Action Plan for Responses to Abnormal Conditions in Hanford Site Radioactive Waste Tanks with High Organic Content

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Date Published
July 1993

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

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Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Date Received: 7/21/93 EMB		INFORMATION RELEASE REQUEST		ORIGINAL		Reference: WHC-CM-3-4	
Complete for all Types of Release							
Purpose				ID Number (include revision, volume, etc.) WHC-EP-0461 REV. 1			
☐ Speech or Presentation ☐ Full Paper (Check only one suffix) ☐ Summary ☐ Abstract ☐ Visual Aid ☐ Speakers Bureau ☐ Poster Session ☐ Videotape		☐ Reference ☒ Technical Report ☐ Thesis or Dissertation ☐ Manual ☐ Brochure/Flier ☐ Software/Database ☐ Controlled Document ☐ Other		List attachments.			
				Date Release Required July 23, 1993			
Title Action Plan for Responses to Abnormal Conditions in Hanford Site Radioactive Waste Tanks with High Organic Content					Unclassified Category UC-600		Impact Level 4
New or novel (patentable) subject matter? ☒ No ☐ Yes If "Yes", has disclosure been submitted by WHC or other company? ☐ No ☐ Yes (Disclosure No(s).)				Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? ☒ No ☐ Yes (Identify)			
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Complete for Speech or Presentation							
Title of Conference or Meeting				Group or Society Sponsoring			
Date(s) of Conference or Meeting		City/State		Will proceedings be published? ☐ Yes ☐ No		Will material be handed out? ☐ Yes ☐ No	
Title of Journal							
CHECKLIST FOR SIGNATORIES							
Review Required per WHC-CM-3-4		Yes	No	Reviewer - Signature Indicates Approval			
				Name (printed)		Signature Date	
Classification/Unclassified Controlled Nuclear Information		☐	☒	<i>[Signature]</i> 8/2/93			
Patent - General Counsel		☒	☐				
Legal - General Counsel		☒	☐	<i>[Signature]</i> 7-28-93			
Applied Technology/Export Controlled Information or International Program		☐	☒				
WHC Program/Project		☒	☐	<i>[Signature]</i> 8-5-93			
Communications		☐	☒				
HI Program/Project		☒	☐	<i>[Signature]</i> 5/1/93			
Publication Services		☒	☐				
Other Program/Project		☐	☒				
Information conforms to all applicable requirements. The above information is certified to be correct.							
Yes No				INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP			
References Available to Intended Audience ☒ Yes ☐ No				Stamp is required before release. Release is contingent upon resolution of mandatory comments. <div style="text-align: center;"> </div>			
Transmit to DOE HQ/Office of Scientific and Technical Information ☒ Yes ☐ No							
Author/Requestor (Printed/Signature) Date							
K. D. Fowler <i>[Signature]</i> 7-21-93							
Intended Audience ☐ Internal ☐ Sponsor ☒ External							
Responsible Manager (Printed/Signature) Date				Date Cancelled			
N. W. Kirch <i>[Signature]</i> 7-21-93				Date Disapproved			

WHC-EP-0461, Revision 1

Document Title: Action Plan for Responses to Abnormal Conditions in
Hanford Site Radioactive Waste Tanks with High Organic
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**ACTION PLAN FOR RESPONSES TO ABNORMAL CONDITIONS IN HANFORD SITE
RADIOACTIVE WASTE TANKS WITH HIGH ORGANIC CONTENT**

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ABSTRACT

This action plan describes the criteria and the organizational responsibilities required for ensuring that waste storage tanks with high organic contents are maintained in a safe condition at the Hanford Site. In addition, response actions are outlined for (1) prevention or mitigation of excessive temperatures; or (2) a material release from any waste tank with high organic content. Other response actions may be defined by Westinghouse Hanford Company Systems Engineering if a waste tank parameter goes out of specification. Trend analysis indicates the waste tank parameters have seasonal variations, but are otherwise stable.

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LIST OF TERMS

ASP	Alarm Set Point
CAM	Continuous Air Monitor
CASS	Computer Automated Surveillance System
dpm	disintegrations per minute
DAC	Derived Air Concentration
DOE	U.S. Department of Energy
DST	Double-Shell Tank
ERG	Energy Response Guide
in w.g.	inches Water Gauge - Unit of Pressure
LFL	Lower Flammability Limit
LOW	Liquid Observation Well
OSD	Operating Specification Document
PID	photoionization detector
POP	Plant Operating Procedure
PUREX	Plutonium/Uranium Extraction (process)
REDOX	Reduction/Oxidation (plant)
RPR	Radiological Problem Report
SAR	Safety Analysis Report
SST	Single-Shell Tank
TBP	Tributyl Phosphate
TC	Thermocouple
TOC	Total Organic Carbon
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company

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ACTION PLAN FOR RESPONSES TO ABNORMAL CONDITIONS IN HANFORD SITE RADIOACTIVE WASTE TANKS WITH HIGH ORGANIC CONTENT

1.0 INTRODUCTION

1.1 BACKGROUND

Public Law 101-510, Section 3137, *Safety Measures for Waste Tanks at Hanford Nuclear Reservation*, requires that an action plan be developed to respond to excessive temperature changes, pressure increases, or a release from any single-shell tank (SST) or double-shell tank (DST) on the Watch List at the Hanford Site (see Hanlon 1992). Fifty-five¹ tanks have been identified and categorized by tank contents. Categories include those tanks that (1) contain ferrocyanide compounds; (2) have the potential for flammable gas generation; (3) contain high concentrations of organics; or (4) have high heat loads.

This action plan has been prepared to address responses to abnormal conditions related to each of the nine waste tanks identified as containing high organic concentrations. A high organic concentration has been defined as >3 wt% of total organic carbon (TOC) equivalent to 10 wt% sodium acetate on a dry weight basis. Table 1-1 lists the nine organic tanks and includes data on waste volumes and temperature, pressure, liquid level, flammable gas concentration and airborne radiation level monitoring frequencies. High concentrations of organic compounds have been found in these nine SSTs. Table 1-2 lists the estimated organic content of each tank. The exact concentration of organic materials is not accurately known. Table 1-3 lists the source of the waste in each tank.

Some organic chemicals are potentially reactive and, when mixed with nitrate and nitrite salts, may deflagrate if dried and heated above 200 °C (392 °F). Laboratory screening studies indicate that the onset of exothermic reactions with stoichiometric mixtures of organics with nitrate/nitrite do not begin below 200 °C (392 °F). In certain scenarios involving overheating of the tank, a mixture of organics with nitrate/nitrite could react rapidly, possibly damaging the waste tank and allowing a release of radioactive material to the environment.

Tank waste temperatures and constituents have been reviewed to assess the potential for exothermic reactions. Baseline temperatures for these tanks range from 17 °C - 43 °C (62 °F - 109 °F), and no individual tank temperature has exceeded its baseline by more than 10°C (18 °F) during the past 2.5 years.

¹This number includes Tank 241-U-111, which has been recommended for addition to the organic tanks Watch List.

Table 1-1. Single-Shell Tanks With Concentrations of High Organic.

Organic Tank Waste				Temperature Monitoring			Pressure Monitoring	Liquid Level Monitoring		Flammable Gas Concentration Limit	Airborne Radiation Level Monitoring	
Tank	Total Waste Kgal	Liquid Kgal	Sludge Kgal	Baseline Temp. (°F)	Type	Interval	Frequency	Type	Interval	%LFL	Tank	Tank Farm
B-103	59	0	59	62	TC	Weekly	Weekly	FIC	Quarterly	20	No	ARM
¹ C-103	195	133	62	126	TC	Weekly	Weekly	FIC	Weekly	20	No	ARM
² S-102	549	230	4	109	TC	Weekly	Weekly	FIC	Weekly	20	No	ARM
^{2,3} SX-106	538	255	12	109	TC	Weekly	Weekly	FIC	Weekly	20	CAM	ARM
TX-105	609	20	0	102	TC	Weekly	Weekly	LLR	Quarterly	20	No	ARM
⁴ TX-118	347	27	0	74	TC	Weekly	Weekly	FIC	Quarterly	20	No	ARM
U-106	226	83	26	84	TC	Weekly	Weekly	FIC	Weekly	20	No	ARM
U-107	406	178	15	81	TC	Weekly	Weekly	FIC	Weekly	20	No	ARM
⁵ U-111	329	122	26	None	TC	6 Mo	Weekly	FIC	Weekly	20	No	ARM

¹Separable organic layer on surface of waste.²Tanks with the potential to accumulate flammable gases.³Also ventilated with exhaust fan through SX-109. Tanks without this note are ventilated passively through high-efficiency particulate air breathing filters.⁴A ferrocyanide tank⁵Tank recommended for organic tanks Watch List

TC - Thermocouple

FIC - Automatic liquid level sensor

LLR - Manual liquid level sensor

LFL - Lower Flammability Limit

ARM - Area Radiation Monitors

CAM - Continuous air monitoring

Table 1-2. Estimated Organic Content.

Tank	Sodium Acetate ¹ Equivalent (wt.%)	TOC ² (wt.%)
B-103	11.4 ³	3.3
C-103	4	-
S-102	21.0 ⁵	6.1
SX-106	14.6 ³	4.3
TX-105	12.8 ³	3.7
TX-118	20.2 ⁵	5.9
U-106	46.6 ⁵	13.6
U-107	14.7 ³	4.3
U-111 ⁶	48.2 ⁵	14.1

¹Dry weight basis calculated and reported by Fisher (1990).

²Dry weight basis calculated as sodium acetate equivalent (wt.%) x .2928.

³From data in Jungfleisch (1984).

⁴Separable organic layer on surface of waste. Quantity of organic unknown.

⁵From data in Schulz (1980).

⁶Tank recommended for organic tanks Watch List

Table 1-3. Source of Waste.

Tank	Waste Source
B-103	First and second cycle waste from B Plant and in-tank solidification (ITS-1 & ITS-2) evaporator bottoms.
C-103	PUREX and insoluble strontium-rich sluicing solids from the operation of 244-CR Vault.
S-102	REDOX
SX-106	Salt waste and first cycle condensate from REDOX, and 242-S Evaporator bottoms.
TX-105 & -118 U-106 & -107	Tributyl phosphate (TBP) process waste and 242-T Evaporator bottoms.
U-111	Concentrated Hanford B-Plant waste

NOTE: DSTs with TOC >3 wt% are not included on the organic tanks Watch List because they contain high concentrations of water and there is, therefore, no credible organic safety concern for these tanks. The safety concern is with tanks that contain low concentrations of water. These tanks could potentially heat up, dry out and undergo an exothermic organic - nitrate/nitrite reaction. In addition, there are no regulatory restrictions on adding water, if needed to a DST.

As indicated above, laboratory screening studies indicate that the onset of exothermic reactions with stoichiometric mixtures of organics with nitrate/nitrite do not begin below 200 °C (392 °F). These data suggest that exothermic reactions in these nine tanks are not an imminent safety concern.

1.1.1 Monitoring Overview

Instruments used at WHC for monitoring organic Watch List tanks consist of (1) temperature thermocouple (TC) trees located inside the waste tanks; (2) portable combustible gas detection instruments used for periodic flammable gas monitoring; (3) colorimetric tubes and photoionization detectors (PIDs) for periodic monitoring of hazardous air contaminants; (4) area radiation monitors; (5) continuous air monitors (CAMs) with alarm system capability throughout the tank farms; (6) breather filter oil seal loops for tank pressure monitoring; and (7) liquid-level measurement devices for each monitored tank.

Breather filters are installed on these SSTs so that the tanks maintain atmospheric pressure. The breather filters have oil seal loops that are checked every week to determine if there has been an abnormal change in the pressure in the tank.

Plant Operating Procedures (POPs) list the frequency for waste tank temperature monitoring. Vapor and pressure monitoring are addressed in the operating specifications (WHC 1990b). Airborne radiation monitoring requirements are given in the site Radiological Control Manual (WHC 1993).

1.2 PURPOSE

This action plan describes the administrative controls, monitoring frequencies, monitoring criteria, and reporting requirements that have been implemented for the organic Watch List tanks. In addition, corrective actions have been outlined where a response to an abnormal condition in an organic Watch List tank is warranted. Such responses may be due to changes in tank temperatures and pressures, flammable and toxic vapor concentrations, and airborne radiation levels.

Additionally, this plan identifies source documents that detail the following:

- The criteria and specification limits required for ensuring organic Watch List tanks are maintained in a safe condition
- Response actions for prevention or mitigation of the consequences of an abnormal condition
- Organizational responsibilities for ensuring that organic tanks are maintained in a safe condition and for responding to abnormal conditions.

1.3 SCOPE

The information contained in this document applies to all single-shell waste tanks with a TOC concentration of >3 wt% (10 wt% sodium acetate equivalent) on a dry weight basis.

This action plan does not include emergency preparedness procedures. Applicable operations documents for response to possible accidents that may result in a release from an organic Watch List tank are WHC-CM-4-1, *Westinghouse Hanford Company Emergency Plan* (WHC 1989), and WHC-CM-4-43, *Westinghouse Hanford Company Emergency Management Procedures* (WHC 1990a).

2.0 DISCUSSION

2.1 TEMPERATURE MONITORING AND RESPONSE

2.1.1 Administrative Controls

Administrative documents and procedures that include trend analysis are in place within Hanford Site tank farm facility operations groups to ensure that corrective responses can be taken before temperatures become excessive for the tanks identified in Table 1-1. These documents and procedures are administered in the following hierarchical order.

- U.S. Department of Energy (DOE) Order 5000.3A - *Occurrence Reporting and Processing of Operation Information* (DOE 1979)
- DOE Order 5480.1A - *Environmental Protection, Safety and Health Protection Standards* (DOE 1988)
- DOE Order 5480.23 - *Nuclear Safety Analysis Report* (DOE 1992)
- DOE Order 5481.1B - *Safety Analysis and Review Systems* (DOE 1983)
- DOE Order 5481.1 - *Environmental Protection, Safety and Health Protection Reporting Requirements* (DOE 1981)
- DOE Order 5700.6C - *Quality Assurance* (DOE 1991)
- DOE Order 6430.1A - *General Design Criteria for DOE Facilities* (DOE 1989)
- DOE Order RL 5820.2A - *Radioactive Waste Management* (DOE 1990)
- Westinghouse Hanford Company *Management Requirements and Procedures*, WHC-CM-1-3 (WHC 1988). This manual implements administrative controls derived from DOE directives.
- Westinghouse Hanford Company *Radiological Control Manual*, WHC-CM-1-6 (WHC 1993). This manual specifies radiation protection control

- The primary administrative control documents for SSTs are the following SARs: WHC-SD-WM-SAR-006, *Single-Shell Tank Isolation Safety Analysis Report* (Smith 1986a); WHC-SD-WM-SAR-016, *Hazard Identification and Evaluation for Nonstabilized Single-Shell Tanks* (Smith 1986b); and WHC-SD-WM-SAR-034, *Safety Analysis Report - Stabilization of Single-Shell Waste Storage Tanks by Salt Well Jet Pumping* (Boyles 1989).
- Specific Watch List tank operation and control limits are detailed within OSD-T-151-00030, *Operating Specifications for Watch List Tanks* (WHC 1992b).
- Basic SST surveillance limits are detailed within OSD-T-151-00013, *Operating Specifications for Single-Shell Waste Storage Tanks* (WHC 1990b).
- Specific technical criteria limits and controls are contained in WHC-SD-WM-TI-357, *Tank Farms Leak Detection Criteria* (Frater 1993).
- Occurrence reporting system requirements are specified within the procedures for occurrence reporting and processing of operations information. See WHC-CM-1-3, *Management Requirements and Procedures* (WHC 1988); WHC-CM-5-7, *Tank Farms, Grout, and Solid Waste Management Administration Manual* (WHC 1990c).

As additional monitoring systems are added to organic Watch List tanks this action plan will be revised to reflect changes in waste tank configuration, criteria, and controls.

2.1.2 Temperature Criteria

Tank temperatures are taken in SSTs to ensure temperatures do not exceed certain specified surveillance limits that might violate a tank's structural integrity. Temperatures are taken with thermocouples, which are thermoelectric devices used to measure temperature. A vertical array of devices (probes) is called a thermocouple tree. In SSTs, there may be one or more thermocouple trees installed directly in a tank, or a single thermocouple may be installed in a riser, or lowered down an existing riser or liquid observation well (LOW)².

The tanks identified in Table 1-1 will be monitored to determine if a trend of increasing temperature from the established baseline exists. The Surveillance Analysis and Data Acquisition group is responsible for such evaluations and for maintaining a data library. Facility Operations shift managers are required to alert the Surveillance Analysis and Data Acquisition group to any anomaly that is measured.

² In-tank LOWs are used for monitoring the interstitial liquid level in SSTs. The wells are constructed of fiberglass or a reinforced epoxy-polyester resin, sized to extend to within one inch of the bottom of the tank's steel liner. They are sealed at their bottom ends and have a nominal outside diameter of 3.5 inches.

Temperatures in the SSTs are monitored to assure temperatures do not reach 149 °C (300 °F). This would result in an Operating Specifications Document (OSD) violation. Temperatures in excess of 177 °C (350 °F) will contribute to waste tank corrosion and cracking, and eventually may result in concrete overstress, causing a Safety Analysis Report (SAR) violation.

The baselines, monitoring frequency, and maximum temperature criteria for all SSTs are specified in Standard Operating Procedure TO-040-650, "Obtain/Record Single-Shell Tank Temperatures," Rev. A6 (WHC 1992a).

The surveillance alert criteria is (6 °C [10 °F] above baseline) as specified by Surveillance Analysis and Data Acquisition.

2.1.3 Monitoring Frequencies

All organic Watch List tanks shall have temperature readings taken routinely at the intervals identified in Table 1-1.

2.1.4 Reporting and Response Requirements

Off-normal occurrence reporting, unusual occurrence reporting, and unusual event reporting requirements are applicable to abnormal temperature excursions in the tanks. The manager of Surveillance Analysis and Data Acquisition is responsible for evaluations and notifications of changes to Systems Engineering and Facility Operations. In the event that a report must be issued, it will be prepared by WHC Administrative Support and will be issued by Facility Operations.

Any temperature reading that exceeds the surveillance alert criteria (6 °C [10 °F] above baseline) as specified by Surveillance Analysis and Data Acquisition, after recheck verification, will result in a discrepancy report being issued by Surveillance Analysis and Data Acquisition.

Failure to monitor an organic tank temperature within the prescribed frequency period will result in a discrepancy report being issued by Surveillance Analysis and Data Acquisition.

Any temperature reading that exceeds the maximum temperature criteria (10 °C [18 °F] above baseline) after recheck verification, will result in a discrepancy report being issued by Surveillance Analysis and Data Acquisition.

Any organic tank temperature that reaches 93 °C (200 °F), after recheck verification, will result in the declaration of an "unusual event" (WHC 1990a).

Systems Engineering is responsible for evaluating and determining the appropriate response actions to be taken, should actions be required.

2.2 FLAMMABLE GAS/TOXIC VAPOR MONITORING AND RESPONSE

2.2.1 Administrative Controls

Combustible gas readings are taken before any work is performed in the vicinity of Hanford Site waste tanks or associated exhaust/ventilation systems. Administrative documents and procedures are in place within tank farm facility operations groups to ensure that corrective responses can be made before any flammable gas readings exceed the criteria presented in Section 2.2.2. These documents and procedures are administered in the hierarchical order discussed in Section 2.1.1.

As additional monitoring systems are added to organic Watch List tanks this action plan will be revised to reflect changes in waste tank configuration, criteria, and controls.

2.2.2 Flammable Gas Concentration Monitoring Criteria

Combustible gas readings are taken from outside the riser, pit vapor space, or around the ventilation system before opening the primary tank air space or the associated ventilation and/or exhaust system.

The required action levels for flammable gases are based on the lower explosive limit (LEL) or the lower flammability limit (LFL). Generally the LFL is a lower limit than the LEL. However, the lower of the two values will be used as the basis for flammable gas monitoring criteria.

If tank vapors exceed the combustible gas monitor display reading of 10% of the LEL/LFL a grab sample of the vapor will be taken for laboratory analysis.

If flammable gases are detected above 20% LEL/LFL, a grab sample of the vapor will be taken for analysis. Activities (including sampling) in the work area shall stop and not resume until laboratory analyses of the grab sample are completed. Approval must be received from the managers of Tank Farm Facility Operations and Safety Assurance to resume work.

2.2.3 Toxic Vapor Concentration Monitoring Criteria

Work activities in the tank farms are monitored for hazardous vapors. Vapor sampling prior to performing potentially high-risk work activities includes sampling with PIDs, colorimetric detector tubes, and/or LFL meters. Conservative action levels for the chemical vapors have been instituted in an effort to control the potential for exposures. The action levels are listed below.

- >1 ppm sustained reading of organic vapors for 3 minutes or more on a PID with a 10.6 eV lamp.
- 12.5 ppm or greater reading with an ammonia (NH₃) colorimetric detector tube.

- Any indication of hydrogen cyanide (HCN) on a colorimetric detector tube.
- >0.5 ppm reading on a nitrous fumes (NO + NO₂) colorimetric detector tube.

Upon detection of chemical vapor readings at or above these levels during work activities where supplied air is not being used, personnel will secure the area for possible spread of contamination and evacuate the tank farm upwind of the area where the readings are taken. Re-entry into the tank farm will require use of supplied air. When the readings have dropped below the action levels and/or are returned to zero, the tank farm can be released by the Respiratory Protection Technician or the Industrial Hygienist [refer to Appendix E of WHC-SD-WM-HSP-002 (Erickson 1992)].

2.2.4 Monitoring Frequencies

Before opening the primary tank air space or the associated ventilation and/or exhaust system, the atmosphere will be tested for toxic vapors and for the concentration of flammable gases relative to the LFL.

Flammable gas and toxic vapor readings are currently taken only before work is performed in or around the organic Watch List tanks.

2.2.5 Reporting and Response Requirements

Off-normal occurrence reporting, unusual occurrence reporting, and unusual event reporting requirements are applicable for any flammable gas release above the operating specification document (OSD) limits. Facility Operations shift managers are responsible for providing such evaluations and notifications to Systems Engineering. Systems Engineering is responsible for evaluating and determining the appropriate response actions to be taken, should actions be required.

2.3 AIRBORNE RADIATION LEVEL MONITORING AND RESPONSE

2.3.1 Administrative Controls

Administrative documents and procedures that include trend analysis are in place within tank farm facility operations groups to ensure that corrective responses are initiated before any airborne radiation level readings exceed the criteria referenced in Section 2.3.2. The documents and procedures are administered in the hierarchical order discussed in Section 2.1.1, especially WHC-CM-1-6, *Radiological Control* (WHC 1993), which specifies radiation protection control standards, requirements, and guidelines. Airborne radiation level criteria are specified in Chapter 2, Part 1, of WHC-CM-1-6.

As additional radiation monitoring systems are added to organic Watch List tanks, this action plan will be revised to reflect changes in waste tank configuration, criteria, and controls.

2.3.2 Airborne Radiation Level Monitoring Criteria

Radiological monitoring of radiation exposure levels, contamination, and airborne radioactive material is conducted to characterize workplace conditions and to identify areas requiring postings. Engineering and administrative controls are used to reduce the potential for internal exposure before personnel, with or without respiratory protection, enter areas with airborne radioactivity.

Occupied areas with airborne concentrations of radioactive materials that are greater than or potentially greater than 10% of a derived air concentration (DAC) are posted. Values of DACs are provided in DOE Order 5480.11.

To establish the continuous air monitor alarm set point (ASP) the following formula is used:

$$ASP = \frac{A \times V \times E}{K}$$

where:

A = DAC limit for Noble Gas (i.e. Krypton 85 most restrictive)

V = Volume of collection chamber (i.e. 850 cc)

K = 4.5×10^{-7} - conversion constant for μCi to dpm^3

E = Efficiency of detector

$$\frac{A \times V}{K} = 2000$$

To determine the Hi ASP:

$$\text{Hi ASP} = 2000 \times E$$

To determine the Hi-Hi ASP multiply the Hi ASP by 10.

2.3.3 Monitoring Frequencies

Continuous air monitors with alarm capabilities are located throughout the tank farms. These monitors are checked routinely in accordance with WHC-CM-4-43 (WHC 1990a).

³ disintegrations per minute

2.3.4 Reporting and Response Requirements

Off-normal occurrence reporting, unusual occurrence reporting, and unusual event reporting requirements are applicable to unexpected increases in airborne radiation levels (refer to WHC 1990c and WHC 1990d).

The manager of Facility Operations is responsible for evaluating and determining the response actions to be taken, should any be required.

2.4 PRESSURE MONITORING AND RESPONSE

2.4.1 Administrative Controls

Tank vapor space pressures are limited to prevent structural damage due to excess tension or compression. The minimum is set well within the Limiting Condition for Operation of -10 in. w. g.

Breather filters are installed on the SSTs, in order to allow the tanks to maintain atmospheric pressure. The breather filters are equipped with oil seal loops for determining if there has been a change in the pressure in the tank with respect to atmospheric pressure. There are no pressure monitors installed in the tank domes.

A visual inspection of the liquid level in the sight glass is performed for the oil seal loops. When the liquid level is at the midpoint of the sight glass the tank is at atmospheric pressure.

Administrative documents and procedures are administered in the hierarchical order discussed in Section 2.1.1.

As additional monitoring systems are added to organic Watch List tanks, this document will be revised to reflect changes in waste tank configuration, criteria, and controls.

2.4.2 Pressure Monitoring Criteria

The action limit for the organic Watch List tanks is a pressure < 1 in. w.g. minus the waste height (in. w.g.) not to exceed -9 in. w.g. in the vapor space. If this requirement is violated, the system seal loop shall be restored (within one shift) to compliance with the requirement.

A seal loop, which evacuates at 4 ± 1 in. w.g., is installed on each passively ventilated tank. The liquid level is maintained at 4 ± 1 inches, and the seal loop status is regularly recorded.

2.4.3 Monitoring Frequencies

The oil seal loops are checked weekly to determine if there has been a change in the tank pressure with respect to changes to atmospheric pressure. The check is performed weekly as specified in Tank Farm Operating Procedure TO-060-015 and in Table 1-1 of this document.

2.4.4 Reporting and Response Requirements

Experience has shown that inactive SSTs are extremely unlikely to develop pressure extremes of ± 4 in. w.g. All SSTs are either equipped with a breather filter/seal loop system or are contained within a ventilation system which pulls a moderate vacuum on each tank.

Off-normal occurrence reporting, unusual occurrence reporting, and unusual event reporting requirements are applicable to unexpected changes in tank pressure.

The manager of Facility Operations is responsible for evaluating and determining the response actions to be taken, should actions be required.

3.0 RESPONSIBILITIES

The WHC Tank Waste Remediation (TWRs) Systems Division is responsible for all WHC Tank Farm operations. The responsibilities associated with response to abnormal conditions in a SST, are assigned as follows [see WHC-CM-5-5, *Operations - General Administration* (WHC 1990e)]:

- Facility Operations shall be responsible for the safety of the tank farm facility, for establishing priorities for corrective actions, and for routine and non-routine temperature monitoring of all waste tanks that are identified in Table 1-1. Initial screening of tank temperature data also shall be performed by Facility Operations.
- Industrial Hygiene and Safety shall be responsible for performing field monitoring for combustible/flammable gases before any work that requires opening the primary tank air space or the associated ventilation/exhaust system is initiated. Industrial Hygiene and Safety shall perform the initial data review, verify that combustible/flammable gas levels meet established guidelines, and maintain records of the data.
- Surveillance Analysis and Data Acquisition receives temperature data and shall be responsible for reviewing (trending), permanently logging (record keeping), and reporting the data. Additionally, Surveillance Analysis and Data Acquisition shall have the responsibility for reporting data anomalies and initiating response actions (WHC 1990d).

- Systems Engineering shall be responsible for determining the action to be taken in response to an abnormal condition in any of the waste tanks related to tank temperatures, flammable gas, and tank liquid levels. Systems Engineering is alerted to the abnormal condition by Surveillance Analysis and Data Acquisition or Facility Operations.
- Facility Operations shall be responsible for determining the action to be taken in response to an abnormal condition in any of the waste tanks related to airborne radiation.
- Waste Tank Safety Assurance shall be responsible for providing independent safety review of all activities related to waste tank safety.
- Quality Assurance shall be responsible for verifying that activities affecting quality have been correctly performed.
- The manager of Facility Operations shall be responsible for conducting assessment activities and determining appropriate corrective actions as defined by Systems Engineering.
- Facility Operations shall be responsible for terminating emergency actions and returning facilities to normal operations.

4.0 CORRECTIVE ACTIONS

4.1 TEMPERATURE INCREASES

Surveillance Analysis and Data Acquisition is responsible for notifying Systems Engineering of any abnormal temperature change. Systems Engineering is then responsible for taking appropriate actions to respond to the abnormal condition.

These actions may include a complete engineering review and system design. They may also be limited to engineering recommendations, such as the following:

- Adjustments or modifications to tank ventilation systems, including the addition of active ventilation systems (i.e., portable exhausters)
- Addition of a refrigerated cooling system into the tank or as a part of the ventilation system
- Addition of water (even to a leaking tank) in minimum quantities to prevent temperature increases and restore temperature controls (water will not be added unless dry cooling methods are ineffective).

4.2 FLAMMABLE GAS/TOXIC VAPOR INCREASES

Facility Operations is responsible for notifying Systems Engineering of any abnormal flammable gas or toxic vapor accumulations and releases. Systems Engineering is then responsible for taking appropriate actions to respond to the abnormal conditions.

Upon detection of readings at or above action levels during work activities where supplied air is not being utilized, personnel will be evacuated from the tank farm, upwind of the area where the readings were taken. Re-entry into the tank farm will require use of supplied air. When the readings have dropped below the action levels and/or are returned to zero, the tank farm can be released by the Respiratory Protection Technician or the Industrial Hygienist [see Appendix E of WHC-SD-WM-HSP-002(Erickson 1992)].

4.3 AIRBORNE RADIATION LEVEL INCREASES

The corrective actions for increases in airborne radiation levels will be conducted in accordance with WHC-CM-4-1 (WHC 1989), WHC-CM-4-43 (WHC 1990a) and WHC-CM-4-12 (WHC 1992c).

Alarms shall be responded to immediately. Alarms in an alarming condition will be promptly reported to management or supervision.

Persons not responsible for overseeing or operating the equipment, system, process, or area of the alarming condition(s) shall respond promptly to ensure personal safety. Emergency Response Guides (ERGs) or specific procedures will govern alarm responses. For alarms not covered by a procedure or ERG, the following steps are appropriate to establish proper control of the alarm condition:

- Respond by acknowledging the alarm
- Warn affected personnel
- Follow the appropriate response for the alarm
- Investigate and (if possible) correct the cause of the alarm
- Reset the alarm
- Document on a Radiological Problem Report (RPR).

The area Health Physics supervisor and Facility Management shall promptly be notified of all alarms and causes at the time of occurrence and when the alarm clears. An RPR (form A-7600-318) should be used to document any alarm deficiencies.

In multiple alarm situations, the cognizant HP supervisor and facility management shall establish priorities for corrective action within 24 hours.

4.4 TANK PRESSURE INCREASES

The action limit for the organic Watch List tanks is a pressure < 1 in. w.g. minus the waste height (in. w.g.) not to exceed -9 in. w.g. in the vapor space. If this requirement is violated, the system shall be restored within one shift to within the requirement. Immediate recovery actions may include adjustment of the air-inleakage to actively ventilated tanks under the direction of the shift manager.

5.0 REFERENCES

- Beitel, G. A., 1976, *Final Report on Investigation of Stability of Organic Materials in Salt Cake*, ARH-LD-126, Atlantic Richfield Hanford Company, Richland, Washington.
- Borsheim, G. L., and N. W. Kirch, 1992, *Summary of Single-Shell Waste Tank Stability*, WHC-EP-0347, Westinghouse Hanford Company, Richland, Washington.
- Boyles, V. C., 1989, *Safety Analysis Report - Stabilization of Single-Shell Waste Storage Tanks by Salt Well Jet Pumping*, WHC-SD-WM-SAR-034, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- DOE, 1979, *Occurrence Reporting and Processing of Operation Information*, DOE Order 5000.3A, U.S. Department of Energy, Washington, D.C.
- DOE, 1981, *Environmental Protection, Safety and Health Protection Reporting Requirements*, DOE Order 5484.1, U.S. Department of Energy, Washington, D.C.
- DOE, 1983, *Safety Analysis and Review Systems*, DOE Order 5481.1, U.S. Department of Energy, Washington, D.C.
- DOE, 1988, *Environmental Protection, Safety and Health Protection Standards*, DOE Order 5480.1A, U.S. Department of Energy, Washington, D.C.
- DOE, 1989, *General Design Criteria for DOE Facilities*, DOE Order 6430.1A, U.S. Department of Energy, Washington, D.C.
- DOE, 1990, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Washington, D.C.

- DOE, 1991, *Quality Assurance*, DOE Order 5700.6C, U.S. Department of Energy, Washington, D.C.
- DOE, 1992, *Nuclear Safety Analysis Report*, DOE Order 5480.23, U.S. Department of Energy, Washington, D.C.
- Erickson, A., 1992, *Tank Farm Health and Safety Plan*, WHC-SD-WM-HSP-002, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Fisher, F. D., 1990, *The Kyshtym Explosion and Explosion Hazards with Nitrate-Nitrite Bearing Wastes with Acetate and Other Organic Salts*, WHC-SD-CP-LB-033, Rev. 0, Procedure GA-2.18, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Fowler, K., 1992, *Summary of Single-Shell Waste Tank Stability*, WHC-EP-0347, Supplement 2, Westinghouse Hanford Company, Richland, Washington.
- Hanlon, B. M., 1992, *Tank Farm Surveillance and Waste Tank Summary Report for November 1992*, WHC-EP-0182-56, Westinghouse Hanford Company, Richland, Washington.
- Jungfleisch, F. M., 1984, *Preliminary Estimates of the Waste in Hanford Tanks Through 1980*, SD-WM-TI-057, Rockwell Hanford Co., Richland, Washington.
- Public Law 101-510, *Safety Measures for Waste Tanks at Hanford Nuclear Reservation*, Section 3137.
- Schulz, W. W., 1980, *Removal of Radionuclides from Hanford Defense Waste Solutions*, RHO-SA-51, Rockwell Hanford Operations, Richland, Washington.
- Smith, D. A., 1986a, *Single-Shell Tank Isolation Safety Analysis Report*, WHC-SD-WM-SAR-006, Rev. 2, Westinghouse Hanford Company, Richland, Washington.
- Smith, D. A., 1986b, *Hazard Identification and Evaluation for Nonstabilized Single-Shell Tanks*, WHC-SD-WM-SAR-022, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- WHC, *Tank Farm Operating Procedures*, TO-060-015, Vol. 38, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1986, *Double-Shell Tank Farm Facility (241-AN, AP, AW, AY, AZ, and SY) Safety Analysis Report*, WHC-SD-WM-SAR-016, Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988, *Management Requirements and Procedures*, WHC-CM-1-3, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1989, *Westinghouse Hanford Company Emergency Plan*, WHC-CM-4-1, Westinghouse Hanford Company, Richland, Washington.

- WHC, 1990a, *Westinghouse Hanford Company Emergency Management Procedures*, WHC-CM-4-43, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990b, *Operating Specifications for Single-Shell Waste Storage Tanks*, OSD-T-151-00013, Rev. D-0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990c, "Interim Tank Farms Occurrence Reporting and Processing of Operations Information," *Tank Farms, Grout, and Solid Waste Management Administration Manual*, WHC-CM-5-7, Section 1.22, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990d, "Tank Farms Occurrence Reporting and Processing of Operations Information," *Management Requirements and Procedures*, WHC-CM-1-3, MRP 5.14, Rev. 5, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990e, "Waste Tank Anomaly Analysis and Reporting," *Operations - General Administration*, WHC-CM-5-5, Procedure Ga-2.18, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991, *SST Leak Emergency Response Guide*, WHC-SD-WM-AP-005, Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992a, *Obtain/Record Single-Shell Tank Temperatures*, TO-040-650, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992b, *Operating Specifications for Watch List Tanks*, OSD-T-151-00030, Rev. A-1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992c, *Health Physics Practices Manual*, WHC-CM-4-12, Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1993, *Radiological Control Manual*, WHC-CM-1-6, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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