Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

AUG 19 1996

96-WSD-161

Mr. John T. Conway, Chairman
Defense Nuclear Facilities Safety Board
625 Indiana, Ave, N.W. Suite 700
Washington, D.C. 20004

Dear Mr. Conway:

TRANSMITTAL OF INFORMATION TO COMPLETE MILESTONE 5.4.3.5.B

Transmitted with this letter is the document that constitutes the information for completion of Milestone 5.4.3.5.b, as specified in Revision 1 of the Recommendation 93-5 Implementation Plan (IP). This milestone, scheduled for completion in August 1996, is described in the IP as "Letter reporting evaluation of gas monitoring instrumentation upgrade needs for additional tanks with the potential to exceed 25% of the Lower Flammability Limit (LFL)..."

In the IP, the discussion for the Flammable Gas Safety Issue states that an evaluation to determine instrumentation upgrade requirements for any additional flammable gas tanks will be made. This evaluation was accomplished following the assessment of 177 tanks to determine their potential to generate and release flammable gas.

The evaluation for instrumentation requirements is contained in the attached letter. The U.S. Department of Energy, Richland Operations Office (RL), has reviewed this letter and concurs with its recommendations. This review occurred in parallel with the development of the "Report Documenting Analysis to Determine if Additional Tanks Have Potential to exceed 25% of the LFL," IP 93-5, Revision 1, Milestone 5.4.3.5.a, which was submitted to you on June 28, 1996. Section 11, Recommendation 5 of the above mentioned report reads: "Identify specific single-shell tanks (in addition to the ones in the current group of Flammable Gas Watch List Tanks) which offer the best opportunity to understand steady state and minor episodic releases of flammable gas and install instrumentation that will continuously monitor the evolution of flammable gases." The evaluation for additional monitoring identified the need to install Standard Hydrogen Monitoring Systems on 17 additional tanks. Installation of these units, ten on single-shell tanks and seven on double-shell tanks, is scheduled for completion by October 1997.

If you have any questions, please contact me or you may contact Jim McClusky on (509) 372-0947.

Sincerely,

John D. Wagoner
Manager

WSD:CAG

Attachment

cc w/attach:
A. Alm, EM-1
R. Guimond, EM-2
J. Tseng, EM-4
S. Cowan, EM-30
M. Hunemuller, EM-38
M. Mikolanis, S-3.1
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S. Trine, RL DNFSB Liaison

Westinghouse
Hanford Company

96/3339

P.O. Box 1970 Richland, WA 99352

May 31, 1996

9651817

Dr. M. F. Jarvis, Project Director
Safety Issue Resolution Projects
U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

Dear Dr. Jarvis:

FLAMMABLE GAS PROGRAM: STRATEGY FOR CONTINUOUS GAS MONITORING

Reference: *Recommendation 93-5 Implementation Plan, Revision 1*, DOE/RL-94-0001, (May 1996 Final Draft), U.S Department of Energy, Richland Operations Office, Richland, Washington.

Attached is the letter report, "Strategy for Continuous Gas Monitoring." This report describes a technical basis and plan for installing additional gas monitoring systems for characterization of the Hanford Site high-level waste tanks with the potential for spontaneous or acute gas releases, or gas accumulation, as a result of near-term waste transfers, retrieval, saltwell pumping, and sluicing operations. Both the types of gas monitoring systems to be utilized and the tanks to be monitored are included in the report. This letter and attachment are intended to fulfill the commitment to provide a "Letter reporting evaluation of gas monitoring instrumentation upgrade needs for additional tanks with the potential to exceed 25% of the lower flammability limit," as established by Milestone 5.4.3.5.b in the reference document. To close the commitment, the Department of Energy, Richland Operations Office (RL) should forward the report to the Defense Nuclear Facilities Safety Board by August 31, 1996.

Westinghouse Hanford Company (WHC) is currently developing a new methodology and risk-based criteria for determining which tanks could exceed flammable gas limits. This process will probably not be completed and approved by RL until September 1996.

Because of the desirability to acquire gas characterization information in a timely manner, WHC is proceeding to design, fabricate, and install the gas monitors identified in the attached report on the indicated schedule, utilizing funds allocated in the Multi-Year Program Plan for the Safety Issue Resolution Project. As described in the attachment, some judgement has been exercised in determining which tanks will be monitored, pending implementation of the above referenced flammable gas methodology and criteria. Only those tanks with a high likelihood of requiring monitors have been selected. Upon completion and approval of the flammable gas methodology and criteria, and the justification for continued operation for

flammable gas tanks, this gas monitoring strategy will be reevaluated to assure that the correct monitoring systems and tanks are included.

Please address any questions to Dr. Jack W. Lentsch on 373-5252.

Very truly yours,

R. J. Cash, Manager
Safety Issue Resolution
TWRS Technical Basis
Tank Waste Remediation System

pll

Attachment

RL - C. A. Groendyke
J. M. McClusky
J. C. Peschong
A. H. Wirkkala (w/o Attachments)

9651817

ATTACHMENT

STRATEGY FOR CONTINUOUS GAS MONITORING

Consisting of 7 pages
including cover page

STRATEGY FOR CONTINUOUS GAS MONITORING

This report describes a strategy for characterization of gases in flammable gas tanks. This strategy was developed by Westinghouse Hanford Company (WHC), Pacific Northwest National Laboratory (PNNL), and Los Alamos National Laboratory (LANL) safety program, engineering, and operations personnel. This strategy provides a technical basis for installing additional continuous gas monitoring systems on the flammable gas tanks.

A value engineering study for flammable gas tank monitoring was conducted in February 1996 (Reference 1). This study identified two important purposes for flammable gas monitoring:

- Controls for operational safety
- Characterization for preparation of safety analysis documents

Gas monitoring is driven, in part, by commitments of the Flammable Gas Safety Issue Resolution Project, including TPA Milestones M-40-10, -40-09, and -40-000, for vapor monitoring, unreviewed safety question (USQ) closure, and safety issue resolution, respectively.

The value engineering study recommended the following:

1. Continue monitoring the current 25 flammable gas Watch List tanks with the standard hydrogen monitoring systems (SHMS) already installed on these tanks.

2. Install additional SHMS on tanks meeting revised criteria for potential high levels of flammable gas release.

3. Provide advanced gas characterization systems on approximately 3 double-shell and 3 single-shell flammable gas tanks, to provide wide-range sensitivity for multiple gas species of interest.

4. Install the additional monitors by early 1997, and continue monitoring until it has been established that the monitors are no longer needed.

Other recommendations from the value engineering study included data recording, centralized data management, and cost minimization.

Based on these value engineering recommendations, and follow-on discussions between WHC, LANL, and PNNL, this plan for future continuous gas monitoring was prepared. This plan encompasses monitoring for both operational safety and for safety assessment needs.

The primary function of the continuous gas monitors addressed here is to determine dome gas composition and gas release rate, and to detect gas release events. Characterization of the gas composition is needed for safety analyses. The lower flammability limit (LFL), as well as the peak burn temperature and pressure, are dependent upon the composition. If there is no, or little, knowledge about the gas composition, safety analyses utilize compositions that yield the worst case in a deflagration or detonation. Gas composition is also needed to assess the toxic effects of waste gas releases, and to design ventilation and stack monitoring systems. Knowledge of the gas composition could lead to a reduction in excessively conservative work controls. Also, knowledge of the actual composition will be required information for the analysis that is needed to close the USQ, and to resolve the safety issue. Gas composition from tank dome space gas monitoring must also consider waste gas composition, such as determined by the retained gas sampling system and gas composition can vary between steady state and acute release or gas release events.

Similarly, the rate of generation and release of gases is required information for performing safety analyses, developing controls, designing equipment, and closing safety issues. To determine release rate, both the gas concentrations and the dome space ventilation rates (exhauster flow rate or passive dome/atmosphere exchange rate) are needed. Separate work is currently underway to determine the degree of mixing in the tank domes.

Several factors are important for evaluating which tanks need additional continuous gas monitoring and detailed gas characterization for operational safety and for safety assessment. These factors include: known high gas concentration in the dome space, high response to changes in barometric pressure (dL/dP), high level growth, the need to saltwell pump, high waste temperature, high waste volume, waste type diversity, overlapping safety issues, and operations/project needs.

New continuous monitoring should be limited to those tanks with the higher potential gas release, pending development and application of new criteria and JCO approval. The basis for monitoring was calculated based on the probability of exceedence of the LFL. The analysis presented in Reference 3 showed which tanks had the highest probability to exceed the LFL in a postulated GRE. There were 24 tanks which might exceed 100% of the LFL with 99th percentile confidence. To a very rough approximation, this translates into a 10^{-2} probability of exceeding the LFL if a gas release were to occur.

Table 1 provides a summary of the recent flammable gas screening for all 177 high level waste tanks (Reference 3). In this table, the tanks are ranked by potential for maximum dome space gas concentration. The original screening methodology was used (Reference 2). However, only the 24 tanks with the potential to exceed 100 % of the LFL were selected here as having a serious potential for release. Additional monitors would be required if the original screening criteria of 25 % of the LFL was used, since there are 52 tanks meeting that criteria. On the other hand, new screening methodology and criteria are under development that use a risk-based approach, which might

reduce the number of tanks to be monitored. A report is also under preparation by the Department of Energy review team for "Analysis of the Flammable Gas Situation in the Hanford Site tanks," Chaired by Donald L. Vieth.

Also shown in Table 1 are the double shell tanks that will be used for receiving waste from salt well pumping of the single shell tanks, for sluicing of tank 241-C-106, and for the aging waste tanks.

In Table 1, of the 24 tanks potentially exceeding 100% of the LFL, 13 are already on the Watch List and already have SHMS installed. Four of the double shell tanks (241-SY-101, 241-AW-101, 241-AN-105, and 241-AN-104) already have augmented gas characterization capability installed; these tanks have had gas release events close to or exceeding 25% of the LFL, and have already received increased monitoring attention. Another double shell tank, 241-AN-107, is expected to be removed from the list after void fraction measurements are performed, and does not warrant a gas monitor at this time.

Of the tanks listed in Table 1, 15 will be salt well pumped on the tentative schedule shown on the table. The salt well flammable gas interlock system lacks adequate sensitivity and specificity to be useful for gas characterization; therefore, additional gas monitoring capability is required.

In addition, all 3 of the double shell tanks for receiving salt well waste will need gas monitoring to satisfy safety controls and resolve uncertainties in the safety assessments. The monitors also support Project W-211 waste retrieval.

To support the Project W-320 sluicing of tank 241-C-106 to tank 241-AY-102, gas monitoring is required for both tanks.

In addition to tank 241-AY-102, the other three aging waste tanks with high gas generation potential will be provided with gas monitors. These monitors support both Projects W-030 ventilation upgrades and Project W-151 mixing tests (although the timing of the monitors may not coincide with Project start-up dates).

There is uncertainty in the schedule for salt well pumping. It is also not certain which tanks will need ventilation exhausters installed for flammable gas control during salt well pumping. Therefore, a flexible gas monitoring system is needed that can be expanded to measure gas compositions at both high and low sensitivities. For these reasons, a modified version of the SHMS (entitled SHMS-E or -E+) is proposed for the new gas monitoring. The SHMS-E will be similar to the current system, with modular, expandable characterization capabilities, as follows:

SHMS-E Basic Design Features:

- Dual Whitaker electrochemical cells to measure high hydrogen concentrations in the range of 2000-100,000 ppm.
- Grab sample capability
- Digital data logging plus Tank Monitoring and Control System (TMACS) connection

SHMS-E+ Additional (expandable) Design Features:

- Gas chromatograph to measure low hydrogen concentrations, nitrous oxide, and methane concentrations
- Photoacoustic monitor to measure ammonia and methane concentrations
- Network data transmission/archiving capabilities
- Tracer gas injection, sampling, and possibly analysis capability for dome ventilation rate measurement.

The SHMS-E has the same basic cabinet, wiring, tubing, and layout design as SHMS-E+, but will not have the gas chromatograph, photoacoustic, and associated computers installed. They may be installed in the future, if needed, as "plug-in" features.

The SHMS-E+ will measure gas concentrations in selectable ranges of approximately:

Hydrogen:3-100,000 ppm
Nitrous Oxide:10-10,000 ppm
Ammonia:10-10,000 ppm
Methane:10-4,000 ppm.

These concentration ranges are needed to measure the expected range of gas concentration, both with and without tank ventilation.

Where practicable, temporary installations of monitoring cabinets and power supplies will be utilized to reduce costs and expedite schedules. Similarly, to reduce the long-term mortgage, these monitoring systems will be removed or relocated to other tanks as soon as practicable, when adequate characterization has been completed, or when there is no longer an operational need, and legal obligations (Wyden Bill) have been fulfilled.

In addition to the new SHMS installation design, five of the currently installed SHMS will be modified to solve a problem with condensation that has caused operational problems. This will be done by sample inlet moisture reduction, and possible flow reduction and probe redesign. This redesign will also be used on several of the additional SHMS that are installed on tanks with high vapor temperatures. Also, digital data logging will be provided for all SHMS.

Of the tanks in Table 1, the need for gas characterization is prioritized according to which tanks have the highest potential gas concentrations and then by which tanks will be salt well pumped first. Because of waste similarity, only one of the more expensive SHMS-E+ is proposed for each tank farm (except for U-Farm). By these criteria, the following tanks should receive full-feature SHMS-E+ gas characterization systems to maximize the value of measurements before, during, and after salt well pumping:

A-101*	SX-103*
BY-105	U-103*
S-106	U-105*

(* these tanks currently have a SHMS installed)

In addition, the following additional tanks should receive new basic SHMS-E units:

S-109	AY-101
TX-112	AZ-101
U-102	AZ-102
AN-101	SY-102
AP-104	

The following tanks should receive SHMS that are displaced by the new SHMS-E+ units shown above by *:

S-101
S-107
T-201
AW-104

The following tanks for tank 106-C sluicing should receive a spare SHMS (2 currently available) with an MTI gas chromatograph:

C-106
AY-102

The SHMS currently installed on the following tanks will remain in service:

AX-101	T-110
AX-103	U-107
BY-103	U-108
BY-106	U-109
BY-109	AN-103
S-102	AN-104
S-111	AN-105
S-112	AN-Farm Stack
SX-101	AW-101
SX-102	AW-Farm Stack
SX-102	SY-101
SX-104	SY-103
SX-105	

SX-106
SX-109

By this approach, 6 new full-feature SHMS-E+ systems, and 9 new basic SHMS-E systems need to be fabricated and installed. Also, two current SHMS spares need to be backfit with MTI gas chromatographs and installed. Four current SHMS that are displaced by the SHMS-E+ would be relocated to the four tanks shown in the attached table with the lower potential gas release of the tanks shown. Twenty-six current SHMS will remain in-service.

In total, 45 tanks (11 double-shell tanks and 34 single-shell tanks) will have continuous gas monitoring systems. This includes all of the current 25 Watch List tanks.

As part of the FY 1997 Multi-Year Work Program Plan planning process, WHC is currently evaluating the need to provide gas monitors on all of the double-shell tanks, in conjunction with the designs and controls for the active ventilation systems for these tanks, and characterization needs. One possible approach to controlling costs would be to install sample probes in each remaining double-shell tank, together with a couple of cart-mounted SHMS-E+ systems that could be moved from tank to tank.

References:

1. Lentsch, J. W., R. N. Stemen, and R. A. Harrington, "Flammable Gas Tank Monitoring Value Engineering Report", ICF Kaiser Hanford Company, Richland, Washington, February, 1996.

2. Hopkins, J. D. "Criteria for Flammable Gas Watch List Tanks, WHC-CP-0702, Westinghouse Hanford Company, Richland, Washington, 1994.

3. Hodgson, K. M., "Evaluation of Hanford Tanks for Trapped Gas", WHC-SD-WM-ER-526, Rev. 1, Westinghouse Hanford Company, Richland, Washington, 1996.

Table 1

Flammable Gas Tanks And Monitors

Tank ID	Max.% LFL	Approximate Salt Well Pumping or Project Start	Current Gas Monitor	Proposed New Gas Monitor and Approximate Need Date
101-SY	825	NA	GMS, SHMS	
105-AN	743	NA	GCS, SHMS	
104-AN	503	NA	SHMS (MTI)	
101-A	379	9/96	SHMS	SHMS-E+ 9/96
103-AN	334	NA	SHMS	
105-U	270	9/97	SHMS	SHMS-E+ 6/97
101-AW	232	NA	GCS, SHMS	
102-S	226	2/98	SHMS	
106-S	223	4/97		SHMS-E+ 1/97
103-SX	216	5/97	SHMS	SHMS-E+ 2/97
102-U	203	10/97		SHMS-E 6/97
112-TX	195	NA		SHMS-E 6/97
111-S	181	11/97	SHMS	
108-U	179 (301SS)	7/97	SHMS	
103-U	161	9/97	SHMS	SHMS-E+ 6/97
109-S	145	11/96		SHMS-E 11/96
105-SY	145	6/97		SHMS-E 3/97
107-S	138	5/99		SHMS 6/97
104-AW	134	NA		SHMS 6/97
106-SY	123	12/96	SHMS	
201-T	121	NA		SHMS 6/97
109-U	118	8/97	SHMS	
107-AN	113	NA		NA
101-S	109	3/97		SHMS 1/97
101-AN*	NA	9/96		SHMS-E 9/96
104-AP*	NA			SHMS-E 6/97
102-SY*	NA	1/97		SHMS-E 1/97
106-C**	NA	10/96		SHMS (MTI) 7/96
102-AY**#	NA	10/96		SHMS (MTI) 7/96
101-AY#	NA	12/96		SHMS-E 12/96
101-AZ#	NA	12/96		SHMS-E 12/96
102-AZ#	NA	12/96		SHMS 12/96

GMS - Gas Monitoring System
GSC - Gas Characterization System
MTI - Gas Chromatograph
SHMS - Standard Hydrogen Monitoring System
#Aging waste tanks
SHMS-E -Basic expandable SHMS
SHMS-E+ - Full feature expandable SHMS
*Double-shell receiver tanks for saltwell pumping
**For C-106 sluicing/receiving