27

Hanford Tank Safety Project

Minutes of the Tank Waste Science Panel Meeting June 26-27, 1990

February 1991

Work Supported by the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

PACIFIC NORTHWEST LABORATORY
operated by
BATTELLE MEMORIAL INSTITUTE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RLO 1830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401. FTS 626-8401.

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.

On the cover:

An aerial photograph of the SY waste tank farm under construction (circa 1975) on the Hanford site in southeastern Washington State. Tank 241-SY-101 is the tank in the foreground to the right.

**Minutes of the
Tank Waste Science Panel Meeting
June 26-27, 1990**

Compiled by
D. M. Strachan
L. G. Morgan

February 1991

Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Richland, Washington 99352

Summary

Members of the Tank Waste Science Panel met June 26-27, 1990, to discuss physical and chemical processes that could be responsible for episodic gas release events in tank 241-101-SY (commonly denoted tank 101-SY). Historical information regarding safety issues of tank 101-SY was presented along with existing technical information.

Science Panel members agreed that the temperature profile just prior to a gas release suggests that either the high solids content or the density in the bottom layer of waste tends to trap gases generated in this layer until buoyancy forces cause the gas to begin moving. The crust is thought to provide only minimal resistance for the passage of the gas released from the bottom of the tank. Insufficient data were available to endorse any suggested mechanism for chemical evolution of H_2 in the tank.

Science Panel members made numerous recommendations for monitoring the tank, sampling gases in the tank vent, taking core samples, and performing analyses. They also recommended performance of experiments to develop a fundamental understanding of the chemical processes involved and to determine the source of the H_2 and N_2O gases.

Contents

SUMMARY	iii
INTRODUCTION	1
PHYSICAL PROCESSES	1
CHEMICAL PROCESSES	2
SUGGESTED MEASUREMENTS	3
LABORATORY EXPERIMENTS	4
SCIENCE PANEL REPORT	4
REFERENCES	4
ATTACHMENT A - AGENDA	A.1
ATTACHMENT B - TANK WASTE SCIENCE PANEL MEMBERS	B.1
ATTACHMENT C - OTHER INVITED WHC AND PNL STAFF ATTENDING	C.1
ATTACHMENT D - DOCUMENTS GIVEN TO TANK WASTE SCIENCE PANEL MEMBERS ..	D.1
ATTACHMENT E - PRESENTATION MATERIALS FROM T. H. DUNNING	E.1
ATTACHMENT F - PRESENTATION MATERIALS FROM G. D. JOHNSON	F.1
ATTACHMENT G - PRESENTATION MATERIALS FROM D. M. STRACHAN	G.1

Minutes of the Tank Waste Science Panel Meeting June 26-27, 1990

Introduction

The first meeting of the Tank Waste Science Panel was held June 26-27, 1990, at Pacific Northwest Laboratory, Richland, Washington. The agenda, list of panel members, other invited attendees, and documents and reports provided to panel members are provided in Attachments A through D. Presenters included staff members from Pacific Northwest Laboratory (PNL)^(a) and Westinghouse Hanford Company (WHC).

The meeting began with brief presentations by T. H. Dunning (PNL), G. D. Johnson (WHC) for W. D. Leggett (WHC), and D. M. Strachan (PNL); copies of their vugraphs are included in this summary as Attachments E through G. H. H. Van Tuyl (PNL) summarized information obtained to date by the Senior Chemists Panel formed by WHC and composed of both WHC and PNL staff. Only panel members and PNL staff members D. S. Trent and L. G. Morgan remained for the meeting after the introductory presentation.

Because Science Panel co-chair E. P. Horwitz had extensive near-term commitments at the time this panel was formed, W. W. Schulz will serve as acting co-chair until Horwitz's schedule permits his full participation as co-chair.

The first day of the meeting was primarily devoted to providing the Science Panel members with historical information regarding the safety issues of tank 241-SY-101 (commonly denoted tank 101-SY) and existing technical information. Much of this information had already been summarized in a brief report by Strachan et al.^(b) and was reviewed further by the full panel.

Panel discussions focused on the physical processes and the chemical processes taking place in tank 101-SY. These discussions are summarized in the following text. More progress was made in developing an understanding of the physical processes than in developing an understanding of the potential chemical processes occurring in tank 101-SY.

Physical Processes

The number of potential physical processes occurring in the tank appears to be limited based on the temperature profile that develops in the tank before a gas release. Soon after a gas release, the thermal profile from the crust to the bottom of the tank is nearly uniform; i.e., the temperature in the region just below the crust is nearly the same as the temperature at the bottom of the tank. Just prior to a gas release, the temperature increases from about 200 in. above the bottom to about 24 to 48 in. from the

(a) Operated for the U.S. Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76RLO 1830.

(b) Strachan, D. M. (compiler), D. A. Reynolds, D. D. Siemer, and R. W. Wallace. 1990. *A Summary of Available Information on Gas Generation in Tank 101-SY (DRAFT)*. Pacific Northwest Laboratory, Richland, Washington.

bottom, then decreases. Above 200 in., the temperature profile is uniform. The Science Panel members agreed that the temperature profile just prior to a gas release suggests that heat is being lost from the bottom layer of waste to the underlying tank bottom and to the overlying, well-mixed waste. The Science Panel further agreed that gas is probably being generated throughout the liquid waste in the tank. However, the gas in the more fluid liquid portion of the waste is not trapped but can be released, either through or around the crust, at the rate it is generated.

The temperature profile also suggests that gas is generated in the bottom layer of waste in the tank. This bottom layer appears to have more solids and, consequently, a higher density than the upper layers. Either the high solids content or the density tends to trap the generated gases in this layer until buoyancy forces cause the gas to begin moving. Initial gas movement is believed to rapidly cause most of the remaining gas to move as well. During a gas release, the contents of the tank below the crust are stirred, and the thermal profile is nearly uniform from top to bottom. The released gas appears to pass through or around the crust with little difficulty based on the observed time behavior of the gas release.

The members of the Science Panel suggested that the data indicate the crust provided only minimal resistance for the passage of the gas released from the bottom of the tank. W. J. Thomson and D. M. Strachan had performed calculations that suggest that the permeability of the crust is sufficient to allow about 7500 ft³ of gas to pass in 20 min. However, the uncertainties that exist in the parameters used for these calculations preclude definitive results at this time. D. M. Strachan measured the permeability of salt cake and salt cake treated with CO₂ while working for Atlantic Richfield Hanford Company (ARHCO) in 1975. These measurements (Strachan 1975a, 1975b) could be used to bound the permeability of salt cake between 2 darcy and 0.002 darcy. Either of these values would be inconsistent with the interpretation that there is a gas bubble under the crust, using the reasonable assumption that the crust in tank 101-SY is similar to salt cake in its gas permeation properties.

Chemical Processes

Although the Science Panel members generally agreed on plausible physical phenomena in the tank, there were no suggestions about the nature of the mechanism for chemical evolution of H₂ in the tank. Previous laboratory studies (Delegard 1980) imply that the H₂ originates from the degradation of organic constituents of the waste. If H₂ is generated from the decomposition of the organic complexants, the members of the Science Panel suggested that the energetics of this reaction would be too high unless there was a low-energy pathway provided by some reaction intermediate. The reaction intermediate suggested by the laboratory studies is one involving Al or Fe. It is not obvious how these elements plus an organic complexant give rise to a low-energy pathway for H₂ production.

A second problem associated with the production of H₂ from the organic complexant is the half life of HEDTA determined by Delegard (1980). If Delegard's data are correct and the half life of HEDTA in these solutions is 100 h, then all of the HEDTA should be gone and the reaction should have ceased or at least decreased substantially. There are no data on the organic species in Tank 101-SY, so the HEDTA concentration is unknown. Nevertheless, the reaction has not abated over the 10 years since the reactions began.

The other suggestion was that the H₂ was coming from decomposition of H₂O. Again, the decomposition of H₂O is also thermodynamically unfavorable in this situation. However, in the absence of data the reaction cannot be completely ruled out.

The presence of radiation will result in the production of H_2 from both water and the organics. In the absence of a credible model for the chemical generation of H_2 , radiolysis may result in a significant portion of the total H_2 generated, although production of H_2 has been observed and reported in previous laboratory studies conducted in the absence of radioactivity.

The mechanism resulting in the production of N_2O also was not obvious in the absence of additional data.

Suggested Measurements

As a result of this meeting and the discussions, several suggestions were made for measurements to be carried out in tank 101-SY and on the samples collected from this tank. This tank, as well as other tanks, needs to be monitored extensively. Data loggers need to be installed to collect data on temperature, pressure, gas flow rate, waste volume, humidity, etc., frequently and reliably. Additional thermocouple trees need to be installed with additional thermocouples spaced closer together to better define the thermal profile, especially through the crust. More accurate instruments need to be installed to sample the gases in the tank vent. These instruments need to be selected in consultation with gas analysis experts so that the most reliable analyses can be made. These instruments must be calibrated for all peaks observed in the gas stream. If there are unknown peaks, the gases giving rise to these peaks must be identified and the instruments calibrated for these gases.

Core samples must be taken at more than one place. In the words of one Science Panel member, "an incorrect fact is much more dangerous than an incorrect theory." An incorrect fact can lead to many complications later when remediation measures are taken for the waste in this tank. A complete suite of analyses must be made on the samples taken from this tank. These analyses include:

- inorganic (cation and anion) analyses
- organic (complexants, solvents, extractants, and the decomposition products of these organics) analyses
- analyses for hydrogen peroxide, organic hydroperoxides and organic diperoxides
- solid state analyses (x-ray diffraction, scanning electron microscopy, and microprobe analyses)
- physical measurements (density, particle size distribution, moisture, permeability)
- and dissolved gases, particularly hydrogen, nitrous oxide, ammonia, and oxygen, nitrogen and carbon dioxide.

The sizes of these samples should be much larger than the small-diameter samples currently scheduled to be taken. These suggested analyses should be compared with those that are already scheduled; any recommended analyses that are not scheduled should be added.

To address the question of the crust permeability, it was suggested that one of the air lances in the tank be used to inject He gas below the crust. A He leak detector could be attached to the tank vent to determine how long it takes He to reach the vent after it is injected under the crust. If the He is detected soon after being injected, then the crust is permeable enough to bleed off any H_2 that arrives below the crust between gas release events. Calculations need to be made in advance to obtain an estimate of the He

arrival time at the leak detector after injection. Helium gas could be injected below the crust and through the holes in the air lance by installing a packer inside the air lance tube. This packer would be used to isolate a single hole in the air lance tube so that the position of the He injection is known with some accuracy.

Using the same, or slightly modified, packer system discussed above, differential pressure measurements could be made at various layers below the crust. These measurements, if successful, would yield data that would indicate the way in which the gas is evolved. The pressure measurements could be taken as a function of depth, time, and temperature. The pressure could also be monitored throughout a gas release event.

Laboratory Experiments

Laboratory experiments must be performed to determine the mechanism that is generating the gases in tank 101-SY. This is important not only to understanding the phenomena in tank 101-SY but also to understanding the chemistry in the other tanks at Hanford and the effects of remediation and processing for final disposal.

In brief, the members of the panel recommended that the basic experiments performed by Delegard (1980) and others be repeated with an emphasis on developing a fundamental understanding of the chemical processes involved. In addition, experiments with isotopically labeled organics should be used to determine the source of the H_2 and N_2O gases. These studies should be conducted at a level of effort necessary to arrive at a logical conclusion to the work and provide the U.S. Department of Energy and WHC a basic understanding of the problems in a timely manner. This effort should also be complemented with the help of consultants with appropriate expertise. WHC staff should provide input on WHC goals and feedback to other WHC staff and management.

Science Panel Report

The members of the panel were requested to write their thoughts concerning both the physical and the chemical behavior of tank 101-SY down on paper and give them to one or all of three committee chairmen. These committee chairmen are W. W. Schulz for the chemistry aspects of the problem, W. J. Thomson for the physical aspects of the problem, and D. A. Reynolds for other concerns especially in the areas of measurements, instrumentation, and safety. The Science Panel then decided that the committee chairmen would summarize these written communications and transmit the summaries and communications to T. H. Dunning. The panel will meet again on July 20, 1990, and a final report will be prepared and issued in early August 1990.

References

- Delegard, C. 1980. *Laboratory Studies of Complexed Waste Slurry Volume Growth in Tank 241-SY-10*. RHO-LD-124, Rockwell Hanford Company, Richland, Washington.
- Strachan, D. M. 1975a. *Effect of Carbon Dioxide on the Permeability of Synthetic Hanford Salt Cake*. ARH-ST-13, Atlantic Richfield Hanford Company, Richland, Washington.
- Strachan, D. M. 1975b. *Permeability, Capillarity, and Pore Volume of Synthetic Hanford Salt Cake*. ARH-ST-129, Atlantic Richfield Hanford Company, Richland, Washington.

Attachment A

Agenda

Agenda

First Meeting of the Tank Waste Science Panel Geneva Room, PSL Building

Tuesday, June 26, 1990

8:30 am	Badging
9:00	Introductions and General Remarks
9:15	Welcome and Opening Statements
9:45	Problem Overview - W. D. Leggett (WHC)
10:15	Break
10:30	Summary of "A Survey of Available Information on Gas Generation in Tank 101-SY" - D. M. Strachan
11:00	Proposed Plan of Attach - W. W. Schulz
12:00 pm	Lunch
1:30 - 5:00	Open format discussion of the situation in Tank 101-SY

Wednesday, June 27, 1990

8:30 am	Open Format - General discussion of the possible chemistry in Tank 101-SY
10:00	Break
10:30	Open Format - General discussion of possible physical mechanisms in Tank 101-SY
12:00 pm	Lunch
1:30	Summary of proposed mechanisms, open questions, and possible experiments.
5:00	Close

Attachment B

Tank Waste Science Panel Members

Tank Waste Science Panel

T. H. (Thom) Dunning, Jr., PNL, Chairman
Pacific Northwest Laboratory
P.O. Box 999, Mail Stop K2-18
Richland, WA 99352
(509) 375-6863, FAX (509) 375-6916

D. M. (Denis) Strachan, PNL, Executive Secretary
Pacific Northwest Laboratory
P.O. Box 999, Mail Stop K2-44
Richland, WA 99352
(509) 375-2550, FAX (509) 375-2186

D. A (Dan) Reynolds, WHC
Westinghouse Hanford Company
P.O. Box 1970, Mail Stop R2-11
Richland, Washington 99352
(509) 373-3115, FAX (509) 373-2908

Darryl D. Siemer
WINCO
IRC, MS 2207
Idaho Falls, ID 83403
FTS 583-1373, (208) 526-1373
FAX FTS 583-1390, (208) 526-1390

Richard M. Wallace
Westinghouse Savannah River Co.
Box 616
Bldg. 773A, Room B132
Aiken, SC 29802
FTS 239-2104, (803) 725-2104
FAX FTS 239-4704, (803) 725-4704

E. P. (Phil) Horwitz
Group Leader
Chemistry Division
Argonne National Laboratory
Argonne, IL 60439
(708) 972-2000, FAX (708) 972-4470

W. W. (Wally) Schulz
727 Sweetleaf Drive
Wilmington, DE 19808
(302) 998-9011

Professor E. C. (Eugene) Ashby
225 North Avenue
Boggs Chemistry Building
Georgia Institute of Technology
Atlanta, GA 30332
(404) 894-4003, (404) 636-4740 Home
FAX (404) 894-7452

W. J. (Bill) Thomson, Chairman
Department of Chemical Engineering
Washington State University
Pullman, WA 99164
(509) 335-4332
FAX (509) 335-7632

E. J. (Ed) Hart
2115 Hart Road
Port Angeles, WA 98362
(206) 928-3695

Attachment C

Other Invited WHC and PNL Staff Attending

Other Invited WHC and PNL Staff Attending

G. D. (Jerry) Johnson (WHC)
G. L. (Gary) Dunford (WHC)
M. H. (Mike) Shannon (WHC)
D. D. (Dan) Stepnewski (WHC)
L. G. (Larry) Morgan (PNL)
D. S. Trent (PNL)
H. H. Van Tuyl (PNL)

Attachment D

Documents Given to Tank Waste Science Panel Members

Tank Waste Science Panel
Documents Sent to Tank Waste Science Panel
Before Their Meeting at PNL June 26-27, 1990
(Prepared July 6, 1990)

Barney, G. S. 1976. *Vapor-Liquid-Solid Phase Equilibria of Radioactive Sodium Salt Wastes at Hanford*, ARH-ST-133, Atlantic Richfield Hanford Company, Richland, WA.

Bibliography. 1990. Compiled by Westinghouse Hanford Company for Information Related to Tank 101-SY.

Bond, W. D., and D. J. Pruett. 1990. Letter to M. J. Lawrence, "Draft Letter Report on Safety Review of Hanford Nuclear Waste Tanks," Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Campbell, B. 1987. Memo to F. E. Boyd, "Ammonia Readings in SY Tank Farm," Westinghouse Hanford Company, Richland, WA.

Delegard, C. 1980. *Laboratory Studies of Complexed Waste Slurry Volume Growth in Tank 241-SY-101*, RHO-LD-124, Rockwell Hanford Operations, Richland, WA.

Gale, L. A. 1981. Letter to D. G. Wilkins, "Slurry Growth Occurring in Tanks 101SY, 103SY, 101A and 101AX," Letter No. 65413-81-035, Rockwell Hanford Operations, Richland, WA.

Gale, L. A. 1982. Letter to M. T. Jansky, "Gas Entrapment Experiments Versus Predicted Gas Production," Letter No. 65411-82-081, Rockwell Hanford Operations, Richland, WA.

Gale, L. A. 1982. Letter to M. T. Jansky, "Gas Analyses - Where is the Ammonia?" Letter No. 65411-82-154, Rockwell Hanford Operations, Richland, WA.

Gale, L. A. 1983. *References from Summary of Slurry Growth Experiments - 1982*, SD-WM-TI-054, Rockwell Hanford Operations, Richland, WA.

Gale, L. A. 1983. *Summary of Slurry Growth Experiments - 1982*, SD-WM-TI-049, Rockwell Hanford Operations, Richland, WA.

Goheen, S. C. 1989. Letter to D. C. Lini, "Acetone in Radioactive Waste," Pacific Northwest Laboratory, Richland, WA.

Herting, D. L. 1990. Letter to D. A. Reynolds, "Comments on 'What's Happening in Tank 101-SY,'" Westinghouse Hanford Company, Richland, WA.

Huang, C. H. 1990. Letter to R. E. Raymond, "SY-101 Waste Surface Collapse Dimensions and Gas Venting Internals," Westinghouse Hanford Company, Richland, WA.

Jansky, M. T. 1982. Letter to L. A. Gale, "Slurry Growth versus Viscosity: 70°C," Letter No. 65453-82-182, Rockwell Hanford Operations, Richland, Washington.

Jansky, M. T. and J. E. Horton, 1982. Letter to L. A. Gale, "Slurry Growth in a Larger Vessel," Letter No. 65453-082-219, Rockwell Hanford Operations, Richland, WA.

- Jansky, M. T. 1982. Letter to L. A. Gale, "Pilot Plant-Slurry Growth Data," Letter No. 65453-082-261, Rockwell Hanford Operations, Richland, WA.
- Jansky, M. T. and B. A. Meissner. 1983. Letter to L. M. Sasaki, "Composition of Gases Generated During Slurry Growth," Letter No. 65453-83-293, Rockwell Hanford Operations, Richland, WA.
- Jansky, M. T. and B. A. Meissner. 1984. Letter to L. M. Sasaki, "Results of Gas Generation Studies," Letter No. 65453-84-071, Rockwell Hanford Operations, Richland, WA.
- Lane, T. A. 1978. Letter to K. G. Carothers, "Synthetic Double Shell Slurry Gas Identification," Letter No. 60120-78-111 J, Rockwell Hanford Operations, Richland, WA.
- Leggett, W. D. 1990. A set of viewgraphs for a presentation to DOE/HQ entitled "Safety Improvement Plan for Waste Tanks" (May 22, 1990), Westinghouse Hanford Company, Richland, WA.
- Lini, D. C. 1990. *The Flammability Characteristics of the System H_2-N_2O-Air* , Westinghouse Hanford Company, Richland, WA.
- Mauss, B. M. 1986. Letter to L. M. Sasaki, "101-SY Samples: Laboratory Analysis and Results," Letter No. 65453-86-079, Rockwell Hanford Operations, Richland, WA.
- Miscellaneous Text Information regarding nitrogen chemistry. References not provided with material.
- Reynolds, D. A. 1990. A set of viewgraphs for a presentation to DOE/HQ entitled "101-SY Slurry Growth and Hydrogen Generation," Westinghouse Hanford Company, Richland, WA.
- Sasaki, L. M. 1984. Letter to K. G. Carothers, "FY 84 Second Quarterly Report on Slurry Growth Studies," Letter No. 65611-84-068, Rockwell Hanford Operations, Richland, WA.
- Sasaki, L. M. 1984. Letter to K. G. Carothers, "FY84 Fourth Quarterly Report on Slurry Growth Studies," Letter No. 65611-84-195, Rockwell Hanford Operations, Richland, WA.
- Simpson, G. P. 1984. Letter to L. M. Sasaki, "Composition of Tanks 101-SY and 103-SY," Letter No. 65611-84-144, Rockwell Hanford Operations, Richland, WA.
- Simpson, G. P. 1984. Letter to L. M. Sasaki, "Slurry Growth Dependence on Vessel Dimensions and Slurry Volume," Letter No. 65611-84-146, Rockwell Hanford Operations, Richland, WA.
- Strachan, D. M., R. O. Lokken, R. D. Scheele, and A. P. Toste. 1986. *Complex Concentrate Pretreatment. FY 1986 Progress Report*, Pacific Northwest Laboratory, Richland, Washington.
- Strachan, D.M., D. A. Reynolds, D. D. Siemer, and R. W. Wallace. 1990. *A Survey of Available Information on Gas Generation in Tank 101-SY*, Pacific Northwest Laboratory, Richland, Washington.
- Tank Farms Process Technology. 1990. Letter to G. L. Dunford, "Hydrogen From Radiolysis in Tank 101-SY," Letter No. 82314-90-035, Westinghouse Hanford Company, Richland, WA.
- Van Tuyl, H. H. 1990. *What's Happening In Tank 101-SY*, Pacific Northwest Laboratory, Richland, WA.

**Tank Waste Science Panel
Documents Given to Panel While at PNL June 26-27, 1990**

Tank Farm Process Technology Section. 1990. Letter to N. W. Kirch, "Modeling of Gas Solubilities in 101-SY". Letter No. 82314-90-055, Westinghouse Hanford Company, Richland, Washington.

Leggett, W. D. 1990. *Safety Improvement Plan - Hydrogen in Waste Tanks - Revision 1*. Westinghouse Hanford Company, Richland, Washington.

FFTF MASF and Plant Systems Engineering. 1990. Letter to D. A. Reynolds, et al., "Senior Chemists' Panel Report Evaluation of Water Addition to Tank 101-SY". Westinghouse Hanford Company, Richland, Washington.

Pajunen, A. L., S. M. Joyce, K. G. Carothers, and T. M. Burke. 1990. Evaluation of April 19, 1990 Tank 241-SY-101 Gas Release Event. WHC-SD-WM-PE-039, Westinghouse Hanford Company, Richland, Washington.

Van Tuyl, H. H. 1990. Informal Report Titled "What's Happening in Waste Tank 101-SY, 5/14/90". Pacific Northwest Laboratory, Richland, Washington.

Attachment E

Presentation Materials from T. H. Dunning

TANK WASTE SCIENCE PANEL

June 26, 1990

T. H. Dunning , Jr.
Pacific Northwest Laboratory
Richland, Washington

|||||

Tank Waste Science Panel Near-Term Objectives

- Prepare a preliminary report on "Physics and Chemistry of Gas Generation in Tank 101-SY" (August 1990).
- Provide recommendations for developing a comprehensive research plan to understand the physico-chemical processes involved in Tank 101-SY (October 1990).
- Prepare a preliminary report on "Physical and Chemical Processes Involved in Tank 101-SY" (December 1990 with biannual updates).

*Tank Waste Science Panel
Charge*

- Develop a preliminary model of the tank behavior from the available data.
- Determine the issues essential to designing an experimental/modeling program to understand the physico-chemical processes involved in the tanks.
- Develop recommendations for establishing a comprehensive experimental/ modeling research program to address these issues.
- Review the results of the research program and recommend further work.

Attachment F

Presentation Materials from G. D. Johnson

OVERVIEW OF TANK 101-SY OFFGAS EVENT AND THE SAFETY IMPROVEMENT PLAN

June 26, 1990

G. D. Johnson
Westinghouse Hanford Company
Richland, Washington

TANK WASTE SCIENCE PANEL

- BACKGROUND DESCRIPTIONS OF 101-SY
 - SUMMARY BY REYNOLDS, SIEMER, STRACHAN & WALLACE
 - SUMMARY BY VAN TUYL
 - CHEMIST'S PANEL REPORT
- PRELIMINARY MODEL
 - REYNOLDS MODEL
 - CALCULATIONS BY FAUSKE & ASSOC.
- NEEDS
 - A CHEMICAL + PHYSICAL MODEL
 - POTENTIAL FOR SECONDARY REACTIONS
 - FLAMMABILITY OF GAS MIXTURE
 - INPUT FROM PANEL ON INFORMATION NEEDED FOR MODEL
 - CORE SAMPLE
 - FORECAST OF WHAT WILL BE FOUND FROM CORE SAMPLING

241-SY-101 Hydrogen in Exhaust From April 19, 1990 Event

APRIL 19, 1990 GAS VENTING, WASTE TANK SY-101

PRESSURE vs TIME

HYDROGEN vs TIME

SY-101 Temperature Profile

Chemistry and Tank Characterization

- Core samples and analysis
- Laboratory activities - synthetic waste, combustibility
- Tank off-gas measurements and other non-intrusive tests
- Chemical and physical modeling - Pacific Northwest Laboratory
- Establish database

CHEMISTRY AND TANK CHARACTERIZATION

MODELING OF TANK CONSTITUENTS

- **CHEMICAL PROCESSES**
- **GAS FLOW IN TANK SYSTEM**
- **PHYSICAL BEHAVIOR OF WASTES (TURNOVER, CRUST DYNAMICS)**

Safety Analysis

- **Analyses of in-tank activities**
 - **Water addition**
 - **Core sampling**
 - **TV camera**

- **Upgrade and extension of hydrogen burn analysis**
 - **New data on waste and off-gas**
 - **Secondary chemical reactions**
 - **Waste tanks other than 101-SY**

Proposed Engineered Remedy

Dilution - Pumping Bottom-to-Top

- Core samples to determine effectiveness
- Pumps - number, placement, lifetime
- Transfer logistic, permits, approvals
- Pump procurement, installation
- Long-term stirring mechanism

F.9

Long-Term Possibilities

- Chemistry
- Heat
- More tank volume

Attachment G

Presentation Materials from D. M. Strachan

A SURVEY OF AVAILABLE INFORMATION ON GAS GENERATION IN TANK 101-SY

G.1

D. A. Reynolds (WHC)

D. D. Siemer (WINC)

D. M. Strachan (PNL)

R. W. Wallace (WSR)

PURPOSE

6.2 To assemble the available information and distill it into a short document.

PRELIMINARY FINDINGS

- Slurry growth plus release required the presence of organics
- Organic content appears to be highest at the bottom of the tank
- Thermal profile appears to be the most indicative measurement

PRELIMINARY FINDINGS (continued)

- Gas volumes also suggest a bottom release mechanism
- Gas volumes and composition are not well known. Lab results indicate a variation with time.

OPEN QUESTIONS:

- Gas composition
- Crust composition and physical properties
- Gas generation - How and Where?
- Slurry growth
- Solution variation with time
- Trace elements

OPEN QUESTIONS: (continued)

- Corrosion and radiolysis
- Organic decomposition products
- Nitrogen chemistry
- Other tanks
- Remediation

DISTRIBUTION

No. of
Copies

No. of
Copies

OFFSITE

12 DOE/Office of Scientific and Technical
Information

J. Tseng
U.S. Department of Energy
EM-35
Trevion II
Washington, DC 20585-0002

C. Abrams
1987 Virginia
Idaho Falls, ID 83404

J. Antizzo
U.S. Department of Energy
EM-351
Trevion II
Washington, DC 20585-0002

E. C. Ashby
225 North Avenue
Boggs Chemistry Building
Georgia Institute of
Technology
Atlanta, GA 30332

K. Bandyopadhyay
Building 129
Brookhaven National Laboratory
Upton, NY 11973

N. E. Bibler
Westinghouse Savannah River
Bldg. 773A, Room 108
Aiken, SC 29802

D. Campbell
Oak Ridge National Laboratory
P.O. Box 2008, MS 6268
Oak Ridge, TN 37831-6268

F. Carlson
6965 North, 5th West
Idaho Falls, ID 83401

P. d'Entremont
Westinghouse Savannah River
P.O. Box 616, Bldg. 703-H
Aiken, SC 29802

R. Daniels
SAIC
20030 Century Blvd.
Suite 201
Germantown, MD 20878

M. First
295 Upland Avenue
Newton Highlands, MA 02161

C. Forsberg
Room 24-109
77 Massachusetts Avenue
Cambridge, MA 02139

E. J. Hart
2115 Hart Road
Port Angeles, WA 98362

P. Hogroian
SAIC
20030 Century Blvd., Suite 201
Germantown, MD 20874

E. P. Horwitz
Chemistry Division
Argonne National Laboratory
Argonne, IL 60439

A. Hoskins
WINCO, MS-5217
P.O. Box 4000
Idaho Falls, ID 83403-4000

No. of
Copies

B. Hudson
Lawrence Livermore National
Laboratory, L-221
P.O. Box 808
Livermore, CA 94550

M. Kazimi
Room 24-102
77 Massachusetts Avenue
Cambridge, MA 02139

P. Kiang
BDM, Trevion I, Suite 300
12850 Middlebrook Road
Germantown, MD 20874

T. Kress
P.O. Box 2009
MS 8088, Building 9108
Oak Ridge, TN 37381

T. Larson
Los Alamos National
Laboratory, M-1
MS C-920, P.O. Box 1663
Los Alamos, NM 87545

D. Oakley
Los Alamos National
Laboratory
University of California,
Suite 310
409 12th Street, SW
Washington, DC 20024-2188

D. Ploetz
West Valley Nuclear
Services Co.
P.O. Box 191, MS 305
West Valley, NY 14171-0191

M. Reich
Building 129
Brookhaven National Laboratory
Upton, NY 11973

No. of
Copies

J. Saveland
20030 Century Blvd., Suite 201
Germantown, MD 20874

G. Schmauch
Air Products & Chemicals, Inc.
7201 Hamilton Blvd.
Allentown, PA 18195-1501

W. W. Schulz
727 Sweetleaf Drive
Wilmington, DE 19808

B. Schutte
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-3940

D. D. Siemer
WINCO
IRC, MS 2207
Idaho Falls, ID 83403

S. Slezak
Sandia National Laboratories,
Division 6463
P.O. Box 5800
Albuquerque, NM 87185

H. Sullivan
Los Alamos National
Laboratory, N-6, MS-K557
P.O. Box 1664
Los Alamos, NM 87545

C. Terrell
U.S. Department of Energy,
Bldg. 704-S
P.O. Box A
Aiken, SC 29801

W. J. Thomson
Department of Chemical
Engineering
Washington State University
Pullman, WA 99164

No. of
Copies

A. S. Veletsos
5211 Paisley
Houston, TX 77096

H. Walter
U.S. Department of Energy
EM-343
Trevion II
Washington, DC 20585-0002

M. Walter
U.S. Department of Energy
EM-35
Trevion II
Washington, DC 20845-0002

D. Wiffen
U.S. Department of Energy
EM-35
Trevion II
Washington, DC 20585-0002

G. Woodall
U.S. Department of Energy,
MS-1139
785 DOE Place
Idaho Falls, ID 83402

ONSITE

2 DOE Richland Operations Office

R. E. Gerton, A5-21
G. Rosenwald, A5-21

32 Westinghouse Hanford Company

H. Babad, B2-15
D. G. Baide, R1-51
M. L. Bell, T5-50
R. M. Black, R1-19

No. of
Copies

R. J. Bliss, B3-04
H. R. Brager, L5-03
R. J. Cash, B3-68
D. L. Deichman, H0-03
G. L. Dunford, R1-51
K. A. Gasper, B3-68
W. H. Hamilton, R2-40
G. D. Johnson, L5-03 (5)
N. W. Kirch, R2-11
W. D. Leggett, L5-04 (5)
L. D. Muhlestein, N1-28
D. A. Reynolds, R2-11 (5)
W. G. Ruff, R2-53
M. H. Shannon, B1-35
D. D. Stepnewski, N1-31
D. D. Wodrich, R2-23

54 Pacific Northwest Laboratory

R. T. Allemann, K5-19
T. H. Dunning, K2-18
R. T. Hallen, K2-12
M. S. Hanson, K1-51
B. M. Johnson, Jr., K5-02 (25)
D. K. Lemon, K2-28
G. B. Mellinger, P7-18 (5)
L. G. Morgan, P8-07
L. R. Pederson, K2-44
J.T.A. Roberts, K1-73
R. D. Scheele, P7-25
J. C. Spanner, K2-31
D. M. Strachan, K2-44 (5)
R. W. Stromatt, P7-22
D. S. Trent, K1-82
H. H. Van Tuyl, P7-22
Publishing Coordination
Technical Report Files (5)