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Sampling and Analysis Plan for Flammable Gases in Inactive Miscellaneous Underground Storage Tanks

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Hoke is a registered trademark of Hoke Incorporated Cresskill New Jersey

SUMMA is a registered trademark of Moletrics Incorporated Cleveland Ohio

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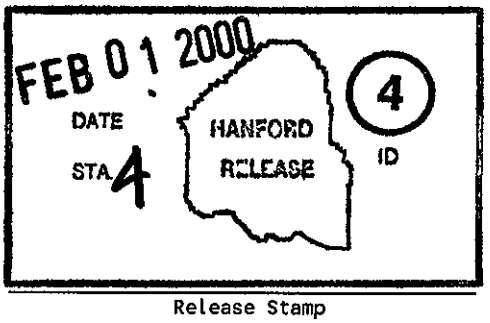

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SAMPLING AND ANALYSIS PLAN FOR FLAMMABLE GASES IN INACTIVE MISCELLANEOUS UNDERGROUND STORAGE TANKS

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CH2M HILL Hanford Group, Inc

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LIST OF TERMS

CGM	combustible gas meter
CHG	CH2M HILL Hanford Group, Inc
CPO	Characterization Project Operations
DOE-RL	U S Department of Energy, Richland Operations Office
DQO	data quality objective
IMUST	inactive miscellaneous underground storage tank
in	inches
LFL	lower flammability limit
HEPA	high-efficiency particulate air (filter)
LMHC	Lockheed Martin Hanford Corporation
PNNL	Pacific Northwest National Laboratory
QA	quality assurance
QC	quality control
RPP	River Protection Project
SAP	sampling and analysis plan
TVD	Tank Vapor Database
WSCF	Waste Sampling and Characterization Facility
%	percent

SAMPLING AND ANALYSIS PLAN FOR FLAMMABLE GASES IN INACTIVE MISCELLANEOUS UNDERGROUND STORAGE TANKS

1 0 SAMPLING AND ANALYSIS OBJECTIVES

This sampling and analysis plan (SAP) identifies the field measurements for a screening of flammable gases in the vapor space of the inactive miscellaneous underground storage tanks (IMUSTs) currently assigned to the River Protection Project (RPP) If a measurement exceeds 25% of the lower flammability limit (LFL), vapor grab samples will be collected for laboratory analysis This SAP also specifies the sample collection, laboratory analysis, quality assurance/quality control (QA/QC), and reporting objectives for grab sampling

Technical bases for the sampling objectives are provided in the *Tank Safety Screening Data Quality Objectives* (Dukelow et al 1995) The screening data will be used to determine if additional data are needed to support closure of a flammable gas unreviewed safety question for these facilities

2 0 BACKGROUND

The IMUSTs are by definition waste storage tanks that are (1) inactive, (2) located underground, (3) known to or potentially contain radioactive waste, and (4) not a principal feature of a major facility The IMUSTs associated with RPP range in volume from 50 gallons to 50,000 gallons They include catch tanks designed to receive spills in diversion boxes or pump pits, tanks used for neutralizing or treating waste, and other interim storage tanks associated with waste processing and transfers The wastes in most IMUSTs have never been sampled A number of these tanks have been isolated, and some may have been sealed

The IMUSTs assigned to RPP are listed in the Tank Waste Remediation System Final Safety Analysis Report (FSAR) (LHMC 1999b) The list includes 45 tanks, 25 of which have risers that are visible on the surface (Brevick 1998) Nineteen of the 25 tanks appear to have good access for vapor sampling (i e , they are not located in areas with significant clutter obstructing access) A brief discussion of these tanks is provided in Table 2-1

Prioritization for sampling the IMUSTs for flammable gas hazard has been performed (Estey 1998 and Hey 1998) Hey (1998) suggests that the nineteen tanks with easy access be sampled first "because these tanks appear to provide a distribution that should be characteristic of the remaining tanks " The need for sampling the remaining RPP IMUSTs will be evaluated based on the data obtained from these first tanks A tentative

sampling order based on the prioritization is also provided in Table 2-1 The order may change to accommodate field operations Ten tanks will be sampled this year if funding is available The remainder will be sampled in subsequent year(s) This SAP is applicable only to flammable gas sampling of the nineteen tanks

Table 2-1 River Protection Project Inactive Miscellaneous Underground Storage Tanks to Be Screened for Flammable Gases[1] (2 sheets)

Sampling Order	Tank Identification Number	Nominal Volume (gallon)	Potential Access To Tank Vapor Space
1	241 B-301	36,000	Four 12 in risers and four 4-in risers All capped with blind flanges
2	241-T-301	36,000	Four 12 in risers and one 4-in riser at ground level All capped with blind flanges
3	241-C-301	36,000	Four 12-in risers and four 4-in risers All capped with blind flanges
4	241-S-302	17,684	Two 4-in risers one capped with a blind flange and the other with a liquid level gauge on top
5	241-A-302B	13,500	Two 4-in risers one at ground level capped with a blind flange and the other with a liquid level gauge on top
6	240-S 302	17,684	One 4-in riser (liquid level gauge was removed in 1998)
7	241-TX-302	17,684	One 12-in and two 4-in risers All capped with blind flanges
8	200-W-7	550	Three 4-in risers one with threaded plug, one with screw cap, and one with breather filter
9	231-W-151-001	4,000	One 4-in and one 2-in risers Both capped with blind flanges
10	241-SX-302	17,684	One 12-in and two 4-in risers All capped with blind flanges
11	241-BX-302B	11,389	One 1-in and two 4-in risers All capped with blind flanges
12	241-BX-302C	11,378	One 12 in and two 4 in risers All capped with blind flanges
13	241 TX-302B	17,684	One 12 in and two 4 in risers All capped with blind flanges
14	241-Z-8	15,435	Two 4 in risers Both capped with

Table 2-1 River Protection Project Inactive Miscellaneous Underground Storage Tanks to Be Screened for Flammable Gases[1] (2 sheets)

Sampling Order	Tank Identification Number	Nominal Volume (gallon)	Potential Access To Tank Vapor Space
			blind flanges
15	241-BX-302	17,684	One 4-in and one 12-in riser Both capped with blind flanges
16	241-TY-302	17,684	One 12 in and two 4-in risers All capped with blind flanges
17	241-TX-302X	14,314	One 12-in and two 4-in risers All capped with blind flanges
18	241 S-302B	14,314	One 12-in and two 4 in risers All capped with blind flanges
19	241-TY-302B	14,314	One 12-in and two 4 in risers All capped with blind flanges

[1]Information taken from Hey (1998) and Brevick (1998)

3 0 SAMPLING EVENT REQUIREMENTS

Concentrations of flammable gases in the access riser and in the headspace of the IMUSTs will be measured using a combustible gas meter (CGM) If more extensive analyses are necessary, vapor grab samples will be taken using Hoke™ and SUMMA™ samplers[1]

The appropriate tank access point (e g , riser) and sample locations (i e , depths) within the vapor space will be determined during the planning phase Also, the sampling system must be purged to assure that the sample system tubing is filled only with gas from the headspace The required duration for purging depends on the length of the system tubing The RPP process engineer and the sampling cognizant engineer shall determine the tank access point, sample locations, and the appropriate purging duration for each IMUST The information shall be specified in the field work package

Three measurements of flammable gas concentration shall be obtained at each sampling location according to the following steps

Note *At any time during sampling if a combustible (flammable) gas level measurement exceeds 25% of the LFL Steps A1 through A11 will no longer apply If the measurement is taken from within the riser proceed with Steps B1 through B12 If the measurement is from within the tank headspace proceed with Steps C1 through C8 Also instead of restoring the tank access point to the initial condition when sampling is complete the tank access shall be reconfigured to allow ventilation of the flammable gas (e g installing a flange or bag with high-efficiency particulate air [HEPA] filter) if the tank has no known ventilation paths*

A1 Lower the sampling line approximately 1 foot into the selected riser

A2 Purge the sample line with gas in the riser using the CGM for the duration specified in the work package

A3 Measure the concentration of combustible gas and record the data as directed in the work package

A4 If flammable gas concentration in the riser is greater than 25% of the LFL, perform Steps B1 through B12

A5 Repeat Step A3 twice

A6 Lower the sampling line into the tank headspace to the depth specified in the work package

[1] Hoke and SUMMA are registered trademarks of Hoke Incorporated and Moletrics Inc respectively

A7 Purge the sample line with gas in the tank headspace using the CGM for the duration specified in the work package

A8 Measure the concentration of combustible gas using the CGM and record the data

A9 If flammable gas concentration in the tank headspace is greater than 25% of the LFL, perform Steps C1 through C8

A10 Repeat Step A8 twice

A11 Configure the assigned tank access point to the condition as specified in the work package

If the flammable gas level in the access riser as measured by a CGM exceeds 25% of the LFL, then perform the following steps

B1 Connect a Hoke™ sampler to the sampling line

B2 Purge the line through the Hoke™ sampler for the duration specified in the work package

B3 Obtain a Hoke™ sample

B4 Install particulate air filter(s) on the sample line

B5 Purge the sample line for the duration specified in the field work package

B6 Connect a SUMMA™/tritium trap assembly to the sample line and obtain a SUMMA™ sample

B7 Disconnect the SUMMA™/tritium trap assembly and the particulate air filter from the sample line

B8 Lower the sample line into the tank headspace to the depth specified in the work package

B9 Purge the sample line

B10 Measure the concentration of combustible gas using the CGM and record the data

B11 Repeat Steps B1 through B7

B12 If the tank has no known ventilation paths and if it is necessary to leave the open riser unattended, install a flange or bag with HEPA filter over the tank access point Otherwise, the tank access shall be reconfigured as directed by engineering

If the flammable gas concentration in the tank headspace exceeds 25%, then perform the following steps

C1 Connect a Hoke™ sampler to the sampling line

C2 Purge the line through the Hoke™ sampler for the duration specified in the field work package

C3 Obtain a Hoke™ sample

C4 Install particulate air filter(s) on the sample line

C5 Purge the sample line

C6 Connect a SUMMA™/tritium trap assembly to the sample line and obtain a SUMMA™ sample

C7 Disconnect the SUMMA™/tritium trap assembly and the particulate air filter from the sample line

C8 If the tank has no known ventilation paths and if it is necessary to leave the open riser unattended, install a flange or bag with HEPA filter over the tank access point Otherwise, the tank access shall be reconfigured as directed by engineering

If used, Hoke™ sample(s) shall be uniquely identified with the date, sequential numbers, and initials of the Industrial Hygiene and Safety (IH&S) technician Each SUMMA™ sample shall be uniquely identified according to the following format

VXXXXXXX-YY-LLLL

Where,

V indicates that the sample is a vapor sample

XXXXXXX indicates the tank number (e g , W151001 or 00000W7)

YY sequential numbers (e g , 01,02, 03, etc)

LLLL laboratory assigned code found on a tag attached to the SUMMA™ canister

Characterization Project Operations (CPO) shall initiate a chain-of-custody form for each tritium trap, Hoke™ or SUMMA™ sample collected The sample number and location (e g , riser and elevation) at which a sample was obtained shall be recorded Also, pertinent sampling information (e g , sampling problems) should be noted in the Comments section of the chain-of-custody form The samples shall be shipped to the appropriate laboratory in accordance with the Job Control System (JCS) work package

4 0 LABORATORY ANALYSIS REQUIREMENTS

Analytical requirements for the Hoke™ samples are specified in Table 4-1 The samples will be analyzed at the Pacific Northwest National Laboratory (PNNL) according to the procedure PNNL-98523-284 (current revision) (PNNL 1999a)

Table 4-1 Required Analysis for Hoke™ Samples

Carbon Monoxide	Oxygen
Carbon Dioxide	Methane
Hydrogen	Nitrogen
Argon	Nitrous Oxide
Helium	Other Nitrogen Oxides
	Ammonia (estimated)

If data from the Hoke™ sample indicate that more extensive analyses (e g , speciation of organic vapors) are needed, the SUMMA™ sample shall be analyzed at the Waste Sampling and Characterization Facility (WSCF) for components listed in Table 4-2 Organic analysis shall be performed per analytical procedure LA-523-404 Radiation screening of particulate filters shall be performed according procedures LA-548-421 for total alpha, LA-508-415 for total beta, and LA-508-462 for gamma emitters Tritium concentration in tritium traps shall be determined per LA-548-411 and LA-508-421

It is anticipated that PNNL will analyze Hoke™ samples and WSCF will analyze SUMMA™ samples In addition to these laboratories, other qualified laboratories may be selected by RPP Process Engineering to analyze the samples as necessary All laboratories shall meet all the QA/QC requirements in this SAP

Table 4-2 Analytical Methods and Laboratory Quality Control Requirements for SUMMA™ Samples (2 Sheets)

Analyte	Suggested Analytical Method	VPRQL[1] (ppbv)	Precision (%RSD or %RPD)[2]	Accuracy (% Recovery)
Freon 12	GC/MS[5]	5 0	25	70 to 130
Methyl chloride	GC/MS[5]	5 0	25	70 to 130
n-Butane	GC/MS[5]	5 0	25	70 to 130
Ethyl chloride	GC/MS[5]	5 0	25	70 to 130
Ethanol	GC/MS[5]	5 0	25	70 to 130
Freon 11	GC/MS[5]	5 0	25	70 to 130
Acetonitrile	GC/MS[5]	5 0	25	70 to 130
Acetone	GC/MS[5]	5 0	25	70 to 130
Furan	GC/MS[5]	5 0	25	70 to 130
n-Pentane	GC/MS[5]	5 0	25	70 to 130
2-Propanol	GC/MS[5]	5 0	25	70 to 130
Dichloromethane	GC/MS[5]	5 0	25	70 to 130
1-Propanol	GC/MS[5]	5 0	25	70 to 130
2-Methyl-pentane	GC/MS[5]	5 0	25	70 to 130
Propanenitrile	GC/MS[5]	5 0	25	70 to 130
Butanal	GC/MS[5]	5 0	25	70 to 130
1-Hexene	GC/MS[5]	5 0	25	70 to 130
2-Butanone	GC/MS[5]	5 0	25	70 to 130
n-Hexane	GC/MS[5]	5 0	25	70 to 130
Chloroform	GC/MS[5]	5 0	25	70 to 130
Tetrahydrofuran	GC/MS[5]	5 0	25	70 to 130
1-Butanol	GC/MS[5]	5 0	25	70 to 130
Benzene	GC/MS[5]	5 0	25	70 to 130
Carbon tetrachloride	GC/MS[5]	5 0	25	70 to 130
Butanenitrile	GC/MS[5]	5 0	25	70 to 130
3-Methyl-hexane	GC/MS[5]	5 0	25	70 to 130
2-Pentanone	GC/MS[5]	5 0	25	70 to 130
n-Heptane	GC/MS[5]	5 0	25	70 to 130
1,4-Dioxane	GC/MS[5]	5 0	25	70 to 130
4-Methyl-2-pentanone	GC/MS[5]	5 0	25	70 to 130
Toluene	GC/MS[5]	5 0	25	70 to 130
2-Hexanone	GC/MS[5]	5 0	25	70 to 130
n-Octane	GC/MS[5]	5 0	25	70 to 130
Tetrachloroethylene	GC/MS[5]	5 0	25	70 to 130
Chlorobenzene	GC/MS[5]	5 0	25	70 to 130
Ethylbenzene	GC/MS[5]	5 0	25	70 to 130
m,p-Xylene	GC/MS[5]	5 0	25	70 to 130
3-Heptanone	GC/MS[5]	5 0	25	70 to 130
2-Heptanone	GC/MS[5]	5 0	25	70 to 130

Table 4-2 Analytical Methods and Laboratory Quality Control Requirements for SUMMA™ Samples (2 Sheets)

Analyte	Suggested Analytical Method	VPRQL[1] (ppbv)	Precision (%RSD or %RPD)[2]	Accuracy (% Recovery)
Cyclohexanone	GC/MS[5]	5 0	25	70 to 130
Styrene	GC/MS[5]	5 0	25	70 to 130
n-Nonane	GC/MS[5]	5 0	25	70 to 130
o-Xylene	GC/MS[5]	5 0	25	70 to 130
1,1,2,2-Tetrachloroethane	GC/MS[5]	5 0	25	70 to 130
2-Octanone	GC/MS[5]	5 0	25	70 to 130
n-Decane	GC/MS[5]	5 0	25	70 to 130
1,2,4-Trimethylbenzene	GC/MS[5]	5 0	25	70 to 130

Notes
[1]VPRQL Vapor Program Required Quantitation Limit
[2]RSD Relative Standard Deviation RPD Relative Percent Difference
[3]GC Gas Chromatography
[4]IC Ion Chromatography
[5]GC/MS Gas Chromatography/Mass Spectrometry

Analytical instruments shall be calibrated and maintained according to laboratory procedure(s) or manufacturer s recommendation Only laboratory-approved procedures shall be used for analysis Personnel performing the analyses shall be appropriately trained for their assigned tasks Calibration, maintenance, and training records shall be available for review when requested by RPP Process Engineering

Traceability of the grab samples (Hoke™ and SUMMA™) shall be maintained through field chain of-custody and sample shipping/receiving documentation Laboratory chain of-custody and/or operating log shall be used to establish traceability for every sample (and sub-sample) undergoing analysis These records shall also be available upon request

5 0 QUALITY ASSURANCE

All sampling and analysis activities shall be performed in accordance with the QA/QC requirements specified in Sections 3 0 and 4 0 Data resulting from activities and conditions that do not conform to requirements specified in this SAP or references herein shall be controlled to prevent inadvertent use or flagged with appropriate cautions Nonconforming sampling and analysis processes and information shall be identified, controlled, reported, and dispositioned as required by *Nonconforming Item Reporting and Control* (CHG 1999)

Laboratories performing analyses in support of this SAP shall have approved and implemented quality assurance project plans These QA plans shall meet the *Hanford*

Analytical Services Quality Assurance Requirements Document (DOE-RL 1998) minimum requirements for laboratory quality systems The *PNNL QA Program for Conducting Analytical Work in Support of Regulatory Programs* (PNNL 1999b) and the *Waste Sampling and Characterization Facility Quality Assurance Program Plan* (Meznarich 1999) specify the requirements for assuring the quality of sample analysis at PNNL and WSCF, respectively

Quality control requirements shall be consistent with the specified analytical procedures and QA plans The laboratories shall use calibration and calibration check standards appropriate for the analytical instrumentation being used (see DOE RL 1998 for definitions of QC samples and standards) The criteria presented are goals for demonstrating reliable method performance It is understood that the laboratories will follow established internal protocols for addressing QC failures If sample QC failures occur or if some analyses cannot be performed (e g , because of insufficient sample or of matrix interference), analysts shall consult with RPP Process Engineering to determine the proper action The performing laboratory should provide a suggested course of action at that time All sample QC failures and limitations on the associated data shall be discussed in the narrative of the data report Proper notification of all data not meeting QC requirements shall be included with the data

6 0 EXCEPTIONS, CLARIFICATIONS, AND ASSUMPTIONS

The Tank Safety Screening Data Quality Objective (DQO) (Dukelow et al 1995) addresses three potential safety issues ferrocyanide and organics, criticality, and flammable gas Only the flammable gas objectives are applicable to this data collection activity

The DQO specifies that comparisons with the threshold value (i e , 25% LFL) be made using one-sided 95% confidence level Based on this requirement, the minimum number of needed measurements can be calculated if the mean concentration and the associated variance (a measure of the spatial variability of combustible gas in the headspace) are known However, historical data are not available to estimate the mean percent LFL and the associated variance Three measurements of combustible gas level in a tank are specified for this initial screening This number of measurements is adequate for a statistical analysis of the data and provides a contingency in the event one of the measurements must be discarded

The DQO states that "if combustible gas meter analysis results in >10% LFL, then a Type 3 or Type 4 vapor sample must be taken and analyzed to address the flammability issue " Type 3 and Type 4 vapor samplers are not available at this time, and the >10% LFL criteria is considered too conservative For this sampling activity, if a combustible gas meter reading exceeds 25% of the LFL, Hoke™ and SUMMA™ samples will be collected for laboratory analysis This level is consistent with the flammable gas limit specified in the Tank Waste Remediation Technical Safety Requirements (LMHC 1999a) Data obtained from the Hoke™ and SUMMA™ samples are equivalent to those obtained with the Type 3 and Type 4 vapor samplers

Both Hoke™ and SUMMA™ are collected because data that can be obtained from a Hoke™ sample are limited but may be available shortly after sampling, SUMMA™ data are more complete but may not be available in time to support an immediate response to a discovery of a flammable atmosphere The Hoke™ samples can be analyzed quickly for gases and vapors shown in Table 4-1 The data will also be used to determine whether or not analysis of the SUMMA™ samples is necessary

If more extensive analyses are needed (e g , speciation of organic chemicals), the SUMMA™ samples shall be analyzed for species shown in Table 4-2 Prior to shipping SUMMA™ samples to WSCF for analysis, the tritium traps and particulate air filters must be sent to the laboratory for radiation screening Radiation Protection uses the data to determine whether or not the SUMMA™ samples can be accepted at WSCF If the radiation level is acceptably low, the SUMMA™ samples are then released to the laboratory for analysis This screening process typically takes several days to complete

7 0 ORGANIZATION

The organization and responsibility of key personnel involved in this sampling and analysis activity are shown in Table 7 1

Table 7-1 Key Personnel for Sampling and Analysis of Inactive Miscellaneous Underground Storage Tanks

Responsibility	Organization	Individual
Manager, Inventory Control and Modeling	RPP Process Engineering	K M Hodgson, 373-3513
Technical Lead for IMUST Vapor Sampling	RPP Process Engineering	D M Nguyen, 372-3042 (fax 373-4641)
Field Sampling Cognizant Engineer	Characterization Field Engineering	D D Wanner, 373-3297
Laboratory Analysis	WSCF	K L Powell, 372-3909
	PNNL	J W Brothers, 375-2396
Field Sampling	Characterization Project Operations	J F Sickels, 373-0259
Safety Issue Resolution point of contact	Safety Issue Resolution	G D Johnson, 373 1324
On-Call Process Engineer	RPP Process Engineer	On-Call Process Engineer, Pager 85-9654
Tank Farms point of contact	Tank Farm Operations	Double-Shell Tank Farm Operations shift manager, 373-2689

8 0 DATA REPORTING AND DELIVERABLES

If a CGM reading exceeds 25% of the LFL, CPO shall immediately notify, via telephone, the Tank Farm Operations shift manager and/or the on call process engineer CPO shall provide electronic notification to the Tank Farm Operations shift manager, the Inventory Control and Modeling Manager, the technical lead for IMUST vapor sampling, and the Safety Issue Resolution point-of-contact as soon as practical At a minimum, the electronic notification shall include the following information

- The measured flammable gas concentration (in %LFL),
- The identification of the IMUST,
- The location of the measurements (e g , riser and elevation),
- The final configurations of the tank access point (e g , whether or not a breather filter installed)

Hard copies of all field measurements shall be forwarded to the IMUST sampling technical lead within one week whether or not flammable gas concentration exceeds 25% of the LFL

The analytical laboratory for Hoke™ samples shall provide preliminary data via electronic mail to the technical lead for IMUST vapor sampling within two working days after the samples are received at the laboratory unless otherwise requested Final reviewed data shall be transmitted formally within two week of receiving the sample(s) The final report shall contain the following information at a minimum

- Sample identification,
- All analytical results,
- Estimate of analytical precision, and
- The analytical procedure used

The analytical laboratory for SUMMA™ samples shall provide preliminary data via electronic mail to the technical lead for IMUST vapor sampling within three weeks after the samples are received at the laboratory The final data package shall be completed within ten weeks after sample receipt The final report shall contain the following information at a minimum

- Sample identification,
- A brief discussion of the sample preparation, analysis, and quality assurance/quality control measures,
- Concentrations of target analytes for each sample,

- Quality control data to document achieved precision and accuracy,
- Appropriate required quantitation limit (RQL) if analyte is not detected, and
- Discussion of applicable analytical issues or data anomaly, resolution of each issue/anomaly and the impact on the data

IMUST vapor sampling and analytical results shall be entered into the Tank Vapor Database (TVD) CGM results shall be entered from field documents Each data report/package for a Hoke™ or a SUMMA™ sample shall be accompanied by an electronic version The electronic version shall be in the standard electronic format specified in Bobrowski and Simonen (1999) The data shall be entered into the TVD and be available for viewing within 14 days after the data is received by RPP Process Engineering

9 0 CHANGE CONTROL

All significant changes to the sampling, analysis, or QA/QC requirements in this SAP shall be documented by RPP Process Engineering in an engineering change notice or a letter All such changes shall be clearly documented in the final data report Minor changes may be documented by placing a notation in the appropriate permanent record (e g , memorandum to file) The determination whether or not a change is significant shall be made by the technical lead for IMUST vapor sampling

10 0 SAFETY CONSIDERATONS

The RPP IMUSTs potentially contain hazardous chemicals, radionuclides, and flammable gases Hazards to the workers due to radiation and hazardous chemicals shall be monitored and controlled during sampling as required by Radiation Protection and Industrial Health and Safety requirements Because most IMUSTs have been isolated and some may even have been sealed, flammable gases may exist at significant concentrations It is prudent to proceed with the sampling under the assumption that a flammable atmosphere may be present in a tank with no known ventilation paths

11 0 REFERENCES

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