented by the existing representative spray leak accident, but where issues were identified concerning whether existing controls acceptably prevented and/or mitigated these hazardous conditions (see Enclosure 6, Part 1). The concerns generally resulted because the Tank 241-SY 101 waste transfer design included an above ground Prefabricated Pump Pit (P3) and a special Tank 241-SY-102-007 riser drop leg enclosure design where the overground transfer line entered Tank 241-SY-102. Attachment 6 presents the consensus on controls that are unique to the Tank 241-SY-101 waste transfer. The safety-functions for the P3 and the riser 241-SY-102-007 drop leg enclosure included safety functions from the TWRS Final Safety Analysis Report (FSAR) for the above ground portion of waste transfer associated structures (e.g., pits).

There was discussion on whether the P3, overground transfer encasement and connections, and riser 241-SY-102-007 drop leg enclosure were required to maintain their safety function for design basis high wind and seismic events. The structures were already being designed to meet design basis high wind (and associated missiles) criteria and, therefore, this requirement was initially imposed on all three structures. Subsequent to the March 15 and 16, 1999 control decision meetings, the design of the overground transfer line change from a hose-in-pipe design to a hose-in-hose design. At the May 18, 1999 control decision meeting the requirement that the overground transfer encasement and connections (now an EPDM hose) be designed to maintain its safety function following the impact of design basis high wind missile was re-examined and deleted. The basis for this control decision was (1) the unlikely occurrence of this event, (2) the time and cost to demonstrate either by analysis or testing that the EPDM hose meets the design basis high wind missile criteria, and (3) the unanimous belief that a design basis high wind missile would not cause a spray or pool leak. The later qualitative judgement considered the general toughness of the hose and that it would be covered by insulation and lead shield blankets.

The consensus on the P3, overground transfer encasement and connections, and riser 241-SY-102-007 drop leg enclosure maintaining their safety function for a design basis seismic

event was that these structures need not be seismically qualified to Performance Category (PC)-3 criteria, and that the only control required for a design basis seismic event is the existing TSR AC 5.14 emergency preparedness control to mitigate the potential consequences. This was justified for several reasons. First, there is a low likelihood of a design basis seismic event during a Tank 241-SY-101 waste transfer. Second, designing the P3 and the riser 241-SY-102-007 drop leg enclosure to meet seismic PC-3 criteria would have had significant cost and schedule impacts.

Leak detection in the riser 241-SY-102-007 drop leg enclosure was also discussed for mitigating the consequences of spray and surface pool leaks. The consensus at the March 15 and 16, 1999 control decision meetings was that leak detection was not required for safety. This decision was based on the large drain area to Tank 241-SY-102, and the potential difficulty in designing a leak detector for the riser drop leg enclosure. A requirement was imposed, however, that the riser drop leg enclosure and the overground transfer encasement and connections be designed to withstand the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the overground transfer encasement to the P3.

At the May 18, 1999 control decision meeting, the safety classification of the riser drop leg enclosure leak detection system was re-examined. A leak detection system was included in the final design of the riser drop leg enclosure to meet environmental requirements, and it meets the safety-class requirements of existing TWRS leak detection systems. Based on this, there was a consensus that the riser drop leg enclosure leak detection system should be designated as a safety-class SSC for the Surface Leak Resulting in Pool accident and should be subject to TSR LCO 3.1.3. (Note: The leak detection system in both the P3 and in the riser drop leg enclosure are not considered as new controls, but as existing controls applied to the Tank 241-SY-101 waste transfer system design, and are, therefore, not listed in Attachments 6 and 7).

### **F3.6 SURFACE LEAK RESULTING IN POOL**

See the control decision meeting discussion of the spray leak accident in Section 3.5 and Attachment 7 for the resulting safety SSCs, TSRs (or prudent contractor controls necessary for safe operation), and defense-in-depth controls that are unique to the Tank 241-SY-101 waste transfer for the Surface Leak Resulting in Pool accident. Attachment 7 also includes the control decision subsequent to the March 15 and 16, 1999 meetings that the Tank 241-SY-101 waste transfer flow totalizer be designated as a safety-significant SSC to implement the material balance requirements of TSR AC 5.12. The basis for this control decision is that Tank 241-SY-101 waste level change may not be an easily measured or reliable input for the material balance.

### **F3.7 MIXING OF INCOMPATIBLE MATERIAL – TOXIC VAPOR GENERATION**

The potential for ammonia releases was identified in the hazard analysis of Tank 241-SY-101 waste transfers. At the time of the March 15 and 16, 1999 control decision meetings, potential hazardous conditions and postulated accidents involving ammonia releases were not considered because the hazard and accident analyses of ammonia release consequences showed that exposures were below risk evaluation guidelines. Subsequent analysis of the consequences of ammonia releases for Tank 241-SY-101 waste transfers showed that without controls onsite

worker risk evaluation guidelines could be exceeded. This resulted in another control decision meeting on May 18, 1999 to select controls to prevent or mitigate postulated ammonia releases for Tank 241-SY-101 waste transfers.

Hazardous conditions involving ammonia releases are represented by the Mixing of Incompatible Material – Toxic Vapor Generation accident (see BIO Section 5.3.2.11). The representative accident is a rapid, uncontrolled addition of caustic (sodium hydroxide) to liquid waste of low pH that causes the release of ammonia as the waste becomes more basic. The analysis of this representative accident showed that onsite and offsite ammonia concentrations were below risk evaluation guidelines, and no controls were identified other than the Industrial Hygiene Program as a defense-in-depth control. Because the representative accident does not bound the potential consequences of potential hazardous conditions and postulated accidents for Tank 241-SY-101 waste transfers, the analysis of postulated ammonia releases contained in Appendix E provided the basis for the controls decisions.

Following presentations on the calculated ammonia concentrations during Tank 241-SY-101 remediation activities and operations (see Enclosure 14, Parts 3 and 4), possible controls were identified and evaluated. The control decision discussions are summarized below, and the selected controls are presented in Attachment 8.

#### **Possible Controls**

Elevated (stack) release (SSC) – There was consensus that the 241-SY Tank Farm primary tank ventilation system should be designated as a safety-significant SSC with its safety function being to ensure an elevated release of ammonia (that is, prevent a ground level release). An elevated or stack release versus a ground level release reduces the ammonia concentration at 100 meters (onsite worker) and also for facility workers.

Taller stack – Increasing the stack height would provide further mitigation of ammonia releases (i.e., decrease the ammonia concentration at 100 meters). Other controls were selected in preference to this control because of the time and cost to design and construct a taller stack and an estimated reduction of ammonia concentration by only a factor of 2 for a doubling of the stack height.

Ammonia monitoring – At the May 18, 1999 control decision meeting, ammonia monitoring was selected by consensus as a TSR-level control since it provided significant defense-in-depth to the controls of an elevated (stack) release and the Tank 241-SY-102 drop leg. With the subsequent decision not to designate the drop leg as a safety SSC (see below), ammonia monitoring together with an elevated release became the selected controls. The ammonia concentrations for initiating operator actions (3000 ppm for the Tank 241-SY-101 ammonia monitoring system and 1000 ppm for the 241-SY Tank Farm primary tank ventilation exhaust ammonia monitoring system) were conservatively selected to be consistent with the existing LA-UR-92-3196 Level I mixer pump operation ammonia monitoring control. At the May 18, 1999 meeting, it was decided that the existing ammonia monitoring systems not be designated as safety-significant SSCs. Instead, to provide operational flexibility, it was determined that the instrument systems used to monitor ammonia need only meet the

requirements of TSR AC 5.19. This decision was subsequently questioned by the TWRS Design Authority and revised. Because of the special monitoring system requirements needed to ensure accurate measurement of ammonia concentrations, the Tank 241-SY-101 and the 241-SY Tank Farm primary tank ventilation exhaust ammonia monitoring systems were designated as a safety-significant SSC.

**Flammable Gas Monitoring** – This control was simply to take credit for flammable gas monitoring controls (see TSR AC 5.11 and Section 3.1). This control was not selected because the correlation of flammable gas and ammonia releases from remediation activities and operations that disturb the waste in Tank 241-SY-101 is not well defined, and ammonia releases in Tank 241-SY-102 during a waste transfer from Tank 241-SY-101 are not associated with flammable gas releases.

**Exclusion zone for onsite personnel** – This control would mitigate potential ammonia releases by restricting personnel access within a specified distance of the 241-SY Tank Farm during Tank 241-SY-101 waste transfers (e.g., 200 meters, 300 meters). The consensus was that this control would be difficult to implement as a TSR-level control and could adversely impact other 200-West area operations. The reduction in ammonia concentration by increasing the 100 meter distance for the onsite worker is also small. (Note: Limiting and/or controlling personnel access in the vicinity of the 241-SY-Tank Farm is being considered for purposes of facility worker protection by the Industrial Hygiene Program.)

**Ammonia monitoring/emergency evacuation** – This control differs from the selected ammonia monitoring control in that if the ammonia concentration in Tank 241-SY-101 or in the 241-SY Tank Farm primary tank ventilation exhaust exceeded a specific limit, evacuation of workers would be required. The consensus was that the selected ammonia monitoring control was sufficient.

**Tank 241-SY-102 drop leg (SSC)** – At the May 18, 1999 control decision meeting, the Tank 241-SY-102 drop leg was designated as a safety-significant SSC by consensus. This passive design feature significantly mitigates ammonia releases in Tank 241-SY-102 by ensuring the waste transferred from Tank 241-SY-101 is discharged below the waste surface. The TWRS Plant Review Committee (PRC) subsequently requested that the initially selected controls for ammonia be reviewed to determine if ammonia monitoring and an elevated release were sufficient to protect the onsite and facility workers without credit for the Tank 241-SY-102 drop leg. Based on additional analysis of the bounding ammonia accident scenario for Tank 241-SY-101 waste transfers, it was demonstrated that ammonia exposures were controlled to within risk evaluation guidelines with just ammonia monitoring and an elevated release. The Tank 241-SY-102 drop leg was, therefore, revised from a safety-significant SSC to a defense-in-depth control.

**Ammonia scrubber** – This control was not selected based on the time and cost to design and install an ammonia scrubber on the 241-SY Tank Farm exhaust ventilation system, and the ability to adequately protect onsite and facility workers from potential ammonia release hazards by the selected controls.

Restrict Tank 241-SY-101 Waste Transfer during “fumigation” weather conditions – The most restrictive atmospheric dispersion condition (i.e., the weather condition resulting in the highest ammonia concentration from an elevated release) is fumigation. Fumigation conditions occur for a short time following sunrise on clear days. This control was not selected since it would require at least daily startup and shutdown of the waste transfer.

Air Injection at the Stack – This control would mitigate ammonia releases by providing dilution and increasing the effective stack height. The selected controls were preferred over this control because of the time and cost to implement this control.

Attachment 8 is the control decision record of the safety SSCs, TSRs (or prudent contractor controls necessary for safe operation), and defense-in-depth controls selected to protect against potential hazardous conditions and postulated accidents that may cause ammonia releases during Tank 241-SY-101 waste transfers.



#### F4.0 REFERENCES

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- HNF-SD-WM-BIO-001, *Tank Waste Remediation System Basis for Interim Operation*, Lockheed Martin Hanford Corporation, Richland, Washington.
- HNF-SD-WM-SAR-067, *Tank Waste Remediation System Final Safety Analysis Report*, Lockheed Martin Hanford Corporation, Richland, Washington.
- LA-UR-92-3196, 1996, *A Safety Assessment for Proposed Pump Mixing Operations to Mitigate Episodic Gas Releases in Tank 241-SY-101: Hanford Site, Richland, Washington*, Rev. 14a, Los Alamos National Laboratory, Los Alamos, New Mexico.
- Wagoner, J. D., 1998, *Contract No. DE-AC06-96RL13200 – Supplemental Controls for Continued Operations in Tank 241-SY-241* (Letter 98-SCD-140 to R. D. Hanson, Fluor Daniel Hanford, Inc.), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

**ATTACHMENT 1**

**SUMMARY OF NEW CONTROLS FOR THE TANK 241-SY-101 WASTE TRANSFER**

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Summary of New Controls for the Tank 241-SY-101 Waste Transfer<sup>1</sup> (5 Sheets)

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement <sup>2</sup>	Comments
	Description	SC	SS		
Flammable Gas Deflagration	Siphon break	X	-	<p>AC: Tank 241-SY-101 Mixer Pump Performance</p> <p>AC: Tank 241-SY-101 Ignition Controls</p>	<p><b>Siphon break:</b> The safety function of the siphon break is to prevent the siphoning of waste from Tank 241-SY-101 to Tank 241-SY-102 when the waste transfer pump is not operating. (See Note 3)</p> <p><b>Tank 241-SY-101 waste transfer flow totalizer:</b> The safety function of the Tank 241-SY-101 waste transfer flow totalizer is to provide the volume of material transferred from Tank 241-SY-101 to Tank 241-SY-102 (waste plus dilution water) for implementation of the Tank 241-SY-101 Waste Transfer Control</p> <p><b>Dilution water flow totalizer:</b> The safety function of the dilution water flow totalizer is to provide dilution water data for implementation of the Tank 241-SY-101 Waste Transfer Control. (See Note 3)</p> <p>Program key elements are:</p> <ul style="list-style-type: none"> <li>Mixer pump performance (e.g., pump motor current, pump discharge pressure, waste thermocouple response) shall be monitored, and the Test Review Group (TRG) shall review the data quarterly for signs of degradation that could affect continued control of gas retention at depth and prevention of buoyant displacement gas release events (BD GREs)</li> <li>The TRG shall direct corrective actions to restore mixer pump performance, as necessary.</li> </ul> <p>Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.</p>
	Tank 241-SY-101 Waste Transfer Flow Totalizer	X	-		
	Dilution Water Flow Totalizer	X	-		

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Summary of New Controls for the Tank 241-SY-101 Waste Transfer<sup>1</sup> (5 Sheets)

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement <sup>2</sup>	Comments
	Description	SC	SS		
Spray Leak in Structure or from Overground Transfer Line	Prefabricated Pump Pit (P3)	X	-	None	<i>P3:</i> The safety function of the P3 is to knock down spray and limit release of aerosols to the environment. The P3 shall be designed to withstand design basis high wind and associated missiles. (See Note 3)
	OGT encasement and connections	X	-		<i>OGT encasement and connections:</i> The safety function of the OGT encasement and connections is to confine a leak from the primary piping and ensure that the leak is directed to the riser 241-SY-102-007 drop leg enclosure or to the P3 which contain leak detection systems. The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind, but not the associated missiles. (See Note 3)
	Riser 241-SY-102-007 drop leg enclosure	X	-		<i>Riser 241-SY-102-007 drop leg enclosure:</i> Same as OGT encasement and connections except that the riser 241-SY-102-007 drop leg enclosure shall be designed to withstand missiles associated with the design basis high wind. (See Note 3)

Summary of New Controls for the Tank 241-SY-101 Waste Transfer<sup>1</sup> (5 Sheets)

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement <sup>2</sup>	Comments
	Description	SC	SS		
Surface Leak Resulting in Pool	Prefabricated Pump Pit (P3)	X	X	None	<i>P3:</i> The <i>safety-class safety function</i> of the P3 is to provide an intact boundary for the leaked waste, and when leak detector alarms and appropriate operator response times to shut off the transfer pump are credited, to prevent premature P3 overflow and the formation of a surface pool. The <i>safety-significant safety function</i> of the P3, including cover, is to limit release of aerosols generated by splatter inside the P3, and limit shine and skyshine dose to onsite receptors. The P3 shall be designed to withstand design basis high wind and associated missiles. (See Note 3)
	OGT encasement and connections	X	-		<i>OGT Encasement and Connections:</i> The safety function of the OGT encasement and connections is to provide secondary confinement for a leak from the primary line and route the leak to the riser 241-SY-102-007 drop leg enclosure or to the P3 which contain leak detection systems. The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241 SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind, but not the associated missiles. (See Note 3)
	Riser 241-SY-102-007 drop leg enclosure	X	-		<i>Riser 241-SY-102-007 Drop Leg Enclosure:</i> Same as OGT encasement and connections, except that the riser 241-SY-102-007 drop leg enclosure shall be designed to withstand missiles associated with the design basis high wind. (See Note 3)
	Tank 241-SY-101 waste transfer flow totalizer	-	X		<i>Tank 241-SY-101 waste transfer flow totalizer:</i> The safety function of the Tank 241-SY-101 waste transfer flow totalizer is to provide the volume of material transferred from Tank 241-SY-101 to Tank 241-SY-102 (waste plus dilution water) for implementation of the TSR AC 5.12 Transfer Controls material balance requirements.

Summary of New Controls for the Tank 241-SY-101 Waste Transfer<sup>1</sup> (5 Sheets)

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement <sup>2</sup>	Comments
	Description	SC	SS		
Mixing of Incompatible Material – Toxic Vapor Generation	241-SY Tank Farm primary tank ventilation system	-	X		241-SY Tank Farm primary tank ventilation system: The safety function of the 241-SY Tank Farm primary tank ventilation system is to provide an elevated release (versus a ground-level release) of ammonia from 241-SY Tank Farm tanks. The primary tank ventilation system for the 241-SY Tank Farm ensures an elevated release of ammonia by maintaining a vacuum in the vapor spaces of Tanks 241-SY-101, -102, and -103 and exhausting through a stack. (See Note 3).
	Ammonia monitoring systems (Tank 241-SY-101 and 241-SY Tank Farm primary tank ventilation exhaust)	-	X		Ammonia monitoring systems: The safety function of the Tank 241-SY-101 ammonia monitoring system is to measure the ammonia concentration in the Tank 241-SY-101 vapor space and alarm at 3000 ppm. The safety function of the 241-SY Tank Farm primary tank ventilation exhaust ammonia monitoring system is to measure the ammonia concentration in the 241-SY Tank Farm ventilation exhaust and alarm at 1000 ppm.
				AC: 241-SY Tank Farm primary tank ventilation system	Ensures operation of the 241-SY Tank Farm primary tank ventilation system during <i>global waste disturbing</i> operations and activities in Tank 241-SY-101, including waste transfers from Tank 241-SY-101 to Tank 241-SY-102. TSR LCO 3.2.1 satisfies this requirement for ammonia releases.



Summary of New Controls for the Tank 241-SY-101 Waste Transfer<sup>1</sup> (5 Sheets)

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement <sup>2</sup>	Comments
	Description	SC	SS		
Mixing of Incompatible Material – Toxic Vapor Generation (continued)				AC: Ammonia monitoring (Tank 241-SY-101 and 241-SY Tank Farm primary tank ventilation exhaust)	<p>The program key elements are:</p> <ul style="list-style-type: none"> <li>During <i>global waste disturbing</i> operations and activities in Tank 241-SY-101 (except waste transfers) and when water sources are connected to equipment for operations and activities that could add water to Tank 241-SY-101, monitor the ammonia concentration in the tank vapor space <u>or</u> in the 241-SY Tank Farm primary tank ventilation exhaust and, if the ammonia concentration reaches 3000 ppm or 1000 ppm, respectively, stop <i>global waste disturbing</i> operations and activities in the tank and isolate all sources of water to the tank.</li> <li>During Tank 241-SY-101 waste transfers, monitor the ammonia concentration in the 241-SY Tank Farm primary tank ventilation exhaust and, if the ammonia concentration reaches 1000 ppm, stop the waste transfer and isolate all sources of water to Tank 241-SY-101.</li> </ul> <p>Note: See HNF-SD-WM-TSR-006 for the definition of <i>global waste disturbing</i>.</p>

Notes:

- This summary lists only the new controls selected for the Tank 241-SY-101 waste transfer.
- As a result of direction received from the U.S. Department of Energy, Office of River Protection (French 1999), new TSR-level controls for Tank 241-SY-101 remediation activities, including waste transfers, will be imposed as prudent contractor controls necessary for safe operation.
- The safety function for a safety-class or safety-significant SSC states the preventive and/or mitigative safety function(s) that the safety SSC is required to meet. Unless specifically stated in the safety function, the safety SSC is not required to perform its safety function during or following design basis natural phenomena (e.g., seismic events, high winds and associated missiles).

**NEW DEFENSE IN DEPTH CONTROLS**

New defense-in-depth controls identified for the Tank 241-SY-101 waste transfer are:

1. Video camera monitoring during the waste transfer and during associated activities that involve crust disturbance or dissolution.
2. Tank 241-SY-102 drop leg and associated Tank 241-SY-102 waste level control that ensure the waste transferred from Tank 241-SY-101 is discharged below the Tank 241-SY-101 waste surface to reduce the rate of ammonia release (i.e., evaporation).

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**ATTACHMENT 2**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER  
FOR FLAMMABLE GAS DEFLAGRATION - INDUCED GAS RELEASE  
FROM CRUST DISTURBANCE**

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## CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR FLAMMABLE GAS DEFLAGRATION – INDUCED GAS RELEASE FROM CRUST DISTURBANCE

**HAZARD/ACCIDENT:** Flammable Gas Deflagration – Induced gas release from crust disturbance

### Structures, Systems, and Components (SSCs)

Note: The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the Los Alamos National Laboratory (LANL) Safety Assessment (SA) Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-101 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

SC is safety class  
SS is safety significant

\*Existing control

## Technical Safety Requirements (TSRs)

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
*DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
*Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
<i>Ignition controls (Revision to AC 5.10)</i>	<i>Prevent the ignition of flammable gases that may be present.</i>	<i>Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.</i>
<i>Flammable Gas Monitoring Controls (Revision to AC 5.11)</i>	<i>Ensures flammable conditions caused by steady-state accumulation or as a result of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.</i>	<i>Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.</i>  <i>Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.</i>
*Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
*HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
*Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

\*Existing control

**Defense-in Depth Controls**

Note: New controls appear in *bold italics*

Control	Safety Function	Comments
<i>Video camera monitor</i>	<i>Visual monitoring during waste transfers and during activities that could involve crust disturbance or dissolution to detect significant unexpected effects.</i>	--



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**ATTACHMENT 3**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER  
FOR FLAMMABLE GAS DEFLAGRATION – INDUCED GAS RELEASE  
FROM CRUST DISSOLUTION**

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# **CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR FLAMMABLE GAS DEFLAGRATION – INDUCED GAS RELEASE FROM CRUST DISSOLUTION**

**HAZARD/ACCIDENT:** Flammable Gas Deflagration – Induced gas release from crust dissolution

## **Structures, Systems, and Components (SSCs)**

Note: The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the LANL SA Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-101 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

SC is safety class  
SS is safety significant

\*Existing control

## Technical Safety Requirements (TSRs)

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
*DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
*Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
<i>Ignition controls (Revision to AC 5.10)</i>	<i>Prevent the ignition of flammable gases that may be present.</i>	<i>Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.</i>
<i>Flammable Gas Monitoring Controls (Revision to AC 5.11)</i>	<i>Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.</i>	<i>Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.</i>  <i>Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.</i>
*Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
*HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
*Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

\*Existing control

## Defense-in Depth Controls

Note: New controls appear in *bold italics*

Control	Safety Function	Comments
<i>Video camera monitor</i>	<i>Visual monitoring during waste transfers and during activities that could involve crust disturbance or dissolution to detect significant unexpected effects.</i>	

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**ATTACHMENT 4**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR  
FLAMMABLE GAS DEFLAGRATION - BUOYANT DISPLACEMENT GRE  
PLUS ADDITIONAL GAS RELEASE FROM THE CRUST**



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# **CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR FLAMMABLE GAS DEFLAGRATION – BUOYANT DISPLACEMENT GRE PLUS ADDITIONAL GAS RELEASE FROM THE CRUST**

**HAZARD/ACCIDENT:** Flammable Gas Deflagration –Buoyant displacement GRE plus additional gas release from the crust

## **Structures, Systems, and Components (SSCs)**

Notes:

- The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the LANL SA Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-101 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function.
- New controls appear in *bold italics*.

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

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Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
<i>Siphon Break</i>	X		<i>The safety function of the siphon break is to prevent the siphoning of waste from Tank 241-SY-101 to Tank 241-SY-102 when the waste transfer pump is not operating.</i>	<i>The siphon break is a passive design feature.</i>
<i>Tank 241-SY-101 Waste Transfer Flow Totalizer</i>	X		<i>Provide volume of material transferred from Tank 241-SY-101 to Tank 241-SY-102 (waste plus dilution water) for implementation of the Tank 241-SY-101 Waste Transfer Control.</i>	--
<i>Dilution Water Flow Totalizer</i>	X		<i>The safety function of the dilution water flow totalizer is to provide dilution water data for implementation of the Tank 241-SY-101 Waste Transfer Control.</i>	--

SC is safety class  
SS is safety significant

\*Existing control

## Technical Safety Requirements (TSRs)

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
*DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
*Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
<i>Tank 241-SY-101 Mixer Pump Performance (Revision to AC 5.9)</i>	<i>Identify and mitigate degradation of Tank 241-SY 101 mixer pump performance caused by interaction of the pump and the crust to ensure that the safety function of the mixer pump (control gas retention at depth and prevent buoyant displacement GRE) is maintained.</i>	<i>Program key elements are:</i> <ul style="list-style-type: none"> <li><i>Mixer pump performance (e.g., pump motor current, pump discharge pressure, waste thermocouple response) shall be monitored, and the Test Review Group (TRG) shall review the data quarterly for signs of degradation that could affect continued control of gas retention at depth and prevention of buoyant displacement gas release events (BD GREs)</i></li> <li><i>The TRG shall direct corrective actions to restore mixer pump performance, as necessary (e.g., add water).</i></li> </ul>
<i>Ignition controls (Revision to AC 5.10)</i>	<i>Prevent the ignition of flammable gases that may be present.</i>	<i>Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.</i>
<i>Flammable Gas Monitoring Controls (Revision to AC 5.11)</i>	<i>Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.</i>	<i>Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.</i>  <i>Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.</i>

Control	Safety Function	Comments
<i>Tank 241-SY-101 Waste Transfer Control (Revision to AC 5.9 or AC 5.12)</i>	<i>Limit the quantity of waste transferred from Tank 241-SY-101 to ensure that the mixer pump continues to perform its safety function (control gas retention at depth and prevent buoyant displacement GREs).</i>	<p><i>Program key elements are:</i></p> <ul style="list-style-type: none"> <li><i>For waste transfers from Tank 241-SY-101, the maximum quantity of waste that can be transferred and maintain a minimum of one (1) foot between the mixer pump suction and the bottom of the crust shall be calculated. The calculation shall consider uncertainties in measuring the bottom of the crust, including level monitoring system accuracy, and the growth of the crust subsequent to the transfer.</i></li> <li><i>The waste transfer from Tank 241-SY-101 shall then be monitored and limited to this maximum quantity.</i></li> </ul>
*Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
*HEPA Filter Control (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
*Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

\*Existing control

### Defense-in Depth Controls

Control	Safety Function	Comments
None identified		

**ATTACHMENT 5**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER  
FOR FLAMMABLE GAS DEFLAGRATION – GENERAL**

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## CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR FLAMMABLE GAS DEFLAGRATION – GENERAL

**HAZARD/ACCIDENT:** Flammable Gas Deflagration – General

### Structures, Systems, and Components (SSCs)

**Note:** The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the LANL SA Level I mixer pump controls (LA-UR-92-3196, Rev. 14a, Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-101 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

SC is safety class  
SS is safety significant

\* Existing control



## Technical Safety Requirements (TSRs)

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
*DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
*Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls, including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
<i>Ignition controls (Revision to AC 5.10)</i>	<i>Prevent the ignition of flammable gases that may be present.</i>	<i>Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.</i>
<i>Flammable Gas Monitoring Controls (Revision to AC 5.11)</i>	<i>Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.</i>	<i>Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.</i>  <i>Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.</i>
*Transfer Controls – Waste Compatibility Controls (AC 5.12)	Ensure final tank states remain within analyzed topography of the flammable gas deflagrations accident.	--
*Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
*Excavation Controls (AC 5.17)	Prevent ignition of flammable gases.	--

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Control	Safety Function	Comments
*HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
*Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

\* Existing control

### Defense-in Depth Controls

Control	Safety Function	Comments
*Flush transfer lines after use	Reduce waste material in transfer lines to limit the production of flammable gases.	--

\*Existing control

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**ATTACHMENT 6**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR  
SPRAY LEAK IN STRUCTURE OR FROM OVERGROUND TRANSFER LINE**

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# CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR SPRAY LEAK IN STRUCTURE OR FROM OVERGROUND TRANSFER LINE

**HAZARD/ACCIDENT:** Spray Leak in Structure or from Overground Transfer (OGT) Line

**Note:** The below listed safety structures, systems, and components (SSCs), technical safety requirements (TSRs), and defense-in-depth controls only include those that are unique to the Tank 241-SY-101 waste transfer.

## Structures, Systems, and Components (SSCs)

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
Prefabricated Pump Pit (PPP)*	X		Knock down spray and limit release of aerosols to the environment.	The P3 shall be designed to withstand design basis high wind and associated missiles.
OGT encasement and connections*	X		Confine a leak from the primary piping and ensure that the leak is directed to the riser 241-SY-102-007 drop leg enclosure or to the PPP which contain leak detection systems.	The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the PPP and (2) design basis high wind, but not the associated missiles.
Riser 241-SY-102-007 Drop Leg Enclosure*	X		Same as OGT encasement and connections.	Comments for OGT encasement and connections above are also applicable to the riser 241-SY-102 drop leg enclosure except that it shall be designed to withstand missiles associated with the design basis high wind.

SC is safety class  
SS is safety significant

\* Additional temporary shielding and administrative controls shall be used to maintain facility worker radiation exposures ALARA.

**Technical Safety Requirements (TSRs)**

Control	Safety Function	Comments
None  Note: The PPP cover is considered a transfer system cover and existing LCO 3.1.1 and AC 5.22 apply.	--	--

**Defense-in Depth Controls**

Control	Safety Function	Comments
None identified	--	--

**ATTACHMENT 7**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER  
FOR SURFACE LEAK RESULTING IN POOL**



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## CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR SURFACE LEAK RESULTING IN POOL

### HAZARD/ACCIDENT: Surface Leak Resulting in Pool

Note: The below listed safety structures, systems, and components (SSCs), technical safety requirements (TSRs), and defense-in-depth controls only include those that are unique to the Tank 241-SY-101 waste transfer.

### Structures, Systems, and Components (SSCs)

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
Prefabricated Pump Pit (P3)*	X	X	<p>The safety-class safety function of the P3 is to provide an intact boundary for the leaked waste, and when leak detector alarms and appropriate operator response times to shut off the transfer pump are credited, to prevent premature P3 overflow and the formation of a surface pool.</p> <p>The safety-significant safety function of the P3, including cover, is to limit release of aerosols generated by splatter inside the P3, and limit shine and skyshine dose to onsite receptors.</p>	The P3 shall be designed to withstand design basis high wind and associated missiles.
OGT encasement and connections*	X		Provide secondary confinement for leaks from the primary line and route the leak to the riser 241-SY-102-007 drop leg enclosure or to the P3 which contain leak detection systems.	The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind, but not the associated missiles.
Riser 241-SY-102-007 drop leg enclosure*	X		Same as OGT encasement and connections.	Comments for OGT encasement and connections above are also applicable to the riser 241-SY-102-007 drop leg enclosure, except that it shall be designed to withstand missiles associated with the design basis high wind.

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Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
Tank 241-SY-101 waste transfer flow totalizer		X	Provide volume of material transferred from Tank 241-SY- 101 to Tank 241-SY-102 (waste plus dilution water) for implementation of the TSR AC 5.12 Transfer Controls material balance requirements.	--

SC is safety class

SS is safety significant

- \* Additional temporary shielding and administrative controls shall be used to maintain facility worker radiation exposures ALARA.

**Technical Safety Requirements (TSRs)**

Control	Safety Function	Comments
None	--	--
Notes:		
1. The P3 cover is considered a transfer system cover and existing LCO 3.1.1 and AC 5.22 apply.		
2. The riser 241-SY-102-007 drop leg enclosure leak detection system is subject to LCO 3.1.3.		

**Defense-in Depth Controls**

Control	Safety Function	Comments
P3 and Riser 241-SY-102-007 drop leg enclosure drains.	Allow leak to drain back to Tanks 241-SY-101 or 241-SY-102.	--

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**ATTACHMENT 8**

**CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR  
MIXING OF INCOMPATIBLE MATERIAL – TOXIC VAPOR GENERATION**

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# CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER FOR MIXING OF INCOMPATIBLE MATERIAL – TOXIC VAPOR GENERATION

**HAZARD/ACCIDENT:** Mixing of Incompatible Material – Toxic Vapor Generation

## Structures, Systems, and Components (SSCs)

Note: New controls appear in *bold italics*.

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
<i>241-SY Tank Farm primary tank ventilation system</i>	-	X	<i>Provide an elevated release (versus a ground-level release) of ammonia from 241-SY Tank Farm tanks.</i>	<i>The primary tank ventilation system for the 241-SY Tank Farm ensures an elevated release of ammonia by maintaining a vacuum in the vapor spaces of Tanks 241-SY-101, -102, and -103 and exhausting through a stack.</i>
Ammonia monitoring system:				
<i>Tank 241-SY-101</i>	-	X	<i>Measure the ammonia concentration in the Tank 241-SY-101 vapor space and alarm at 3000 ppm.</i>	- -
<i>241-SY Tank Farm primary tank ventilation exhaust</i>	-	X	<i>Measure the ammonia concentration in the 241-SY Tank Farm primary tank ventilation exhaust and alarm at 1000 ppm.</i>	

SC is safety class  
SS is safety significant



## Technical Safety Requirements (TSRs)

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
<i>241-SY Tank Farm primary tank ventilation system</i>	<i>Ensures operation of the 241-SY Tank Farm primary tank ventilation system during global waste disturbing operations and activities in Tank 241-SY-101, including waste transfers from Tank 241-SY-101 to Tank 241-SY-102.</i>	<p><i>The primary tank ventilation system for the 241-SY Tank Farm provides an elevated release of ammonia by maintaining a vacuum in the vapor spaces of Tanks 241-SY-101, -102, and -103 and exhausting through a stack.</i></p> <p><i>This TSR-level control for ammonia releases is an expansion of the basis of TSR LCO 3.2.1. Action statement A.1 of LCO 3.2.1 requires that all waste disturbing operations and activities be stopped when the primary tank ventilation system is not operating. This satisfies the safety function for ammonia releases.</i></p> <p><i>See HNF-SD-WM-TSR-006 for the definition of waste disturbing and global waste disturbing.</i></p>
<i>Ammonia Monitoring</i>	<p><i>During global waste disturbing operations and activities in Tank 241-SY-101 (except waste transfers - see below) and when water sources are connected to equipment for operations and activities that could add water to Tank 241-SY-101, monitor the ammonia concentration in the tank vapor space <u>or</u> in the 241-SY Tank Farm primary tank ventilation exhaust and, if the ammonia concentration reaches 3000 ppm or 1000 ppm, respectively, stop global waste disturbing operations and activities in the tank and isolate all sources of water to the tank.</i></p> <p><i>During Tank 241-SY-101 waste transfers, monitor the ammonia concentration in the 241-SY Tank Farm primary tank ventilation exhaust and, if the ammonia concentration reaches 1000 ppm, stop the waste transfer and isolate all sources of water to Tank 241-SY-101.</i></p>	<p><i>Stopping global waste disturbing operations and activities in Tank 241-SY-101, including waste transfers from Tank 241-SY-101 to Tank 241-SY-102, eliminates these causes of ammonia releases. Isolating sources of water to Tank 241-SY-101 prevents water additions (intentional or inadvertent) that can cause ammonia releases from the waste.</i></p> <p><i>(See HNF-SD-WM-TSR-006 for the definition of global waste disturbing.)</i></p>

## Defense-in Depth Controls

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
Industrial Hygiene Program*	Ensures personnel safety during activities and operations that could generate or release toxic vapor.	-
<i>Tank 241-SY-102 drop leg and associated Tank 241-SY-102 waste level control</i>	<i>The Tank 241-SY-102 drop leg discharges the waste transferred from Tank 241-SY-101 below the Tank 241-SY-102 waste surface to reduce the ammonia release (i.e., evaporation). The associated Tank 241-SY-102 waste level control ensures that during Tank 241-SY-101 transfers, the Tank 241-SY-102 waste surface is above the discharge of the drop leg by a minimum distance specified in a Process Memo or Process Control Plan.</i>	<i>The Tank 241-SY-102 drop leg and associated waste level control minimize the surface area of Tank 241-SY-101 waste exposed to air in Tank 241-SY-102 caused by falling waste, splashing, waste surface disturbance, and poor mixing with Tank 241-SY-102 waste.</i>

\*Existing control

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APPENDIX F

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