Tank 241-AY-102 Leak Assessment Supporting Documentation: Miscellaneous Reports, Letters, Memoranda, and Data

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Abstract: This report contains reference materials cited in RPP-ASMT-53793, Tank 241-AY-102 Leak Assessment Report, that were obtained from the National Archives Federal Records Repository in Seattle, Washington, or from other sources including the Hanford Site's Integrated Data Management System database (IDMS).

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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

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EXECUTIVE SUMMARY

This report provides reference documents and other information supporting RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*. The report contains the reference materials cited in the leak assessment report that were obtained from the National Archives Federal Records Repository in Seattle, Washington, or from other sources including the Hanford Site's Integrated Data Management System database (IDMS). The documents which are either not available or not easily found in IDMS are presented to provide detailed background information for RPP-ASMT-53793. The first seven sections deal with construction, waste transfers-liquid levels, chemistry, ultrasonic testing, annulus sample results, leak detection pit sample results, and historical annulus continuous air monitor (CAM) notifications all of which coincide with the RPP-ASMT-53793 document outline. Time lines are also available in Section 8.0 that list events occurring between 1968 and 2012 relating to overall operations and the annulus leak detectors, CAM, and inspections.

CONTENTS

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ENRAF is a registered trademark of Enraf B. V., Delft, Netherlands.
Kaolite is a registered trademark of Babcock & Wilcox Company.
Linde is a registered trademark of Linde AG Corporation.
HEPA is a registered trademark of HEPA Corporation.

1.0 Supporting Documentation for RPP-ASMT-53793, Section 3.0, Tank AY-102 Construction

1.1 ARH-1833, 1970, Investigation of the 241-AY Insulating Refractory Task Force Report, Atlantic Richfield Hanford Company, Richland, Washington.

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DOCUMENT NO. ARH-1833

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Atlantic Richfield Hanford Company

RICHLAND, WASHINGTON

TITLE AND AUTHOR

INVESTIGATION OF THE 241-AY INSULATING REFRACTORY TASK FORCE REPORT

By

H. L. Caudill

For

Members of Task Force

G. Jansen, D.G. Lien, D.A. Bruce,
W.C. Schmidt and F.R. Vollert

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INVESTIGATION OF THE 241-AY INSULATING REFRACTORY

TASK FORCE REPORT

By

H. L. Caudill

For

Task Force

Members of Task Force

G. Jansen
D.G. Lien
W.C. Schmidt
F.R. Vollert
D.A. Bruce

Chemical Processing Division

October 30, 1970

INVESTIGATION OF THE 241-AY INSULATING REFRACTORY

TASK FORCE REPORT

TABLE OF CONTENTS

INVESTIGATION OF THE 241-AY INSULATING REFRACTORY

TASK FORCE REPORT

I. INTRODUCTION

The design of the 241-AY Tank incorporates a tank-in-tank concept with the primary or inner-tank stress relieved at an elevated temperature to minimize nitrate stress corrosion cracking. To protect the concrete base slab from excessive temperature during the stress relieving of the primary tank, a castable refractory (Kaolite 2200-LI*) was placed between the bottoms of the tanks. This refractory serves as the foundation for the primary tank. Inspections in the annulus between the primary and secondary tanks made prior to preparing the tanks for service revealed deterioration and cracking of the refractory material. A comprehensive visual inspection of the refractory was undertaken and physical samples were removed for analysis and tests. The deterioration was found to be primarily in the surface of the refractory slab. The deteriorated refractory material was found to be quite friable with little structural strength.

As a result of these preliminary findings, a task force was formed to identify and evaluate the kinds and extent of problems that might exist or develop as a result of the observed condition of the refractory material and to recommend corrective action if needed.

This report presents the results of the investigation and evaluations which have been completed by the task force.

II. CONCLUSION

Four potential problem areas were identified for evaluation. These were 1) structural support problems, i.e., the refractory is the foundation for the primary tank, 2) thermal gradient problems expected in the system should a leak in the primary tank develop and release radioactive solution into the refractory, 3) high pressure steam that might form between and damage the tanks if a leak should occur in the primary tank at elevated operating temperatures, and 4) operational reliability problems related to monitoring and surveillance.

The structural analyses indicated that the loss of competence of the refractory material under the primary shell knuckle would compromise the integrity of the tank. The loss of six to twelve inches of the refractory materials beyond the primary tank knuckle would generate stresses in the primary tank greater than the allowable specified in the ASME Pressure Vessel Code, Section II, Nuclear Vessels.

*Trade name of Babcock & Wilcox Co., Refractories Division, Augusta, Georgia

The evaluation and analyses of the other three potential problem areas identified indicated that the associated risk would not be significantly increased by the refractory's noted condition.

As a result of the structural analyses, a course of action was proposed which included removal of approximately two feet of the refractory from the outer perimeter under the primary tank and replacement with reinforced concrete. This course of action was implemented.

III. INVESTIGATIONS

A. Visual Inspections

After stress relief and hydrostatic test, an annulus cleanup crew reported cracking and spalling in the visible refractory in both 241-AY tanks 101 and 102. Thus, it was decided to enter the annulus of each tank, make a formal visual inspection of the exposed part of the slab, photograph deteriorated areas, and take samples of the material to determine the extent and nature of the problem.

Tank 102 - The condition of the refractory in TK-102, as observed on the outer periphery, was described as follows: The surface of the slab was generally deteriorated to an average thickness of 3/4 to 1 inch. (Localized surface deterioration much greater than 1 inch thick were noted.) The deteriorated surface readily broke off in friable flakes, i.e., the surface was nearly cohesionless. Competent refractory existed below. Also, a few cracks through the slab's 8 inch thickness were visible on the periphery. The only marked differences from this condition were: Two areas, identified as individual 10° pours, were soft and friable for the entire thickness. One area, also an individual 10° pour, was in very good condition with minimal surface deterioration (less than 1/4 inches) relative to the rest of the 102 slab. Figure 1 is a photograph showing the typical condition of the 102 refractory. Figure 2 shows one of the extremely poor areas, while Figure 3 is a photograph of a crack in the 102 refractory. Figure 4, AY Tank 102 Condition Plot, shows the location of these general refractory conditions.

Tank 101 - The general condition of the refractory in TK-101, as observed on the periphery, varied from good (less than 1/4 inches deterioration) to a condition of 3/4 inches surface deterioration. (Localized surface deterioration much greater than 1 inch thick were noted.) One localized badly fractured area was noted on the periphery. Also, a few cracks through the 8 inch thickness occurred around the slab. The deteriorated surface broke off in friable flakes, i.e, the surface was nearly cohesionless. Competent refractory existed below. Figure 5 is a photograph of the badly fractured area. Figure 6 is a photograph of the 3/4 inch surface deterioration. Figure 7 is a picture of surface deterioration less than 1/2 inches. Figure 8 is the picture of a typical crack and Figure 9 is a photograph of a good area in 101. Figure 10, AY Tank 101 Condition Plot, locates these general refractory conditions.

B. Sample Evaluations

Two samples were taken from each tank for laboratory analysis. One of the samples from each tank was a darker colored material concentrated at the top in a crusty formation. The other samples, one from each tank, represented the more competent material and was light colored. The following results were reported:

1. Chemical Analysis

TANK 102

Element As Oxide	102-A Light	102-B Dark	Manufacturer's Data
SiO_2	37.6	38.1	37.4
Al_2O	35.4	36.9	40.7
Fe_2O_3	0.99	1.04	0.9
TiO_2	1.4	1.6	1.7
CaO	15.5	15.7	18.6
MgO	0.6	0.4	0.4
Na_2O	1.1	1.5	0.3
Specific Gravity	0.53	----	0.785
Moisture	12.5	9.3	----

TANK 101

Element As Oxide	101-A Light	101-B Dark	Manufacturer's Data
SiO_2	37.0	33.0	37.4
Al_2O	35.4	31.2	40.7
Fe_2O_3	0.92	16.6	0.9
TiO_2	1.6	1.4	1.7
CaO	16.2	12.1	18.6
MgO	0.8	0.4	0.4
Na_2O	0.7	2.3	0.3
Specific Gravity	0.75	----	0.785
Moisture	12.7	8.9	

X-Ray Diffraction Analyses

Two samples were taken from Tank 101 for examination, one from the top or friable layer and one from the bottom of the kaolite pad. Both samples contained the anhydrous calcium aluminum silicate ($CaAl_2Si_2O_8$) mineral called anorthite. The bottom sample, in addition, contained several hydrous compounds: $Al(OH)_3$, $3CaO\text{-}Al_2O_3\text{-}6H_2O$, and $Ca_2SiO_4\text{-}\frac{1}{2}H_2O$. The sample from the top contained only $CaCO_3$ in addition to anorthite.

Ion-Exchange Properties

The ion exchange properties were tested with cesium-137 in the synthetic supernate solution and an equal amount of supernate and boiling waste solution. Test results showed that less than one percent of the cesium was adsorbed by either mixture.

Density

The measured density of the material was approximately 49 lb/ft^3 on a fired basis.

Supernate Retention

The material gained approximately 80 percent by weight in the synthetic solution or the equivalent of 39.2 lbs. of solution per ft^3 of material.

2. Physical Analysis

Deteriorated Surface Layer - Intact samples of the deteriorated surface from both tanks were examined and found to afford negligible resistance to compressive and sliding loads. The samples crumbled to a cohesionless state when subjected to these loadings.

Material Below Deteriorated Surface Layer (Competent Material) - Samples of this material were taken from each tank and compression tested by B & W Refractories Division. The reported results were: Tank 101, 425 to 439 psi; Tank 102, 272 to 279 psi. Subsequent samples were taken and compression tested on project. Results were Tank 101, 428 to 764 psi; Tank 102, 158 to 285 psi It was noted from these tests that the refractory from the bottom of the two slabs was significantly stronger than that near the top. All samples compression tested were below the deteriorated surface previously described. The specified minimum strength for the refractory is 200 psi.

C. Thermal Evaluation

Thermal analyses were made by Battelle-Northwest Laboratories based on laboratory results and assumptions made from published information (References 1 and 2). These analyses indicate that no problems are expected from the postulated thermal conditions.

Temperature excursions were estimated for Kaolite 2200-LI with 70 percent voids assuming three undetected leak conditions.* A bulge in the primary liner above the Kaolite of 4 inches was assumed to be part of the Kaolite voids.

A maximum temperature only 3.8 °F above the inner steel liner temperature (maximum liner temperature approximately 350 °F) was estimated for Kaolite saturated with supernate solution.

If the solution in the voids evaporates and more solution seeps into the remaining voids until they are filled with dried supernate, the maximum temperature in the Kaolite would be 13.1 °F above the inner steel liner temperature.

In the unlikely event that all the voids beneath the liner would be filled with sludge, the temperature would be somewhat higher and would be strongly dependent on the age of the sludge. Sludge with a volumetric heat generation rate of 60 (Btu)/(hr) (ft3) would create a maximum temperature in the Kaolite that is 51.4 °F above the inner steel liner temperature.

The inner steel liner temperature would also rise somewhat because of the heat flowing into the sludge from the Kaolite. The amount of this additional temperature rise is difficult to estimate, but it would be small for a tank under normal operating conditions.

Assumptions

The following assumptions were made during the calculations:

1. Supernate has a heat generation rate of 0.5 Btu/(hr) (gal) and a specific gravity of 1.1.

2. The Kaolite has a void fraction of 0.70. It picks up 80 wt% supernate resulting in a final composition of $\frac{39.2 \text{ lb. of supernate}}{\text{ft}^3 \text{ of Kaolite}}$.

*Leak detection systems exist in the annulus and should give an early notice of tank failure. Thus, the tank contents should be transferred before these temperature rises occur.

3. Solidified supernate would concentrate the heat generation by a factor of four.

4. The maximum local Kaolite thickness is 8 inches.

5. The maximum local bulge in the steel inner tank liner is 4 inches.

6. All of the bulge is filled with the same material that is permeating the voids of the Kaolite.

7. All the heat generated below the inner liner goes upward into the tank. This is equivalent to assuming that the bottom of the tank is insulated.

Thermal Conductivities

The thermal conductivities of the composites of Kaolite with imbibed materials are crucial in determining the temperature rises.

The thermal conductivity of Kaolite as given by the manufacturer is 0.129 Btu/(hr) (ft^2) (°F/ft). At low temperatures this is due to a mixture of 70 vol % air (thermal conductivity = 0.0514 Btu/(hr) (ft^2) (°F/ft) and 30 vol % pure Kaolite. The correlations of Harper and Sahrigi (I. &E. C Fundamentals 3:318-24 (1964) and of Hamilton and Crosser (I. &E. C Fundamentals 1:187-91 (1962) both predict an extrapolation to a thermal conductivity of pure, dense Kaolite of 0.66 Btu/(hr) (ft^2) (°F/ft). There could be 10 - 20 percent error in the estimates because of the large extrapolation from 30 vol % Kaolite.

The thermal conductivity of aqueous supernate is estimated to be 0.36 Btu/(hr) (ft^2) (°F/ft). The thermal conductivity of the supernate Kaolite composite is estimated to be 0.44 Btu/(hr) (ft^2) (°F/ft) by the methods of Hamilton and Crosser and of Cheng and Vachon (Int. J. Heat & Mass Transfer 12:249-64 (1968).

The thermal conductivities of solidified supernate and dry sludge are estimated to be 0.45 Btu/(hr) (ft^2) (°F/ft). By the above methods, the thermal conductivities of solidified supernate - Kaolite and dry sludge - Kaolite composites are estimated to be 0.51 Btu/(hr) (ft^2) (°F/ft).

Calculations

The temperature rise from the inner steel liner to the bottom of the Kaolite is calculated from the equation:

$$T = \frac{S_k l_k l_c}{k_c} + \frac{S_k l_k^2}{2k_k} + \frac{S_c l_c^2}{2k_c}$$

S_k = volumetric heat generation rate in Kaolite composite, Btu/(hr) (ft^3)

S_c = volumetric heat generation rate of material in bulge above Kaolite, Btu/(hr) (ft^3)

l_k = Kaolite thickness, ft.

l_c = thickness of bulge above Kaolite ft.

k_c = thermal conductivity of material in bulge above Kaolite, Btu/(hr) (ft^2) (°F/ft).

k_k = thermal conductivity of Kaolite composite, Btu/(hr) (ft^2) (°F/ft).

The first term is the temperature rise through the bulge above the Kaolite due to heat generation in the Kaolite, the second term is the temperature rise through the material in the bulge above the Kaolite due to its own heat generation. The terms are approximately of equal importance.

D. Pressure Evaluations

Some concern existed over the potential blockage of the air distribution channels which were provided in the refractory slab. If a primary tank leak were to occur at the operating temperature and with these channels tightly plugged, high pressure steam could form between and damage the tanks. However, it appears doubtful that conditions could exist which would not permit slight movement of the steel liner with subsequent pressure release before damaging the inner tank.

E. Structural Evaluation

The task force concluded from visual observations and from studying the photographs of the refractory that further deterioration would occur if the AY tanks were operated as is. With further deterioration, support would be lost from under the primary tank knuckle, i.e., the primary bottom would be cantilevered over its deteriorated foundation. See Figure 11. Therefore, stress analyses of the primary tank assuming increments of support loss under the knuckle were attempted in order to determine how much foundation deterioration could be tolerated.

Stress Analyses and Results

1. Pittsburg Des Moines Company, (PDM), the AY steel tank fabricators, stress analyzed the primary tank assuming 6 inches and 12 inches of knuckle support loss and using their axisymmetric thin shell computer program AX2. PDM was requested to do these analyses because they had adapted AX2 to this structure and stress checked the design for a variety of loads prior to fabrication. The results of the early PDM analyses were transmitted December 18, 1968 (Reference 3). The latest PDM analyses calculated stress intensities, as defined in N-412 of the ASME Pressure Vessel Code, Section III, Nuclear Vessels, for the extreme fibers of the primary shell plate. The results (Reference 4) for 6 inches and 12 inches of support loss are plotted in Figure 12 and Figure 13, respectively. The maximum stress intensities corresponding to 6 and 12 inches loss are 41515 psi and 67633 psi. As expected, the maximum stresses would occur where the primary bottom resumes contact with the foundation.

   PDM's AX2 employs the "stiffness method", i.e., the shell is idealized as a series of smaller shell bodies interconnected by nodes. Twenty-four such shell elements were modeled for the runs reported here. The program assembles a stiffness matrix and load vectors, modifies the stiffness matrix to account for boundary conditions, and then solves for node displacements.

2. Also, the primary tank was analyzed to determine the affect of foundation loss using AXISOL, a program for computing deflections and stresses in axisymmetric solids. The knuckle region (expected location of maximum stresses) was idealized as 541 finite elements and isolated as a free body. The most realistic boundary conditions that could be assumed for the isolated body, and still apply AXISOL, were very conservative. The maximum stress intensities the AXISOL analyses gave were 57308 psi and 83900 psi for zero and 3 inches foundation loss, respectively. The conservatism of this analysis shows when comparing the results to those of AX2.

AXISOL is a finite element program for elastic-plastic analysis of axisymmetric solids, and has been in use at Hanford since 1967. To apply AXISOL, the continuous structure is divided into a system of elements interconnected at node points. The program developes equilibrium equations in terms of unknown nodal displacements. The solution of this set of equations is then obtained and manipulated to give final results.

3. In addition to the AX2 and AXISOL analyses just described, Computer Sciences Corporation (CSC) was delegated to attempt a one time best effort analysis of the primary tank with deteriorated foundation using their axisymmetric thin shell program, ESHELL. The analytical model CSC used for the ESHELL analyses was not as refined as the one used for the AX2 analysis, i.e., the tank was only broken up into seven shell elements for the ESHELL runs. Therefore, a direct comparison between results of AX2 and ESHELL analyses is not practical. However, the ESHELL analyses do indicate significant stress increases for progressing knuckle support loss (Reference 5).

According to ASME Section III, the stress intensity in the primary tank at the specified maximum operating temperature must be compared to an allowable value of ($3S_m$) 52500 psi. The PDM AX2 results indicate that the structure likely could tolerate 6 inches of foundation deterioration, but that support losses greater than 6 inches would put the vessel in questionable status.

The AXISOL analyses show stress intensities significantly greater than the above ($3S_m$) value if only a small amount of foundation loss occurs under the tank.

The general conclusion from the AX2 and AXISOL analyses is that good knuckle support is very critical to the safety of the primary tank. Also, based on the inspection of the as-built refractory and its demonstrated physical properties or the surface, support losses from under the knuckle greater than 6 inches are credible. Therefore, the task force recommended a structural modification to the insulative refractory before operating the AY tanks 101 and 102. The modification must provide adequate support under the primary knuckle and confine the refractory back in from the knuckle such that the primary bottom is also supported. The proposed modification, subsequently implemented, is to remove the outer 1 foot 9 inches of the refractory and replace with reinforced, shrink compensating concrete, (see Drawing H-2-35299). Other pertinent details of the modification are: Tank fluid level must be lowered to 36 inches maximum, during repair, the work must be accomplished using 8 foot (maximum) skip pours around the perimeter, and channels will be formed in the new concrete matching the originals.

IV. REFERENCES

1. B & W Kaolite 2200-LI Average Properties, Babcock & Wilcox Refractories Division, January 9, 1968.

2. Letter, G. Jansen, Jr. to H.L. Caudill, "Temperatures in Kaolite in the AY Tank Farms After a Waste Leak", dated June 3, 1970.

3. Stress Analyses for 241-AY Primary Liner, Pittsburg Des Moines Company, PDM Contract 38570, December 18, 1968.

4. Effects of Foundation Deterioration, Part I, Purex Waste Storage Facility, PDM Contract 38570, June 5, 1970.

5. Letter, J.C. Go, Computer Sciences Corporation to F.R. Vollert, "Tank Support and Stress Analysis, dated June 15, 1970.

FIGURE 1

TYPICAL 3/4 IN. REFRACTORY SURFACE
DETERIORATION, TANK 102

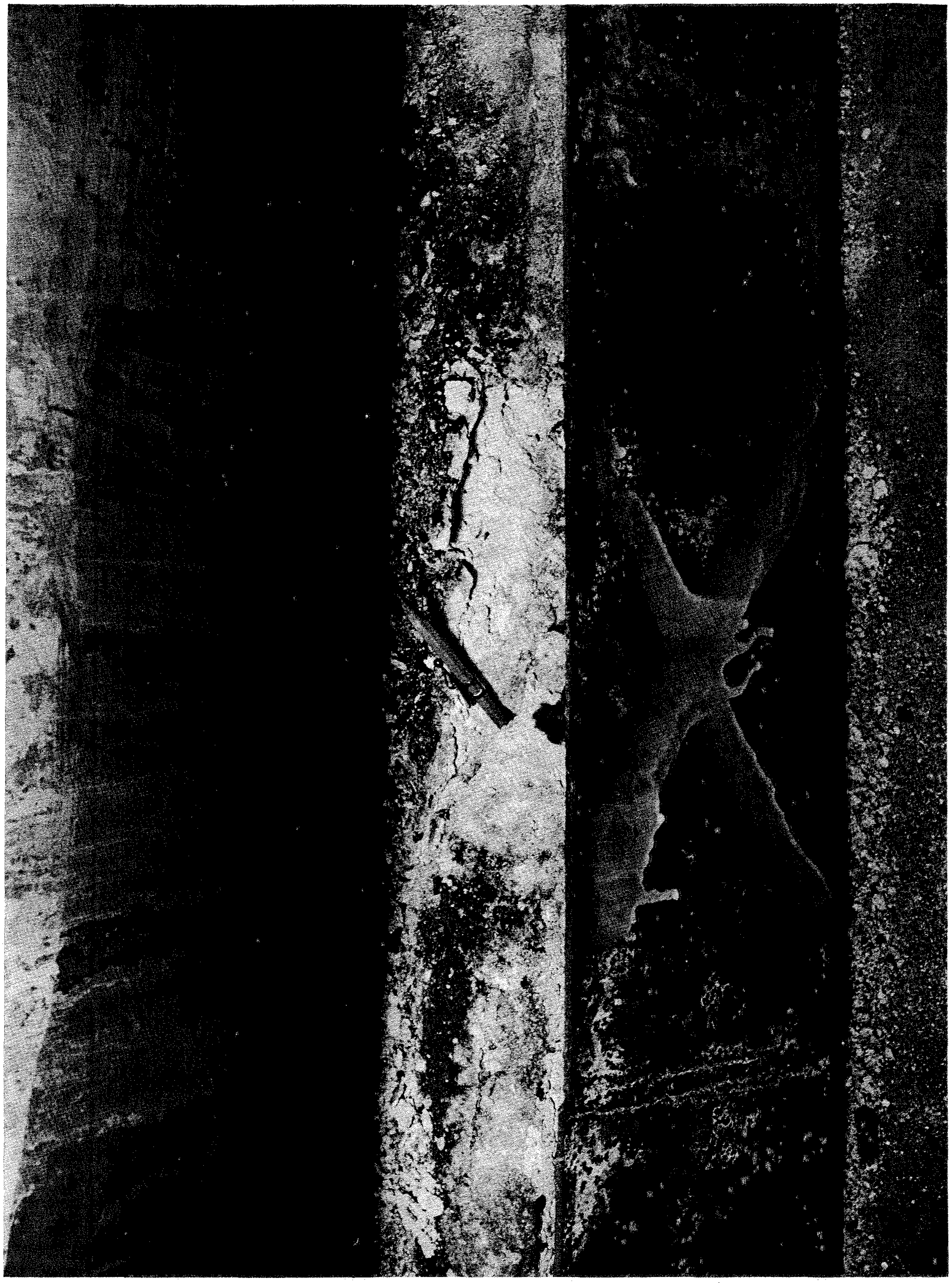
[redacted]

FIGURE 2

EXTREMELY POOR SECTION OF REFRACTORY
TANK 102

AEC-RL RICHLAND, WASH.

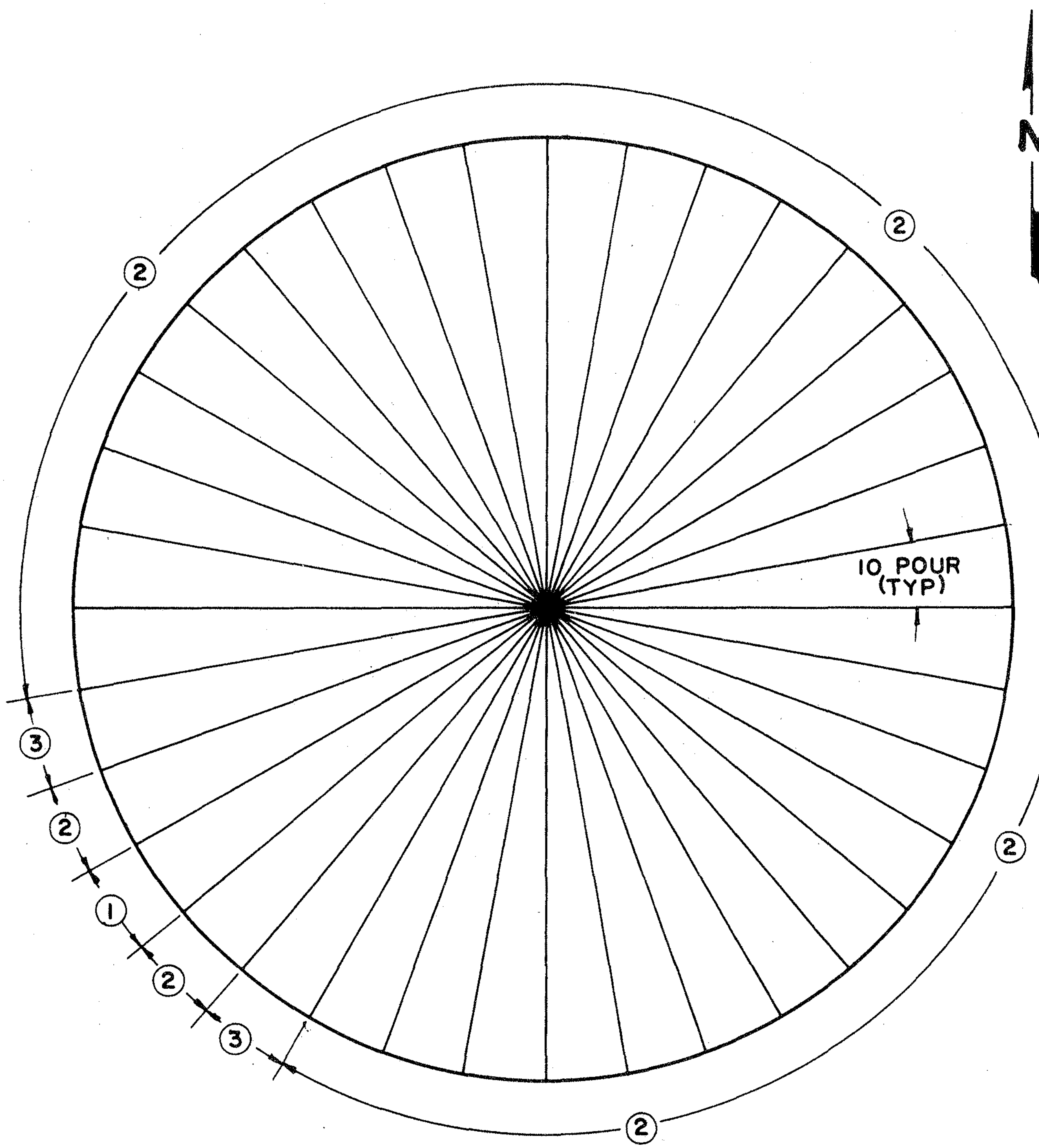
FIGURE 3



FULL DEPTH CRACK IN REFRACTORY, TANK 102

FIGURE 4

AY TANK 102 CONDITION PLOT



LEGEND

1 – GOOD
2 – SURFACE DETERIORATION = $\frac{3}{4}$ – 1 IN.
3 – VERY POOR

FIGURE 5

BADLY FRACTURED REFRACTORY, TANK 101

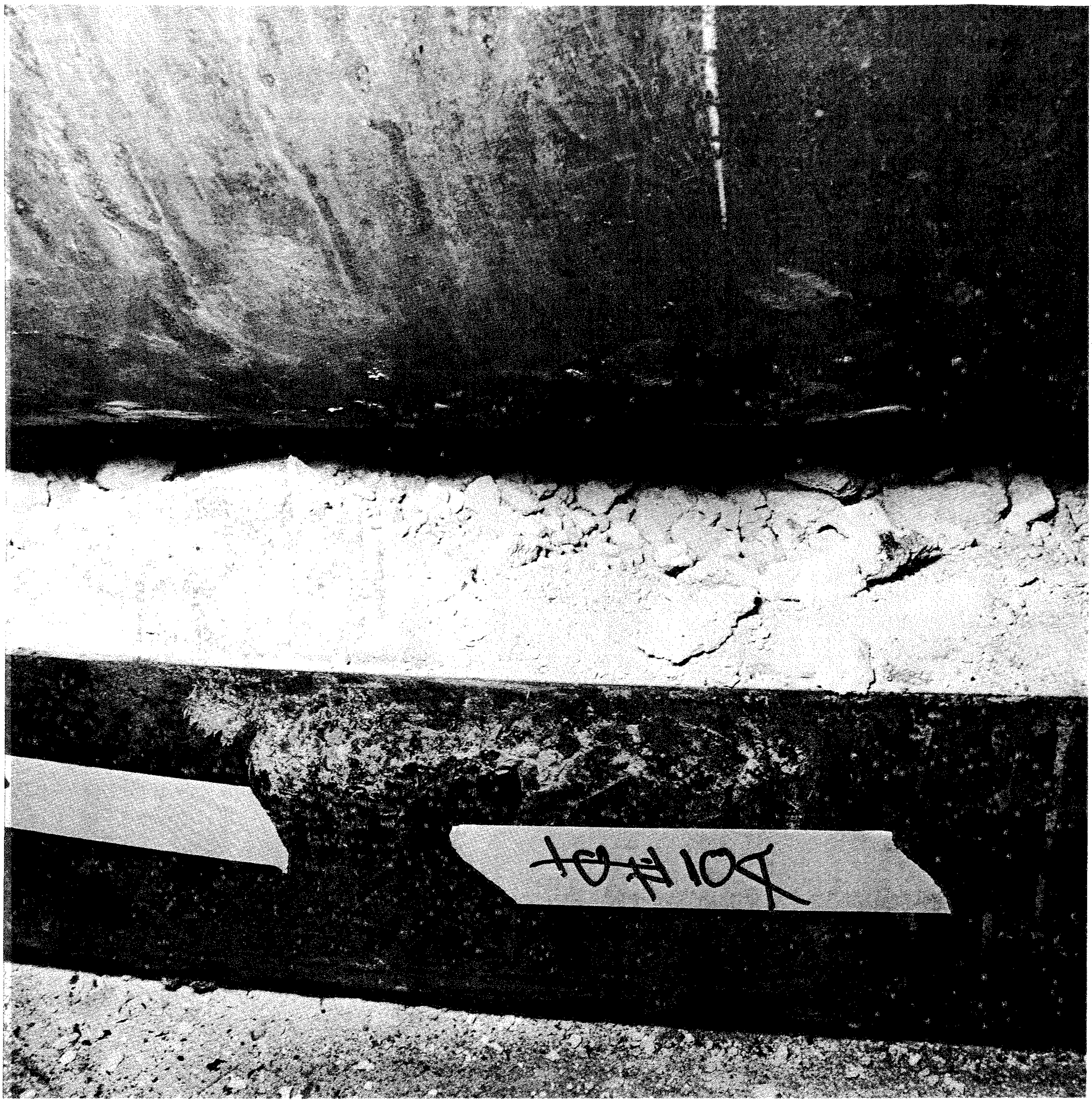


FIGURE 6

3/4 IN. REFRACTORY SURFACE DETERIORATION
TANK 101

AEC-RL RICHLAND, WASH.

FIGURE 7

REFRACTORY SURFACE DETERIORATION
LESS THAN 1/2 IN., TANK 101

AEC-RL RICHLAND, WASH.

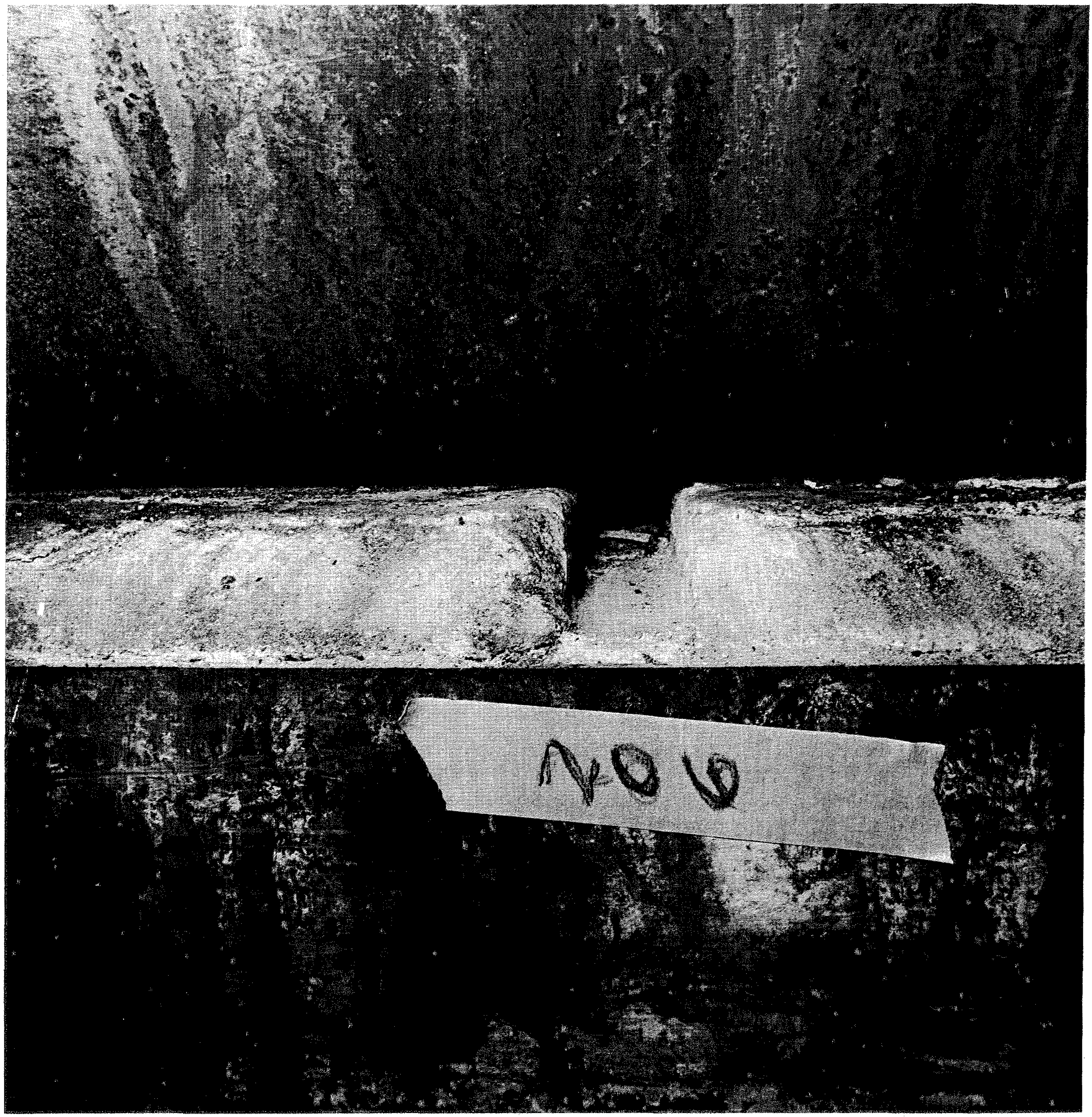
FIGURE 8

TYPICAL CRACK IN REFRACTORY, TANK 101

AEC-RL RICHLAND, WASH.

FIGURE 9

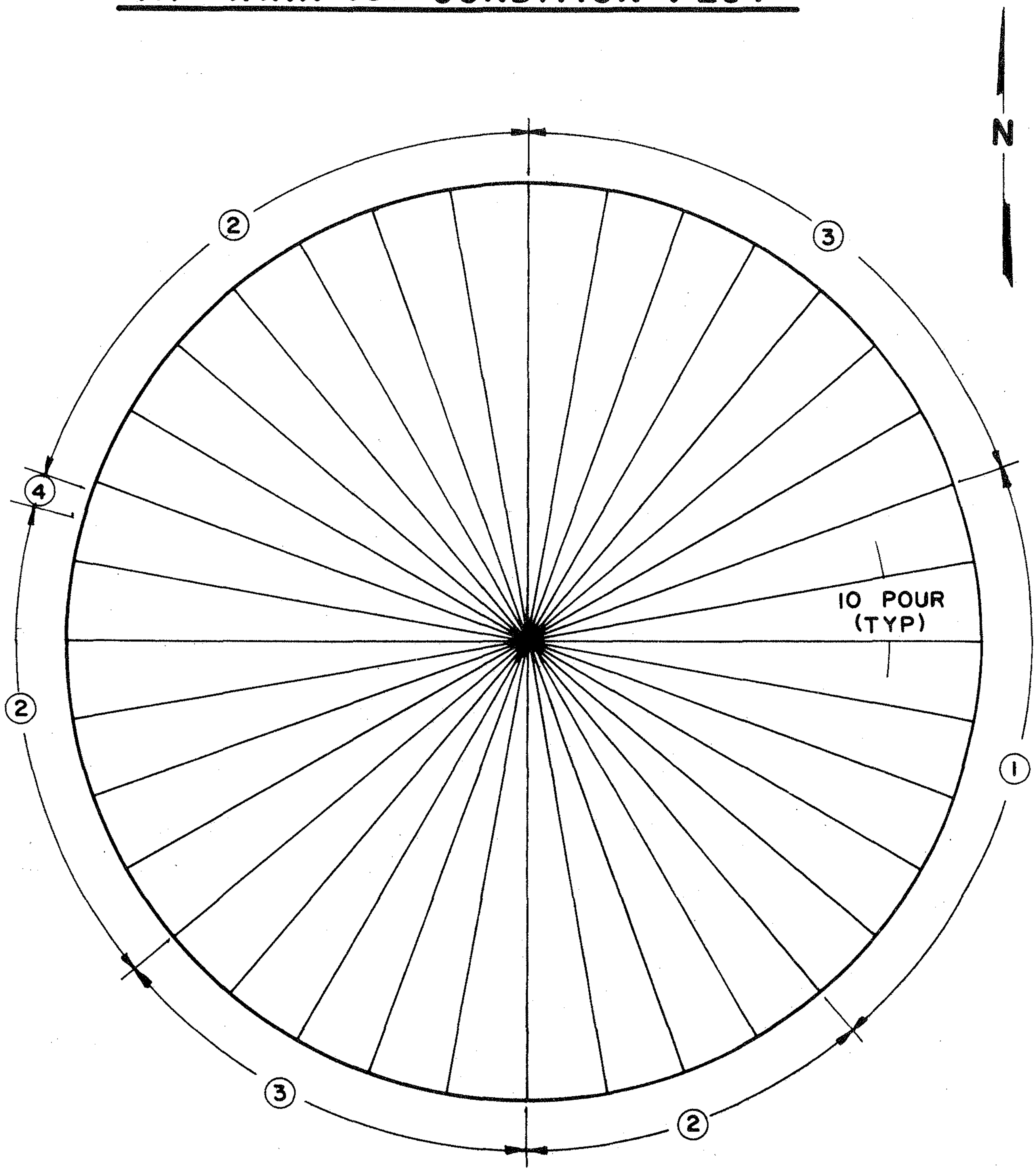
GOOD REFRACTORY, TANK 101



AEC-RL RICHLAND, WASH.

FIGURE - 10

AY TANK 101 CONDITION PLOT



LEGEND

1 - GOOD CONDITION
2 - SURFACE DETERIORATION < 1/2 IN.
3 - SURFACE DETERIORATION ≈ 3/4 IN.
4 - BADLY FRACTURED AT PERIPHERY

FIGURE – II

SUPPORT LOSS AT PRIMARY KNUCKLE

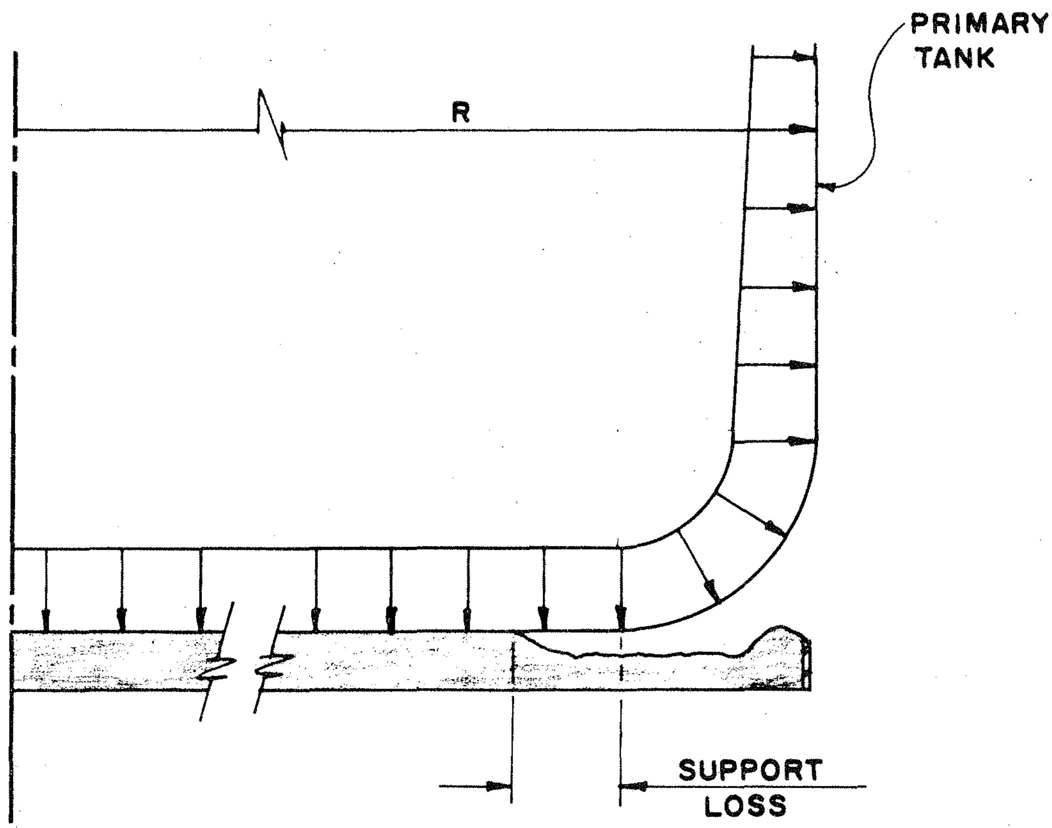


FIGURE-12

STRESS INTENSITY PLOT FOR 6 IN. SUPPORT LOSS

(AXZ RESULTS)

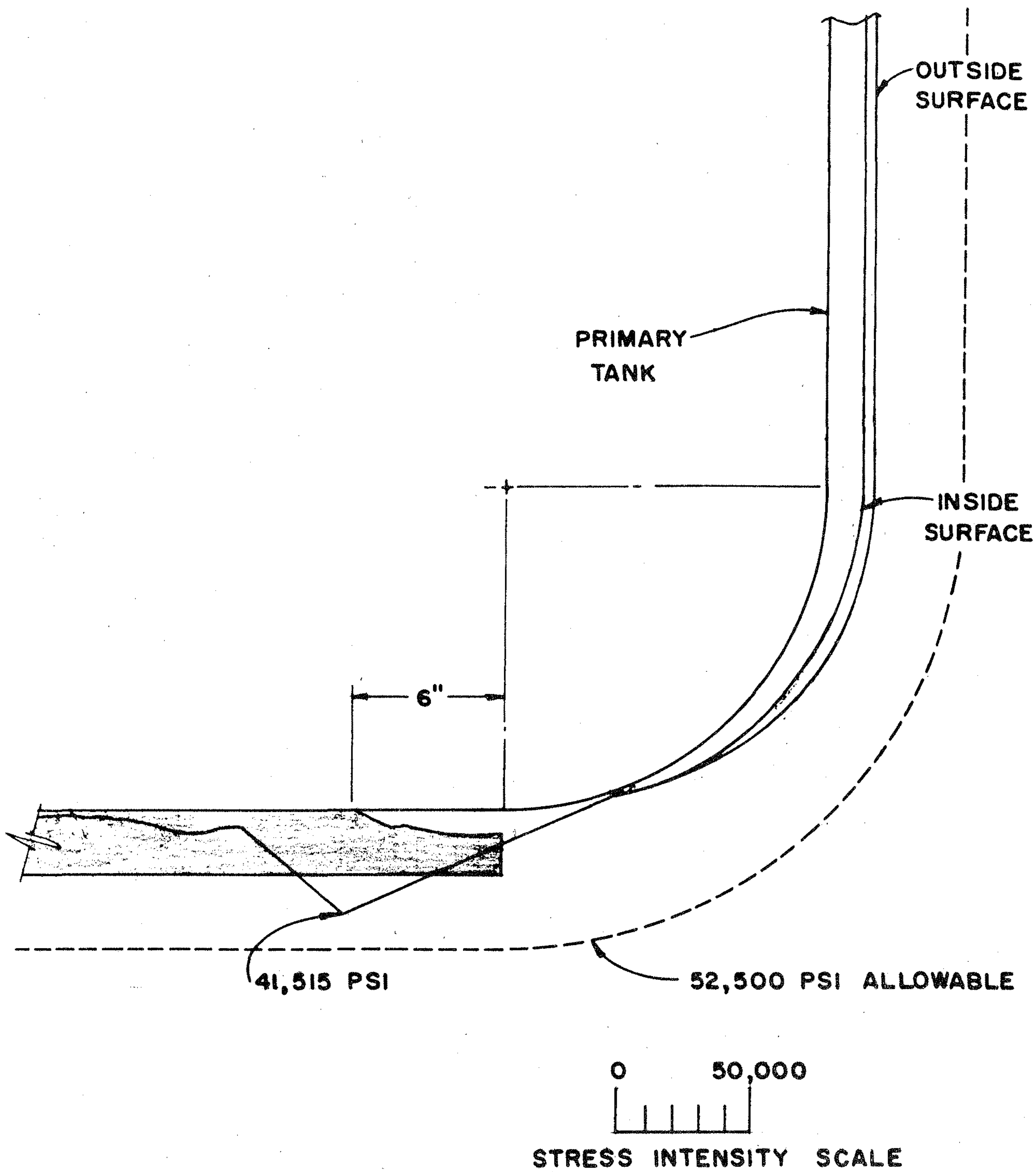
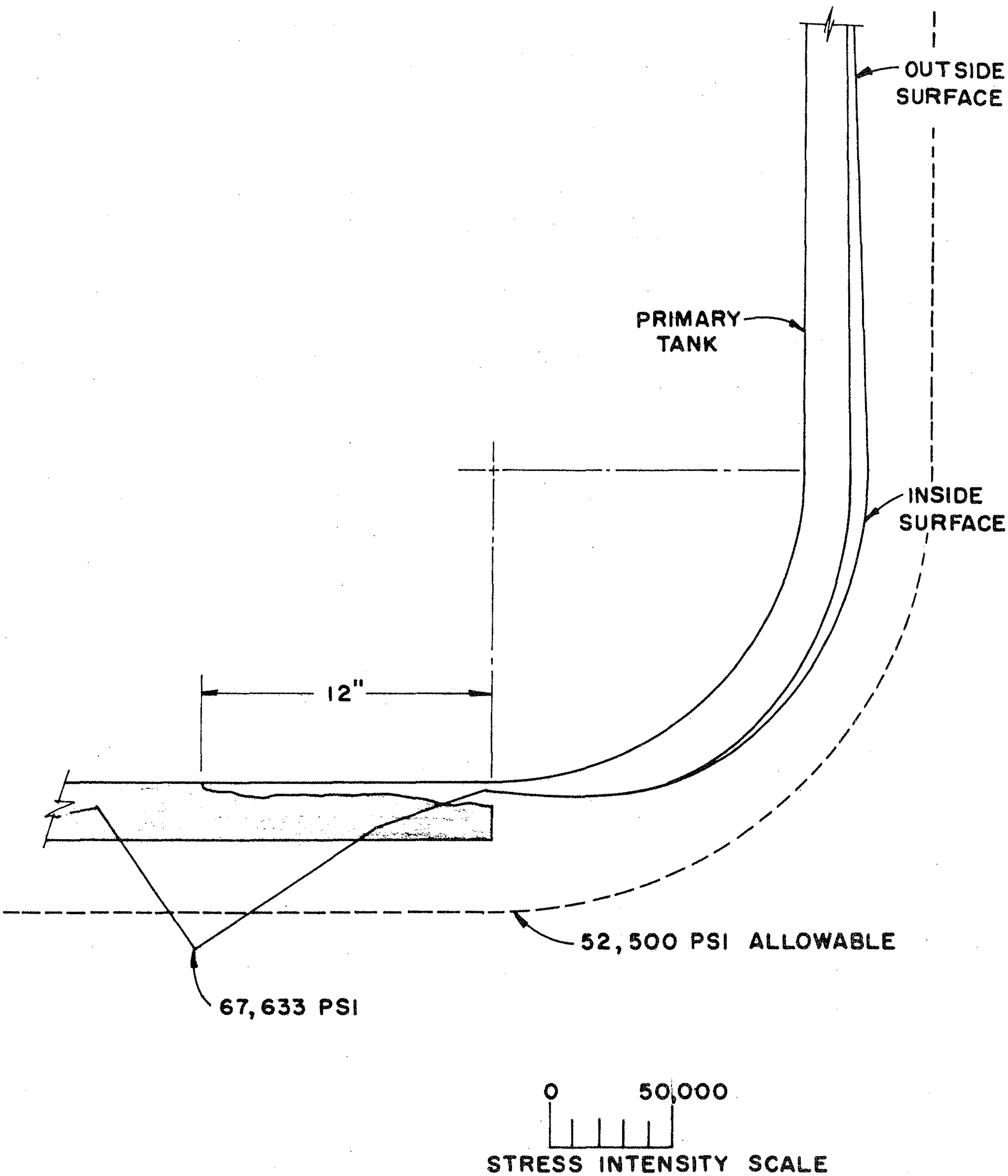


FIGURE - 13

STRESS INTENSITY PLOT FOR 12 IN. SUPPORT LOSS

(AXZ RESULTS)



1.2. Armstrong, W. C., 1970, "Project IAP-614 – PUREX Tank Farm Expansion Post Weld Heat Treating – Tanks 241-AY 101 and 10," (Letter to File, February 2), Atlantic Richfield Hanford Company, Richland, Washington.

Date: February 2, 1970

To: File

From: W. C. Armstrong WCA

Subject: PROJECT IAP-614 - PUREX TANK FARM EXPANSION
POST WELD HEAT TREATING - TANKS 241-AY-101 AND 102

The post weld heat treating was accomplished by introducing the flame from two propane gas fired burners of 10,000,000 Btu per hr. capacity directly into the tanks. The tanks, which rest on 8" of kaolite insulating concrete, were insulated on the sides and dome with 3" of mineral wool batting. Monitoring of the tank wall temperatures was by means of uniformly spaced thermocouples connected to continuous strip chart recorders. Tank 241-AY-102 was heat treated before 241-AY-101 due to its earlier completion. The following is an account of the post weld heat treating of the two tanks:

Tank 241-AY-102

Immediately prior to lighting off the burners the propane supply line was pressurized and inspected with the aid of soap solution. After several small leaks were repaired, the line was approved for use. All recorders were reading the same ambient temperature.

The first burner was lit at approximately 4:30 p.m., 9/26/69. In the immediately ensuing period a significant amount of firing system trouble was experienced by the contractor performing the work. The most serious trouble was the persistent blowing out of the pilot lights by the main fuel stream. Of the two burners the one in the northwest quadrant gave the most trouble. This caused the safety valve which was actuated by the flame rod at the pilot light to shut off the fuel supply to the burner. Persistent trouble with the pilot lights and other equipment occurred for the first three days and sporadically during the whole heat treating period.

As evidenced by escaping steam, free water boiling off in the insulating concrete upon which the tank rested prevented the tank bottom temperature from rising above approximately 210° until the night of 9/28/69.

ATTACHMENT III

After a very slow rise in temperature the contractor proposed to increase the heat at a maximum rate of 100°F per hour until the two dome thermocouples nearest the burners read 1000°F to get the benefit of more radiant heat at the tank bottom. It had been apparent since fire up that these two thermocouples were not representative of the other dome thermocouples, but always lead because of their proximity to the burner flames. It was determined by ARHCO's metallurgist, Dr. Moore, that metallurgically no harm would be done. By consensus of ARHCO, Vitro and AEC, the matter was referred to the contractor's engineering headquarters in Pittsburgh, Pa., for guidance. During this time cycling on and off of the burners was required to hold the spread between wall temperatures within tolerance. After a stress analysis the contractor's chief engineer, John Adams, approved the above increase to 1000°F with the proviso that the temperature difference between the bottom and top of the lower knuckle be held to a maximum of 220°F. He also confirmed the ARHCO metallurgical approval.

At approximately 10:00 a.m., 9/30/69 the heat was increased within the 100°F per hr. rate to 1000°F at the two control thermocouples nearest the burners.

At approximately 12:00 midnight 9/30/69 it appeared that due to limits of heat transfer it would be impossible to reach 1100°F (the Spec. minimum) in all sections of the tank in any reasonable time, if ever. It was agreed by E. L. Moore, ARHCO; P. Hatch, ARHCO; D. J. Squires, AEC; W. C. Armstrong, ARHCO and via telecon M. Schultze, Vitro, that a holding time of three hours at 1000° in accordance with ASME Boiler and Pressure Vessel Code, Section VIII UCS-56 would be accepted. It was considered that this was preferable, especially in view of the extended heating period, to continued extended heating with its attendant oxidation just for the sake of trying to meet specifications.

At approximately 4:30 a.m., 10/1/69, the tank bottom temperature reached 1000°F while the maximum dome temperature was 1150°F. These temperatures were held until 7:30 a.m. when controlled cooling was commenced. At approximately 4:30 p.m., 10/1/69, after a steady rate of decline well within the maximum of 100°F/hr., the 600°F non-critical temperature was reached.

Tank 241-AY-101

The venting of this tank was from the bottom rather than from the top as in Tank 102-AY. Ten 4" vent pipes were extended to near the bottom of the tank to aid in narrowing the spread between the dome and bottom temperatures by using convection heating more effectively. Temporary thermocouples were installed on the inside face of the tank bottom to aid in correctly monitoring bottom temperatures.

The burners were fired off at 4:30 p.m., 10-31-69. At 9:00 p.m. dome temperatures were 500°F. This temperature was held during the night while the base insulating concrete dried out.

At 7:20 a.m., 11/1/69, the controlled heating period was started; i.e., 100°F per hr. rise with Max-Min difference of 200°F. at 7:00 p.m. dome temperatures were 900°-950°F.

At approximately 9:00 one burner stopped firing due to low gas pressure caused by icing up of the propane storage tanks. The ice was washed off the tanks and enough vapor pressure was obtained to fire both burners but there was not enough pressure to provide adequate flow to increase the firing rate. A temperature of approximately 900°F maximum was maintained until 4:30 p.m. 11/2/69 when steam was applied to the propane tanks. This increased the line pressure to 40 psi, well over that required for full firing.

At 9:00 p.m. all base temperatures were over 1000°F and dome temperatures were 1030°F to 1115°F. There was little temperature increase after 10:00 p.m., 11/2/69. A heat transfer equilibrium seemed to have been reached. At 12:00 a.m., a burner cut off because of electrical control difficulties. The dome temperature dropped about 30°F before re-ignition while the other surfaces of the tank were barely affected.

As with Tank 102-AY, it was decided to invoke the ASME Code Sec. VIII rules for 1000°F holding temperature. The holding period was concluded at 1:20 a.m. 11/3/69. Controlled cooling was maintained at a rate of approximately 50°F per hour. The non-critical 600°F temperature was reached at 11:00 a.m., 11/3/69.

During the post weld heat treating of both tanks, the concrete foundations never attained a temperature of 200°F. The Kaolite insulating concrete was intended to protect the foundation concrete from temperatures above 500°F. Although the specification requirement of holding the tanks at 1150°F ± 50° for one hour was not met, the holding of the tanks at 1000° for three hours is in full agreement with the provisions of the ASME Boiler and Pressure Vessel Code and assures a positive post weld stress relief to combat stress corrosion cracking.

WCA:mwa

cc: DR Gustavson
HP Shaw (6)

1.3 Cardwell, C. W., 1968, "Inspection Report – PDM Provo Shops," (Interoffice memorandum to G. Kligfield, December 18), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

INTER-OFFICE MEMORANDUM

DATE December 18, 1968

TO Mr. G. Kligfield (LOCATION OR DEPARTMENT)

FROM C. W. Cardwell (LOCATION OR DEPARTMENT)

SUBJECT INSPECTION REPORT - PDM PROVO SHOPS

The following report was submitted by out Mr. A. Short on December 14, 1968 and delineates the cause and effects of the thermal distortion of the knuckle plates fabricated for Tank 102 secondary. Al also describes the inordinate width of some areas of weld repairs in addition to the convex-concave irregularities of the knuckle plate sections. The corrective measures to the secondary bottom plate described by Al as possible procedure to be used in the field has not been fully evaluated. We quote:

"During the fabrication of the 1/4 inch lower knuckle plates for secondary tanks 101 and 102, it became apparent the excessive distortion would be experienced in the flat sections of the plates as a result of repeated weld repairs. The complete avoidance of thermally-caused distortion is nearly impossible in butt-welded steel plate as thin as 1/4", especially if there are repeated weld repairs. The degree of distortion seems to be directly proportional to the number and magnitude of the weld repairs.

"Wherever several second and third repairs were necessary, and close enough together so that the distortive forces became cumulative to a common area, then the distortion appeared, in some cases, to be in excess of that allowed in the governing specification, HWS-7789. In a few cases attempts were made to flatten the distorted areas in the hydraulic press, but an "oil-can" effect was the only result, and no measurable success was achieved. It was therefore decided to stress relieve the repaired plates and then make another attempt to straighten them in the hydraulic press.

"Stress relieving of all 1/4" lower knuckle plates for secondary tank 102 took place on Saturday, Dec. 7, in conformance with the approved PDM procedure. The following Monday morning, Dec. 9, the plates were removed from the heating oven and an immediate attempt was made to flatten some of the most distorted areas. Virtually the same measure of success was experienced as before, except that in some areas a little straightening was possible. In the areas where the distortion assumed a roughly circular shape, all attempts to straighten them were completely unsuccessful. It appeared that the most advisable solution would be to ship them to the work site, fabricate the bottoms and perhaps the first course of side plates, complete all welding, and then employ

HES-60 (8-67)
AEC-RL RICHLAND, WASH.

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INTER-OFFICE MEMORANDUM

carefully regulated flame-shrinking to return the entire bottom, as a unit, to conform to the flatness tolerance required in HWS-7789. That approach was agreeable to all the involved PDM people here at the Provo plant.

"Wednesday, Dec. 11, before the plates were loaded on the truck for transportation to the erection site, a check was made to determine areas that were suspected of being out of tolerance for flatness. Each plate was placed in its normal position on an area of flat concrete floor, then visually examined for irregularities. In the suspect areas a straight edge was placed across the top center of a convexity so that it also intersected the bottom center of a contiguous concavity, and the difference measured. The horizontal distance from the center of the convexity to the center of the concavity was also measured in order to determine the slope per foot. Admittedly, the method was inaccurate, but we were not attempting to establish definite and specific values, because those values would change as soon as the plates became an integral part of the welded bottom. Our efforts were only to document the existence of a condition.

"The areas that are suspected of being out of tolerance are identified by seam number as called out on PDM Dwg. S-6, contract number 38570, and are as follows: Seams A4, A9, A13, A15, A25.

"In addition to the convex-concave irregularities, it is also to be noted that in some areas of repaired welds, the width of the weld had increased from the original nominal 1/2", to a dimension of 1-3/4" wide. For 1/4" plate this is considered completely unnecessary. However, in spite of the undesirable width, the quality of the welds are within acceptable limits." End of quote.

C. W. Cardwell

CWC:ms

cc: ES Davis
A Short
FE Proj. File
FE LB

HES-59 (12-66)
AEC-RL RICHLAND, WASH.

1.4 Cardwell, C. W., 1969a, "Installation of Kaolite Insulation," (Letter to H. E. Eager, February 20), Vitro Hanford Engineering Services, Richland, Washington.

19

Vitro

H. E. Eager, Area Engineer

U. S. Atomic Energy Commission

C. W. Cardwell, Field Engineering

February 20, 69

Project IAP-614
Contract AT(45-1)-2124

INSTALLATION OF KAOLITE INSULATION

Several meetings have been held regarding data provided to us for review and comment pertaining to installation of Kaolite by the contractor. Most of these items were resolved in a meeting held in 2101-M Bldg., this date. Those in attendance were as follows:

ARHCO	VITRO-HES	AEC
W. C. Armstrong	C. W. Cardwell	H. E. Eager
	W. S. Graves	J. Slaughter
	M. Schulze	
	A. Short	
	E. S. Davis	

Discussions centered around the following which in most instances were not provided as part of the above noted data:

1. The shell bottom is out-of-tolerance with respect to peak-to-valley and slope requirements in several places. These out-of-tolerance conditions are acceptable provided the contractor assumes responsibility for the changes in elevation of the primary tank caused by these conditions.

2. Placing of Kaolite is to begin at the greatest out-of-tolerance location of the secondary shell.

3. Any visual cracks, fractures in or damages to the Kaolite will be repaired as recommended by the Kaolite manufacturer.

4. Regarding placement of Kaolite insulation, in a discussion with the insulation contractor on 2-19-69, the following is understood to be the result of the discussion:

   The strength and thermal characteristics of the insulation will not be affected by the type of joint created by the proposed placement methods.

5. Threads on fittings used in conduit can not be exposed to thermocouples.

It is suggested that these items be reviewed with the contractor and his concurrence obtained prior to placement of the insulation.

2/24/69 ESD Preparing marked Print of Levels.

/s/ C. W. Cardwell/ESD
C. W. Cardwell

CWC/ESD:ms

cc: G. Kligfield/V-HES
WC Armstrong/ARHCO
WS Graves/V-HES
FE Project File
FE LB

February 14, 1969

C. W. Cardwell

W. S. Graves

Purex Tank Farm Expansion IAP-614

Minimum Thickness Insulating Concrete

Confirming discussions with A. Short and E. S. Davis, five inches of Kaolite insulating concrete is sufficient to protect the base concrete during stress-relieving of the primary tank. This judgement is based upon the Battelle report BNL-797, detail requirements on the similar project at Savannah River, tests run by Nooter in Saint Louis for the Savannah River project, and Vitro calculations.

It was with this information in mind that a "humped" bottom 3" in height could be accepted since this still left 5" of insulation available. The condition at the air inlet pipes requires a minimum thickness as shown, but in this limited area the steel plate of the secondary tank will spread the heat flow and thus lessen the intensity to a satisfactory level.

Please note that Pittsburgh-Des Moines is technically responsible for adequate thickness as required by their stress-relief procedure as noted in Specification HWS-7789 Para. 9. Our drawings specify only a minimum acceptable thickness at the air-inlet pipes.

Original Signed By
W. S. Graves
W. S. Graves

WSG:fwk

cc: GK/CAS
WSG/files

1.5 Cardwell, C. W., 1969b, “Design Change 2124-17,” (Letter to H. E. Eager, April 7), Vitro Hanford Engineering Services, Richland, Washington.

HANFORD ENGINEERING SERVICES
RICHLAND, WASHINGTON

NO. OF EACH	DISTRIBUTION:	SERIAL NO.
	Courtesy copy	
1	GK/ES Graves/V-HES	
1	RL Lysher/V-HES	
1	A. Short	
1	FE Project File	

DATE April 7, 1969

TO: H. E. Eager, Area Engineer
U. S. Atomic Energy Commission

FROM: C. W. Cardwell
Field Engineering

PROJ. OR SUBJECT: Project IAP-614
Contract AT(45-1)-2124
PDM Contract 38570
241-AY Purex Tank Farm Expansion
Design Change 2124-17

ATTACHED ARE	THEY ARE TO BE USED FOR	THESE ARE	PLEASE NOTE	PLEASE
___ REQUISITIONS	___ ESTIMATING	___ PRELIMINARY	___ REVISION	___ COMMENT
___ PRINTS	___ ORDERING MAT'L.	___ UNCHECKED	___ HOLDS	___ APPROVE
___ PHOTOSTATS	___ SECURING QUOT.	___ CHECKED	___	___
___ SPECIFICATIONS	___ CONSTRUCTION	___ FINAL	___	___
___ TRACINGS	___ INFORMATION	___	___	___
___	___	___	___	___

DRAWING NUMBERS, TITLES AND COMMENTS:

Transmitted herewith are one original and five copies with attachment of subject Design Change. Please forward to the Operating Contractor for his consideration.

RECEIVED
APR 8 1969
Vitro
Richland, Washington

RECEIVED
APR

CWC/ESD:ms

HES-1 (6-67) AEC-RL RICHLAND, WASH.

RL-144 (REV. 3-68)
AEC-RL RICHLAND, WASH.

U. S. ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
RICHLAND, WASHINGTON

RECORD OF DESIGN CHANGE

PROJECT TITLE	DATE
241-AY PUREX TANK FARM EXPANSION	April 7, 1969

PROJECT NUMBER	CHANGE NUMBER
IAP-614 Contract AT(45-1)-2124	2124-17

DETAILED DESCRIPTION AND REASON FOR CHANGE

See Attachment

EFFECT OF CHANGE ON TIME FOR CONSTRUCTION

None

EFFECT OF CHANGE ON WORK WHICH HAS BEEN COMPLETED

None

SHOULD "AS BUILT" BE RECORDED ON PLANS? [X] YES [ ] NO
IS DESIGN AFFECTED? [ ] YES [X] NO

REQUESTED BY VITRO-Hanford Engineering Services

APPROVALS

OPERATING CONTRACTOR	ARCHITECT ENGINEERS (AS REQUIRED)	ATOMIC ENERGY COMMISSION
	/s/ CWC/ESD C. W. Cardwell, Field Engr'g VITRO-HES	

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5. YELLOW – OPERATING CONTRACTOR
6. GOLDENROD – CONSTRUCTION CONTRACTOR (CPFF ONLY)

ATTACHMENT
Design Change 2124-17

April 7, 1969

Detailed Description and Reason for Change

1. Reference: Design Change 2124-9

Description:

HWS 7749, Paragraph 12.2 e is further revised to include use of film up to thirty-six inches in length on different plate thicknesses. Lengths of film used must provide consistent and acceptable film quality.

Reason:

To expedite x-ray production and assist in maintaining tank erection schedules.

Cost:

None

2. Reference: Drawing H-2-64449, Section A-A, Cleat Detail

Description:

Change the height of the cleat from 3" to 5". Total required - 18 per tank.

Reason:

The difference in elevation between the secondary and primary tank bottoms is increased approximately two inches because of variations in the level of the secondary tank bottoms. This, in turn, raises the cleats within the container ring (see Dwg. H-2-64449, Detail 6), causing the 3"-high cleats to become ineffective.

Cost:

Pittsburgh-Des Moines should bear any increase in cost since they failed to place the secondary tank bottom and air piping in its design location.

1.6 CE-0283, 1967, "Report on a Study of Possible Insulating Materials for Use Between Tank Shells – 241-AY Tank Farm," Vitro Hanford Engineering Services, Richland, Washington.

HANFORD ENGINEERING SERVICES
RICHLAND, WASHINGTON

NO. OF EACH	DISTRIBUTION:	SERIAL NO.
2	Paul Hatch, ARHCO	241-T/102
1	E. F. Smith	F.B.
1	G. Kligfield/CAS	F.B.
1	E. J. Latzko	F.B.
1	W. S. Graves	F.B.

DATE October 23, 1967

TO: Paul Hatch, ARHCO

FROM: E. J. Latzko, Vitro/HES

PROJ. OR SUBJECT: IAP-614 (CE-0283)
241-AY Tank Farm
Intra-Tank Insulation

ATTACHED ARE	THEY ARE TO BE USED FOR	THESE ARE	PLEASE NOTE	PLEASE
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___ TRACINGS	X INFORMATION	___	___	___
X Report	___	___	___	___

DRAWING NUMBERS, TITLES AND COMMENTS:

HES-1 (6-67) AEC-RL RICHLAND, WASH.

Vitro

REPORT ON A STUDY

OF

POSSIBLE INSULATING MATERIALS FOR USE BETWEEN TANK SHELLS

241-AY TANK FARM

Work Order CE-0283

Prepared By: ________________________ 10/23/67
E. J. Latzko — Date

Approved By: ________________________ 10/23/67
C. A. Sursaw — Date

HANFORD ENGINEERING SERVICES

A Division of Vitro Corporation of America

INTRODUCTION

The proposed construction of the 241-AY Tank Farm is centered about a design for each underground tank to include an inner and outer steel shell. Each shell shall be of welded construction at the site. Reference Drawing SK-2-3942.

There is to be a support pad approximately eight (8) inches thick between shells at the bottom.

The pad shall act as an insulator to protect the concrete below the outer steel shell from the temperature incurred in stress relieving the inner shell. Present plans call for a gradual temperature rise to 1100 F and a gradual temperature decrease back to ambient. The time interval for the heat up and cool down cycle may be as much as twenty-four hours to hold the relieving temperature for thirty minutes.

This pad shall incorporate a series of channels which, in the event of failure of the inner tank, would conduct any fluid leaking out to a drain in the outer tank.

REQUIREMENTS

The requirements of the insulating slab are as follows:

A. Installation

1. To be laid or poured at the site.
2. To support inner tank and concrete dome erection equipment.
3. To contain channels for passage of air from center to periphery during normal operation and stored fluid to periphery in case of inner tank failure.
4. To prevent a rise in temperature at the upper surface of the structural concrete below the lower shell to 550 F. This requirement occurs only during the period of weld stress relieving the inner shell. Based upon a net thickness of four inches and an overall coefficient of heat transfer to the soil of 7 BTU/HR °F Ft^2, the required coefficient of thermal conductivity is 2 BTU-IN/HR °F Ft^2.

B. Operation

1. To support approximately 400 pounds per square foot dry or in the presence of tank fluid.

2. To remain stable in the present of 350 F 1 molar HNO_3 or NaOH solution having a radioactivity level of 10^6 R/Hr.

DISCUSSION

The survey was made of available insulating materials both precast and castable at the site.

Table A lists those insulations considered but judged unsuitable for use. Table B provides a comparison of those insulations considered good prospects to satisfy the requirements.

At present, two products appear most satisfactory. They are: an expanded glass product such as Pittsburgh-Cornings' FOAMGLAS, or a castable insulation such as Johns-Manville 200 F No. 20 FIRECRETE or GREAT LAKES CARBON-PERMALITE.

Moisture content within the insulation cast onsite presents a task of drying and keeping down the moisture content to limits such that, when the temperature is brought up on the tank above, there will be no build-up of pressure within to break up the slab.

The lower compressive strength, borderline temperature limits, and presence of SO_2 in the foamglas are properties which must be studied further to complete this evaluation.

Vitro/HES has samples of 2 inches and 4 inches thick Foamglas and 4 sack and 8 sack Permalite concrete. These are available for laboratory test to determine suitability to the project.

APPENDIX A

Insulations Considered and Rejected

Trade Name and Manufacturer	Reason for Rejection
Inorganic Materials	
1. Fiberglas Board - All Manufacturers	Poor compressive strength - Hygroscopic
2. Asbestos Board	Hygroscopic
3. Mineral Fiber	Poor compressive strength
4. Bentonite Clay - Air Entraining Additive to Cement	Waterproofing and air entraining agent only
5. Calcium Silicate	Hygroscopic
Organic Materials	
1. Polyurethane Rigid Foam - Unarco	220° maximum service temperature
2. Aerotube Sheet - Foamed Plastic - Johns-Manville	220° maximum service temperature
3. Polystyrene - Johns-Manville	175° maximum service temperature

INSULATION COMPARISON

Trade Name	Permalite	Foamglas	Firecrete Castable Refractory	Marinite 23
Manufacturer	Great Lakes Carbon	Pittsburgh-Corning	Johns-Manville	Johns-Manville
Method of Installation	Poured	Block - 18" x 24"	Poured	Sheets - 4' x 12'
Service Temperature - Degree Fahrenheit	1400 F	800 F	2000 F	1200 F
Resistance to Wetting	Poor - Resin added to retard moisture absorption	Good	Poor	Good - Normal 5% moisture by weight
Mix Ratio - Cement:Insulation	1:4 1:8	---	---	---
Compressive Strength: Dry - psi	450 100	100	210 and Up	14,000
Drying Time - Days	28 56	0	?	0
Density - Lbs/Ft^3	37 22	9	45 - 180	23
K Factor - BTU/Hr °F Ft^2 @ 350 F @ 1100 F	0.85 0.50	Estim. 0.5	1.5 - 4.5	0.60

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RICHLAND, WASHINGTON

NO. OF EACH	DISTRIBUTIC	SERIAL NO.
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1	W. S. Graves	F.B.

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FROM: E. J. Latzko, Vitro/HES

PROJ. OR SUBJECT: IAP-614 (CE-0283)
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Intra-Tank Insulation

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X Report	___	___	___	___

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Vitro

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Work Order CE-0283

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Date

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Resistance to Wetting	Poor - Resin added to retard moisture absorption	Good	Poor	Good - Normal 5% moisture by weight
Mix Ratio - Cement:Insulation	1:4 1:8	---	---	---
Compressive Strength: Dry - psi	450 100	100	210 and Up	14,000
Drying Time - Days	28 56	0	?	0
Density - Lbs/Ft^3	37 22	9	45 - 180	23
K Factor - BTU/Hr °F Ft^2 @ 350 F @ 1100 F	0.85 0.50	Estim. 0.5	1.5 - 4.5	0.60

APPENDIX B

1.7 CML-SSP Working Paper 2001.002, 2001, Literature Study on Degradation Products of Known Emissions, Centre of Environmental Science (CML), Leiden University, Leiden, Netherlands.

CML
Centre of Environmental Science

Literature study on degradation products of *known* emissions.

Project within Chlorine Chain Follow-up Research Programme on chlorinated microcontaminants (OVOC)

CML-SSP Working Paper 2001.002

Leiden, March 2001

Authors: René Kleijn[1], Ayman Elshkaki[1], Arjan de Koning[1], Arnold Tukker[2]

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1. Introduction

This report is one of a series of reports generated in the framework of the OVOC research programme[1]. The OVOC programme was started as a follow-up to the Dutch chlorine chain study, which made an inventory of chlorine flows and – emissions in the Dutch society[2]. In the discussion following publication of the latter study, the a central question was if unexpected sources and unexpected pathways still could contribute to pollution of the environment with yet unknown persistent, bioaccumulative and toxic chlorinated compounds (PBTs). Figure 1 gives an overview of the knowledge problem that the whole OVOC programme wants to tackle. A considerable amount of chlorinated organic substances can be found in environmental media, such as sediments and fish fat. Initial data available for the OVOC project partners gave the strong suggestion that 'traditional' compounds such as DDT, PCBs, etc can explain just a limited amount of this organochlorine[3]. This problem formed an important driver for the whole OVOC research programme. There are various potential sources for the fraction of 'unknown' organochlorine, part of which of human origin. It concerns:

1. Historical releases from sources which do not exist any more;
2. Sources of naturally produced organochlorine;
3. Releases of yet undetected organochlorine compounds from known (point) sources, a possibility which is often put into relation to the reactivity of chlorine and the formation of by-products in production processes;
4. Degradation products formed from high-volume emissions of known organochlorine compounds.

The OVOC programme focuses on a measurement campaign related to point 3. However, the other elements are addressed in a number of limited sub-projects. Apart from the questions addressed above, it is of course very useful to obtain more knowledge about the type of degradation products of organochlorine compounds currently emitted can be found in environmental media. This point is the central issue in this report.

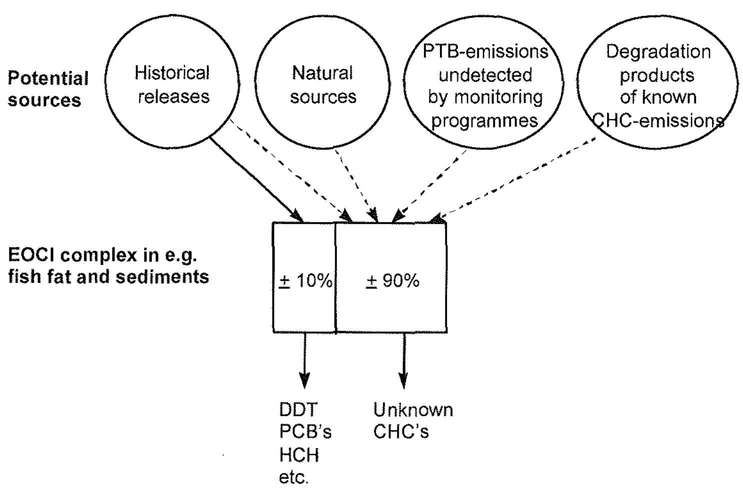


Figure 1. Potential sources of organo-chlorine compounds in the environment.

[1] Van Hattum B., H. Pols, M. van den Berg, W. Seinen, A. Brouwer, A. Tukker, R. Kleijn, J.W.W. Wegener (1998). Proposal Research Programme Chlorine Chain Follow-Up Studies (OVOC). Institute for Environmental Studies, Vrije Universiteit, Amsterdam (In Dutch, English translation July 1999)
[2] A. Tukker, R. Kleijn, E. v.d. Voet (eds.). A chlorine balance for the Netherlands. TNO-STB and CML, Apeldoorn, 1995
[3] Particularly the paper of Wesen et al. of 1995, as summarised under No. 85 in Appendix B.

The question which should be answered in this report is thus: *which degradation products can be expected from chlorinated compounds which are in the standard monitoring programs.* Since it is not straightforward to determine which compounds are likely to produce hazardous degradation products we started top down in the list of total emissions of chlorinated substances in Netherlands presented in the Chlorine Chain study [25]. Thus degradation products of substances with very low emissions are missed in this exercise. This also implies that most substances which are mainly emitted to water are not discussed because emissions to water are often very small compared to emissions to air. PCBs are an exception to this rule because for PCBs it is well known that degradation products have an important environmental impact see [28] and paragraph 3.12 of this text. Pesticides are not discussed. The amount literature on the degradation of chlorinated compounds is overwhelming. In this report a selection of this literature is used to describe the main pathways and products of degradation. In a separate spreadsheet (http://www.leidenuniv.nl/cml/ssp/degradation.html) an overview is given of a large number of other references which could be useful to answer more specific questions.

2. Methods

Three sources of information have been used to find degradation pathways for organochlorine compounds which have the highest emissions in the Netherlands:

- literature databases;
- *in house* literature;
- the internet.

Several literature databases have been tested for their use within this project, in the end a choice was made for *The Web of Science* of the ISI (*Institute for Scientific information*) which can be found on http://wos.library.tudelft.nl/CIW.cgi. Next to that the *in house* literature was search for possible information on degradation pathways and products. Thirdly an internet search was done. Since the quality of data found on the internet is often hard to assess this data was verified via the literature database when possible.

3. Results

3.1. Degradation of chlorinated organic compounds in general

Organic chemicals discharged into the environment are subject to different reactive species and by the reactions with these species, further toxic by-products can be produced. Although the rate of biodegradation of a chemical compound largely depends upon its structure, also other parameters such as the concentration of the reactive species in the environment, the season and time of day are of importance.

Organic compounds share the same major atmospheric removal or degradation mechanisms, which include the following:

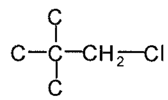
- photochemical oxidation by hydroxyl (·OH) radicals;
- photolysis in the troposphere;
- deposition and uptake at the earth's surface;
- reaction with other reactive species such as chlorine atoms, nitrate radicals at night and ozone.

The same is true for the surface water where hydrolysis is the main chemical degradation route. However, in surface water, sediments and soil, biological degradation is the main degradation route for many compounds.

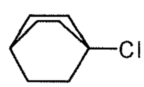
In general the more hydrogen is substituted for chlorine in a substance, the more difficult the degradation of the organochlorine compound will be. The chlorine group acts as a stabiliser making (bio)chemical transformation processes (elimination or substitution reactions) more difficult. For instance the rate constants for the gas-phase reactions of the ·OH radical with PCBs decreases from approximately 2.7×10^{-12} $dm^3.molecule^{-1}.s^{-1}$ for 2-chlorobiphenyl to approximately 0.6×10^{-12} $dm^3.molecule^{-1}.s^{-1}$ for 2,3,3',4',6 pentachlorobiphenyl [23].

Extremely persistent in the environment are those organochlorine compounds where elimination or substitution reactions are almost completely prevented. This is specially the case for the following groups of substances [24]:

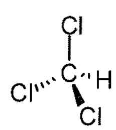
1) neopentylalkanes



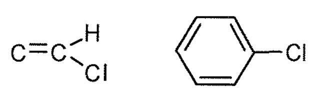
2) halogen atoms at a bridgehead



3) di, tri and tetra halogen carbon atoms



4) vinyl and aryl halogenated compounds



The removal of halogen substituents is a key step in biodegradation. Dehalogenation can occur in through three classes of reactions [29].

1) Oxidative dehalogenation occurs in aerobic conditions and involves fortuitous loss of halogens substituents during oxygenation of the aromatic ring.
2) Hydrolyic dehalogenation occurs in both aerobic and denitrifying conditions an involves the replacement of a halogen substituent by a hydroxyde group with water as the source of the oxygen atom.
3) Reductive dehalogenation occurs almost exclusively under anaerobic conditions and involves substitution of the halogen atom by a hydrogen atom. Chlorinated benzenes and chlorofenols can be totally dehalogenated by reductive dehalogenation.

In the following paragraphs, degradation pathways are given for the organochlorine compounds which have the highest emissions in the Netherlands. In paragraph 3.16 an overview is given of possible degradation products of number of other chlorinated compounds in the atmosphere.

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3.2. Chlorophenol

3.2.1. Sources
Chlorophenolic compounds are basic chemical ingredients for many products made in the chemical industry, including pesticides like 2,4-D and 2,4,5-T [24]. If reaction conditions in the production of chlorophenols are not well controlled, impurities like dioxane or furanes may result [24]. Also chlorophenolic compounds are an unwanted by-product of bleaching of pulp with chlorine [1].

3.2.2. Degradation

In water and on solid surfaces
Experimental work on the degradation and transformation of pentachlorophenol (PCP) showed that photolysis by sunlight is the main degradation pathway in water, organic solvents and on solid surfaces [2,35]. The first step in the photolysis of PCP is a photonucleophilic substitution of hydroxide for chloride to provide three possible tetrachlorodiols. The tetrachlorodiols are then oxidised to their corresponding quinones, followed by further displacement of chloride to form the hydroxytrichloroquinones and dichlorohydroxyquinones (chloranilic acids). Tetrachlorophenols and trichlorophenols are also thought to be formed early by photoreduction but are expected to undergo similar photonucleophilic and photooxidation reactions.Transformation products of PCP include tetrachlororesorcinol and various dimeric benzoquinones [2,35]. Half-lives that have been report in situ are in the order of 2-4.7 days (pH 7.3-10.3; 10-21 °C) [35].

Biodegradation of PCP in water is much faster in aerobic conditions than in anaerobic conditions. Therefore PCP persists much longer in sediments (up to decades) than in water [35]. Furthermore degradation products like tetrachlorocatechol are very persistent too.

In soils
Under aerobic and anaerobic natural conditions slow and partial degradation of chlorophenols has been observed [1]. Aerobic biodegradation of chlorophenols proceeds through the formation of catechols and under anaerobic conditions, reductive dehalogenation is the preferred metabolic pathway. PCP transformation products in soil under natural conditions that have been reported [3] include: tetra- and trichlorophenols, pentachlorobenzene, chlorinated dioxines.

3.3. 1,1,2-Trichloroethane

3.3.1. Sources
1,1,2-Trichloroethane (1,1,2-ETC, cas no. 79-00-5) is used as a chemical intermediate in the production of 1,1 dichloroethene and a limited amount is used as a solvent for chlorinated rubber, fats, oils, waxes and resins [4]. This indicates that in addition to the point source pollution from chemical production, it can be found a in number of limited pollution sources [4].

3.3.2. Degradation

In the aquatic environment
In aquatic system, volatilisation is the major route for 1,1,2-ETC removal. Half-life value of evaporation of 21 minutes has been reported [4]. ETC undergoes a pH-independent and a base catalysed hydrolysis at environmental pH's [4, 27]. The neutral hydrolysis process is a substitution reaction leading to the formation of an alcohol while the base catalysed reaction is

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an elimination reaction giving rise to 1,1-dichloroethane and HCl. The hydrolysis rate of 1,1,2 ETC is 5.9×10^{-3} $l.mol^{-1}.s^{-1}$ at 25°C [4].

In the atmosphere
The environmental distribution model of 1,1,2-ETC predicts that 99% will be found in the atmosphere and less than 1% in the aquatic environment [4]. It has been found that 1,1,2-ETC will be degraded by reaction with photochemically produced hydroxyl radicals (·OH), the residence times are in the range of a few months [4]. Reaction products from photooxidation include phosgene, Cl_2, HCl and CO_2. The half-life values and degradation products in different compartment are listed in Table 1.

Table 1 Half-life and degradation products of 1,1,2-trichloroethane in different environmental compartments [4].

Compartment	Mechanism	Degradation	Products
De-ionised water	Reaction with ·OH	K= 1.1×10^{8} $dm^3 \cdot mol^{-1}.s^{-1}$	$CH_2Cl - CHCl$
Dilute aqueous solution	Homogeneous hydrolysis	$T_{1/2}$ =139.2y	
Aqueous solution	Hydrolysis	$T_{1/2}$ =37y	
Aqueous solution		$T_{1/2}$ =135y	
Surface water	Volatilisation	$T_{1/2}$ =4.5h	
Sea water		No degradation	
Atmosphere	Hydrolysis + DHH	$T_{1/2}$ =170d	1,1dichloroethylene
	Reaction with ·OH	$T_{1/2}$ = 49d	

Biological degradation
Aerobic degradation of 1,1,2-ETC seems to be non-existent or very slow [4]. Under anaerobic conditions, it undergoes dehalogenation [4] The microbial transformation of 1,1,2-ETC in different systems listed in Table 2.

Table 2 Microbial transformation of 1,1,2-trichloroethane in different environmental compartments [4].

System	Redox condition	Degradation	Reaction products
Aqueous biodegradation	Anaerobic	$T_{1/2}$ = 1-4y	
Pseudomonas putida PpG786	Aerobic dehalogenation	70%	
	Oxydative pathway (85%)		Chloroacetic acid + glyoxylic acid
			Vinyl chloride
	Reductive pathway(15%)		
Aqueous biodegradation	Aerobic	$T_{1/2}$ = 6-12m	

3.4. 1,1,1-Trichloroethane

3.4.1. Sources

1,1,1-Trichloroethane (1,1,1-ETC, cas no 71-55-6) is mainly used in metal cleaning and as a solvent in various formulations including adhesives, paint, varnishes, ink and solvents. It is also used as a propellant and solvent in aerosols and as an intermediate in the production of vinylidene chloride [4]. High levels of 1,1,1-ETC have been reported to occur in a number of ground water samples at polluted spots in Europe as well as in the USA and Japan [4].

3.4.2. Degradation

In the aquatic environment

1,1,1-ETC undergoes a pH-independent and a base catalysed hydrolysis at environmental pH's [4, 27]. The neutral hydrolysis process is a substitution reaction leading to the formation of an alcohol while the base catalysed reaction is an elimination reaction giving rise to 1,1-dichloroethane and HCl. The hydrolysis rate of 1,1,1 ETC is higher than 5.9×10^{-3} $l.mol^{-1}.sec^{-1}$ at 25°C [4]. Half lives are reported varying from 0.5-10 years at temperatures from 10 to 25 °C. In sea water (pH=8) shorter half-lives have been reported: 39 weeks at 10 °C [36]. Photodegradation is negligible at the earth's surface [36].

Since degradation is so slow volatilisation is the major route for 1,1,1-ETC loss from water. Half-lives of 17-23 min have been reported for evaporation [4].

In the atmosphere

The environmental distribution model of 1,1,1-ETC predicts that 99% will be found in the atmosphere and less than 1% in the aquatic environment [4]. It has been found that 1,1,1-ETC will be degraded by reaction with hydroxyl radicals (·OH). The residence time in the atmosphere varies from less than one year to ten years. Reaction products from photo-oxidation include phosgene, Cl_2, HCl and CO_2 [4]. The half-life values and degradation products in different compartment are listed in Table 3. It is estimated that 15% of the global emissions is transported to the stratosphere where it is degraded by uv radiation of shorter wavelengths [36]. In this process free radical chlorine atoms are released which destroy ozone via a process in which they are regenerated to repeat the process.

Table 3 Half-life and degradation products of 1,1,1-trichloroethane in different environmental compartments [4].

Compartment	Mechanism	Degradation	Products
De-ionised water	Reaction with OH°	K= 4×10^7 $dm^3/mol.s$	CH_3CCl_2 1,1dichloroethylene
Aqueous solution	Homogeneous hydrolysis	$T_{1/2}$ =1.1y	
Aqueous solution	Hydrolysis and DHH	$T_{1/2}$ =0.5-2.5y	Acetic acid + 1,1-dichloroethylene
Sea water	Hydrolysis and DHH	$T_{1/2}$ =0.8y	
Narraganset Bay sea water	Volatilisation	$T_{1/2}$ =11d summer = 24d winter	
Atmosphere	Reaction with ·OH	$T_{1/2}$ = 3215d	
Sediment	Neutral and base catalysed hydrolysis	$T_{1/2}$ = 450d	

Biological degradation
Aerobic degradation of 1,1,1-ETC seems to be non existent or very slow [36]. No aerobic degradation was found in soil samples after 27 weeks [36]. Under anaerobic conditions, reductive dehalogenation can yield in an biodegradation rate of > 99.5% [4]. The degradation products of 1,1,1-ETC are 1,1-dichloroethane and acetic acid. The microbial transformation of

Table 4 Microbial transformation of 1,1,1-trichloroethane in different environmental compartments [4].

System	Redox condition	Degradation	Reaction products
Aqueous biodegradation	Anaerobic	$T_{1/2}$ = 20-40m	
Aqueous biodegradation	Aerobic	$T_{1/2}$ = 5-10m	
Methanogenic sludge	Reductive DH	98%	1,1dichloroethane
sediment	Anaerobic	100%	1,1dichloroethane

1,1,1-ETC in different systems listed in Table 4. Biodegradation of 1,1,1-ETC has been reported for sediments under anaerobic conditions with total disappearance after 4 to 5 months, the major degradation product being 1,1-dichlorethane [36].

3.5. Dichloromethane

3.5.1. Sources

Dichloromethane (DCM, cas no. 75-09-2) is used in many industrial processes such as metal cleaning, paints, extracting agent, paints and varnish removers, aerosol propellants, degreasing and cleaning fluids, blowing agent in the urethane foam production and refrigerant. It is further used as a solvent in insecticides and as a fumigant [4, 5].

3.5.2. Degradation

In the aquatic environment
The volatilisation is the main mechanism for DCM loss from aquatic system. Half-lives of volatilisation ranging from 5.3 hours in a 1m deep water system to 36-38 hours in rivers and 33-37 days in seas have been reported [4]. Photochemical degradation as well as reductive dehalogenation and hydrolysis in surface water is insignificant [5,37]. In water the reaction with the ·OH radical is the dominant degradation pathway when sunlight is present resulting in halve lives of 68 years.

DCM is biologically degraded under anaerobic conditions via methyl chloride but no accumulation was observed. The half-life of DCM in an anaerobic water/sludge system was reported to be 11 days [37].

In the atmosphere
DCM released into the atmosphere will degrade by reaction with ·OH with an expected half-life of several months [4]. DCM will not be subject to direct photolysis [4]. The reaction of DCM with a hydroxyl radical is fast (completed in about 5 minutes) and gives the reaction products CO, HCl, CO_2 and $COCl_2$ (phosgene) or CHOCl formylchloride and later CO and HCl [5]. Phosgene is stable in the atmosphere. The hypothetical reaction mechanism is [5]:

CH_2Cl_2 + ·OH	→	·$CHCl_2$ + H_2O
·$CHCl_2$ + O_2	→	·O_2CHCl_2
·O_2CHCl_2 + NO	→	·$OCHCl_2$ + NO_2
·$OCHCl_2$ + O_2	→	·HO_2 + $COCl_2$ (phosgene)
or		
·$OCHCl_2$	→	CHOCl (formylchloride) + ·Cl
CHOCl	→	CO + HCl (minor reaction)

Formyl chloride may be taken up by cloud droplets, hydrolysed to formic acid and wet deposited as such, or dry deposited to the ocean or land surfaces and than hydrolysed. The overall lifetime for wet or dry deposition is probably a few months or shorter [37]. However degradation in the troposphere via reaction with ·OH radical to CO, CO_2 and HCl is probably a more rapid process.

Phosgene is slowly hydrolysed in the gas phase but this process is very rapid once it is dissolved in liquid water to give CO_2 and HCl [37].

In soils
DCM is reported to biodegrade completely under aerobic conditions within 6 hours to 7 days. Under anaerobic conditions, 86 – 92% conversion to CO_2 was obtained [4].

3.6. 1,1-Dichloroethane

3.6.1. Sources
1,1-Dichloroethane (1,1-EDC, cas no 75-34-3) is an important intermediate in the production of 1,1,1-trichloroethane. It has a minor application as solvent for caoutchouc (natural rubber) and silicone greases, and as coupling agent in antiknock gasoline [4].

3.6.2. Degradation

In the aquatic environment
In aquatic systems, volatilisation is the major pathway for removal of the compound. Calculated half-life value are reported to be 22 minutes under natural conditions [4], but measurements in the natural environment shows that the half-life of removal from rivers by volatilisation is in the order of 10-30 days [4].

In the atmosphere
In the atmosphere, the major environmental sink for 1,1-EDC is the reaction with ·OH [4]. The half-life is about 2 months [4]. The reported degradation products are formyl chloride, HCl, CO_2, CO and monoacetylchloride [4].

3.7. HCFC-22

3.7.1. Sources
HCFC-22 ($CHClF_2$, cas no 75-45-6) is an important industrial chemical having a range of applications [26] It is used as a chemical intermediate, aerosol propellant, blowing agent for foams, and in refrigeration and air-conditioning applications [26]. Annual emission in 1990 was estimated in the order of 195.2 × 10^6 kg [26].

3.7.2. Degradation
The dominating degradation process for HCFCs in the atmosphere is by reaction with the hydroxyl radical ·OH. Other degradation processes such as reaction with ·Cl atoms, $\cdot NO_3$, or $O(^3P)$ atoms are negligible. The lifetime reported is 13.3 years according to UNEP. The principal products expected from HCFCs and HFCs are:

- Acid halides $CF_3C(O)Cl$ and $CF_3C(O)F$
- Carbonyl halides CF_2O, CFClO, CCl_2O, HCFO, and HCClO
- Aldehydes CX_3CHO

The principal end-products of atmospheric degradation of HCFC-22 are HCl, COF_2,(HF,CO_2).

3.8. Vinylchloride

3.8.1. Sources
Vinylchloride (VC,C_2H_3Cl, cas no 75-01-4) is a bulk chemical which is used as a monomer in the production of PVC [24]. Annual total world production of VC was about 26 million tonnes in 1995 [40].

3.8.2. Degradation

In the aquatic environment
In aquatic systems, volatilisation is the primary loss process for VC in natural water. Other physical and chemical degradation processes such as photodegradation, oxidation and hydrolysis do not appear to play a major role [4]. It appears that photolysis of VC in water containing photosensitiser, i.e. humic materials may be fairly rapid. VC has low adsorption potential to soil and sediment [4].

Biological degradation of VC can occur in surface water as well as in ground water by a limited number of microorganisms, but biodegradation is rather slow [4]. The biodegradation studies have given contradictory results but VC degradation by micro-organism seems to be a little faster (several weeks) under anaerobic conditions than under aerobic conditions (several months) [4, 40]. The main degradation products include glycolic acid or CO_2 after aerobic conversion and ethane, ethene, methane or chloromethane after anearobic transformation [40].

In the atmosphere
The partitioning of VC into environmental compartments has been calculated to be 99.99% air; 0.01% water; <0.01% soil and <0.01% sediment [40]. In the atmosphere, the major degradation pathway for VC is the photochemical oxidation. The products of the reaction are HCl, formaldehyde, formyl chloride, CO, CO_2, chloroacetylaldehyde, acetylene, chloroethylene and H_2O. The recent typical half-life values in air are listed in Table 5.

Table 5 Recently reported half-lives of removal of VC from the atmosphere [4].

Medium	Mechanism	Result
Ambient air	Photochemical	$T_{1/2}$ = 1.5-1.8d
Smog	Photochemical	$T_{1/2}$ = 3-7d
Air	Photochemical	15% degradation
Air	Reaction with O_3	$T_{1/2}$ = 4.2-33d
Air	Reaction with ·OH	T= 3d

Chloroacetylaldehyde has often been reported to be the main degradation product. Chloroacetylaldehyde in itself is a rather stable intermediate [40]. Formyl chloride is a stable potential toxicant [40].

Reactions with ozone as well as direct photolysis appears to be relatively insignificant [4].

3.9. 1,1-Dichloroethene

3.9.1. Sources

1,1-Dichloroethene (1,1-dichloroethylene, 1,1-DCE, cas no 75-35-4) is used for captive organic chemical synthesis and in the production of polyvinylidene chloride polymers [4].

3.9.2. Degradation

In the aquatic environment

In aquatic systems, volatilisation is the principal mechanism for removal of 1,1-DCE from water [4]. Half-lives of 1.6 hours have been reported. Photolysis and hydrolysis of DCE are not likely to be significant processes. Dehalogenation has proved to be a minor importance in soil and sediment [4].

In the atmosphere

In the environment, atmospheric radicals ·OH and ·NO are playing a major role in the degradation of the compound resulting in the production of chloroacetyl chloride, phosgene, formaldehyde, carbon monoxide and nitric acid [4]. Overall degradation half-life is expected to be a few days [4]. The compound may also react with a chlorine atom, peroxy-radicals and ozone. Photolysis of the compound in the presence of nitrogen oxides is also rapid with a half-lives shorter than 2 hours [4]. An overview of degradation pathways in different environmental compartments is given in Table 6.

Table 6 Half-life and degradation products of 1,1-dichloroethene in different environmental compartments [4].

Compartment	Mechanism	Degradation	Products
Dilute aqueous solution	hydrolysis	$T_{1/2} = 1.2 \times 10^8$ y	
Aqueous solution	Volatilisation	$T_{1/2} = 1.6$h	
Atmosphere	reaction with ·OH	$T_{1/2} = 3$d	HCHO and $COCl_2$ $CHxCl_3$-xC(O)Cl
	photolysis	$T_{1/2} < 2$h	

Biodegradation
Biotransformation of 1,1-DCE is believed to be an important process [4]. Under aerobic conditions, no evidence was found for the degradation of the compound. Under anaerobic conditions, the compound is partially to completely converted to vinyl chloride [4].

3.10. 1,2-Dichloropropane

3.10.1. Sources

1,2-Dichloropropane (1,2-DCP, cas no 78-87-5) is a volatile compound which is released into the environment primarily through its use as a soil fumigant [4]. Furthermore it is used in gum processing, oil processing, organic chemical synthesis, in rubber making, wax making and in the making of scouring compounds [38]. It is used in furniture finishing, dry cleaning fluid, paint remover and metal degreasers.

3.10.2. Degradation

An overview of degradation pathways in different environmental compartments is given in Table 7.

Table 7 Half-life and degradation products of 1,2 -dichloropropane in different environmental compartments [4].

Compartment	Mechanism	Degradation	Products
Water stream	Volatilisation	$T_{1/2} = 5.5$h	
Aqueous solution	Volatilisation	$T_{1/2} = 8.3$h	
Demineralised water	Hydrolysis	$T_{1/2} = 8613$d	Chloro-1propanol-2 hydrochloric acid
Demineralised water	Photolysis	$T_{1/2} = 840$min	
Demineralised water + H_2O_2	Photolysis + oxidation	$T_{1/2} = 30$min	
Atmosphere	reaction with ·OH	$T_{1/2} = 6.2$d	

In the aquatic environment
In aquatic systems, 1,2-DCP will be lost primarily by volatilisation. Half-lives ranging from 5 to 8 hours in a typical river and of 10 days in a lake [4]. 1,2-DCP is resistant to hydrolysis with an estimated half-life ranging between 25 and 200 weeks. Photolysis is not likely to be very important, since a half-life of much more than 14 hours was reported [4].

In the atmosphere
The primary mode of degradation in air is through reaction with ·OH radicals [4]. Adsorption to particulate matter seems to be necessary for appreciable direct phototransformation. The calculated half-life on the basis of reaction with hydroxyl radicals was > 313 days (hydroxyl concentration of 1 x 10^6 cm^3)

In Soil
Biodegradation rates depends heavily on local circumstances. Little or no chemical degradation has been observed in laboratory and field studies. More than 98% was found 12-20 weeks after application to sandy loam soil and medium loam soil.

3.11. 1,3-Dichloropropene

3.11.1. Sources
1,3-Dichloropropene (1,3-DCP trans- and cis-isomer mixture, cas no 542-75-6) is widely used as a soil fumigant for parasitic plant nematodes [4].

3.11.2. Degradation

In the aquatic environment
In aquatic environment, 1,3-DCP will be lost primarily by volatilisation. Half-lives ranging from 20 to 30 min [4]. Chloropropenes are sensitive to hydrolysis. However, the rate depends on the conditions in the aqueous medium. Temperature plays a major role [4]. The products formed are the corresponding allylic alcohols with concomitant release of chloride ions. Half-lives range from 1.5-2.0 days at 29°C to 91-100 days at 2°C [4]. Photolysis seems to be possible, no conclusions can be made on its importance for degradation [4].

In the atmosphere
In the atmosphere, ·OH radicals are playing the major role in the degradation of 1,3-DCP. Absorption to particulate matter seems to be necessary for an appreciable direct phototransformation to occur. Direct photodegradation results in the formation of CO_2 and phosgene [38]. The atmospheric life time is approximately 2-3 days at a ·OH concentration of 5 $\times 10^5$ $mol.cm^{-3}$[4].

In soil
1,3-DCP was reported to have a half-life in soil between 3 and 37 days without any correlation between organic matter of the soil, or with pH but with increasing rate when moisture content and temperature rise [38]. The major degradation products, cis- and trans-3-chloroallyl alcohols [4]. An overview of degradation pathways is given in Table 8. Although between 15 and 80% decomposition of field applications of 1,3-dichloropropene has been shown, the large amount that can be adsorbed (80-90%) can result in soil residues existing months after application is completed [38]. An important intermediate in the degradation is 3-chloro-allyl alcohol which is also the product of chemical hydrolyses is moist soils [38] .

Table 8 Half-life and degradation products of 1,-dichloropropene in different environmental compartments [4].

Compartment	Mechanism	Degradation	Products
Aqueous solution	Volatilisation	$T_{1/2}$ =20-30min	
Demineralised water	Hydrolysis	$T_{1/2}$ =6d(cis) $T_{1/2}$ =7d(trans)	Chloropropenol-3 hydrochloric acid
Aqueous solution	Hydrolysis	$T_{1/2}$ =4.8d	
Atmosphere	reaction with ·OH	T =3d (cis) T= 2d (trans)	
Soil and sediment (wet soil)	Hydrolysis	$T_{1/2}$ =3-25d	3-chloroacrylic acids

Biodegradation
The aerobic degradation of 1,3-DCP seems possible with a half-life ranging from 7 days with unadapted bacterial cultures to < 6 days for adapted bacteria [4]. The biodegradation rates will strongly depend on moisture content, oxygen concentration in the soil and temperature. Degradation products of 1,3-DCP in aerobic soil include 3-chloroallyl alcohol, 3-chloroacrylic acid, numerous minor carboxylic acid metabolites and carbon dioxide [9].

3.12. Polychlorinated biphenyl

3.12.1. Sources

Polychlorinated biphenyl (PCBs cas no 1336-36-3) have been widely used as hydraulic fluid, dielectric fluid in transformers, cutting fluid, carbonless copy papers etc [31]. Total global production has been estimated at 1 200 000 tons [32].

3.12.2. Degradation

In the atmosphere
In general PCBs in the troposphere could be degraded by four mechanisms: photolysis, Reaction with ozone, reaction with the ·OH radical and reaction with the $\cdot NO_3$ radical.

Reactions of ozone and the $\cdot NO_3$ radical with PCBs in the atmosphere have not been observed [23]. Reaction of the ·OH radical with PCBs has been studied rather well and seems to be the only important troposheric loss process for the gas-phase PCBs [23]. Reaction products have not been given. Only a very few studies deal with the photolysis of PCBs in the troposhere [23]. Tropospheric lifetimes for PCBs given by [15] are shown in Table 9.

Biodegradation

Biodegradation of PCBs in soil is considered to be very complex due to various physico-chemical factors involved. Isotope labelling technique seem to be the best way to trace fate of PCBs in the environment [13]. Using the isotope labelled PCB congener 11 (3,3'-chlorobiphenyl) as a low chlorinated coplanar biphenyl, 3-chlorobenzoic acid was found to be the major biodegradation product. PCB-11 was readily degraded by micro-organisms. In another study [14], it has been reported that in addition to chlorobenzoic acid as biodegradation product of PCBs, there are some other metabolites such as 2,3-dihydro-2,3-dihydroxy-2'-chlorobiphenyl and 2,3-dihydroxy-2'-chlorobiphenyl. A general pathway for the biodegradation of PCBs by micro-organism [29] is given in Figure 1 and corroborates the findings of [14] and [30].

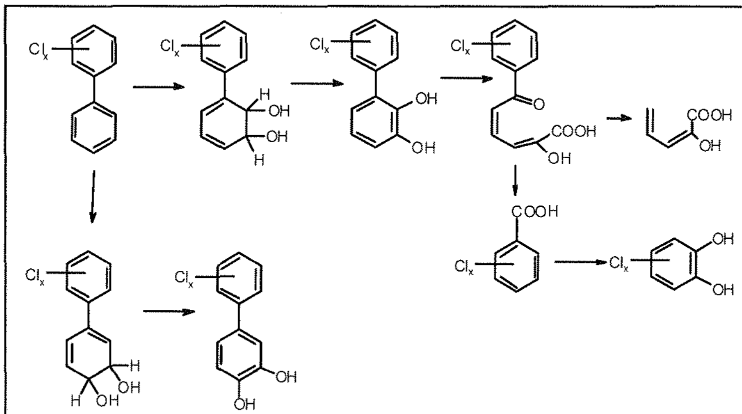

Figure 1 Pathways for the aerobic biodegradation of PCBs according [29].

However the metabolism of PCBs by vertebrate is different form the degradation by micro-organisms [29]. In vertebrate the PCB is transformed in a hydrolysed species but alternatively may also be coupled with endogenous molecules like gluthatione (GSH). Metabolites of PCB like the hydroxylated congeners as well as the lipophylic methyl-sulfonyl compounds have been found in wildlife [29]. A general pathway for the biotransformation of PCBs in vertebrate is given in Figure 2.

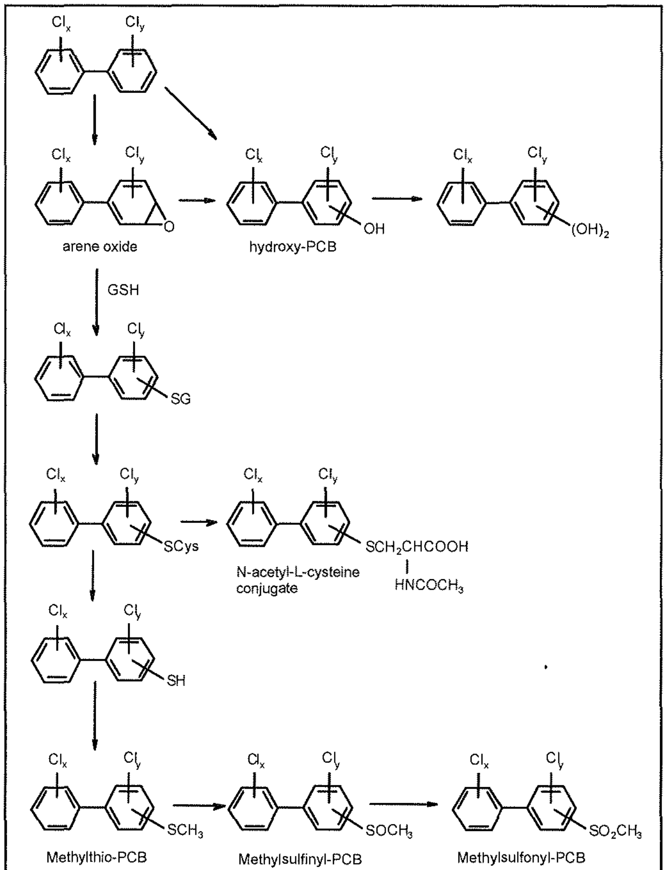

Figure 2. Metabolic pathways of PCB transformation in vertebrates.

The following half-life times (h) of some PCB congeners in air, water, soil and sediment at average temperature +7°C have been suggested [15].

Table 9 Half-lives for some PCB congeners in air, water, soil and sediment at an average temperature of +7°C [15]

	Structure	Air [hr]	Water [hr]	Soil [hr]	Sediment [hr]
PCB 28	244'-trichloro	72	1450	26000	26000
PCB 52	22'55'-tetra-	1500	30000	87600	87600
PCB 77	33'44'-tetra-	1500	30000	87600	87600
PCB 101	22'455'-penta-	3000	60000	87600	87600
PCB 105	233'44'-penta-	3000	60000	87600	87600
PCB 118	23'44'5-penta-	3000	60000	60000	60000
PCB 126	33'44'5-penta-	3000	60000	87600	87600
PCB 138	22'44'5'-hexa-	6000	120000	165000	165000
PCB 153	22'44'55'-hexa-	6000	120000	165000	165000
PCB 169	33'44'55'-hexa-	6000	120000	165000	165000
PCB 180	22'344'55'-hepta-	12000	240000	330000	333000

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3.13. CFC-113

3.13.1. Sources

CFC-113 (1,1,2-trichloro-1,2,2-trofluoroethane, cas no 76-13-1) has been used widely as cleaning agent, propellant and blowing agent in the foam production.

3.13.2. Degradation

Chlorodifluoroacetic acid (CDFA) was detected in rain and snow samples from various regions of Canada [17]. A degradation study suggests that CDFA is recalcitrant to biotic and abiotic degradation relative to dichloroacetic acid (DCA) and may accumulate in the aquatic environment. On the basis of the existing experimental data, they postulate that CDFA is a degradation product of CFC-113.

The degradation pathway of CFC-113 in water under anaerobic conditions has been studied [18]. CFC-113 was transformed to HCFC-123a with a half-life time of 5 days at 20°C. under the same conditions, HCFC-123a was then further dechlorinated to HCFC-133 and HCFC-133b.

Microbial degradation of HCFC-123 was observed in anoxic fresh water and salt marsh sediments, and the recovery of 1,1,1-trifluoro-2-chloroethane indicated the involvement of reductive dechlorination, no degradation of HCFC-123 was observed in aerobic soils [19].

3.14. Carbon tetrachloride

3.14.1. Sources

Carbon tetrachloride or tetrachloromethane (CCl_4, CT, cas no 56-23-5) has been used in fire extinguisher manufacture, dry cleaning operations, refrigerator manufacture, aerosols, metal degreasing, fumigant and chlorinating organic compounds [10].The Montreal protocol of 1990 and its subsequent amendments established the phase-out by 1996 of production and use of carbon tetrachloride [39]

3.14.2. Degradation

In the atmosphere

Practically all CT released into the environment is present in the atmosphere [39] because CT does not degrade readily in the atmosphere significant global transport is expected. Estimates of the atmospheric lifetime (overall persistence in troposphere and stratosphere combined) are in the rage from 2 to 100 years. with 40-50 years generally being accepted as the most reasonable value.

Degradation in the atmosphere by photodegradation is very slow because CT has a low reactivity towards hydroxyl radicals. Estimated life-time in the troposphere due to photolysis is in the order of 500 years. The principal degradation process of CT occurs in the stratosphere by photolysis, where it is dissociated by short wave length (190-220 nm) UV radiation to form trichloromethyl radical and chlorine atoms. The estimated half-life for this process is in the order of 18- 80 years for this photodissociation process [39]. This reaction is responsible for the ozone depletion properties of CT according:

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$$CCl_4 + h? \rightarrow \cdot CCl_3 + \cdot Cl$$
$$\cdot CCl_3 + O_2 \rightarrow\rightarrow COCl_2 + CLO \cdot$$
$$\cdot Cl + O_3 \rightarrow ClO \cdot + O_2$$
$$ClO \cdot + O \rightarrow \cdot Cl + O_2$$

In the aquatic environment
Abiotic degradation like hydrolysis and photodegradation does not seem to play an important role. It has been found that under anaerobic conditions, tetrachloromethane has been transformed to trichloromethan (chloroform) by bacteria. No dichloromethane, chloromethane, or methane was produced [20, 39]. This observations was confirmed by another group which conducted a field experiment in which CT was found to transform to chloroform (CF) and carbon disulfide (CS_2) in a ratio of about 2:1 [21].

3.15. Formation of chloroacetic acids from Per and Tri

Trichloroacetic acid is a know product of atmospheric degradation of tetrachloroethene (global average yield 5%) and to a much lesser extend of 1,1,1-trichloroethane [17]. Dichloracetic acid is a known product of atmospheric degradation of trichloroethene (average global yield 0.5%). Average concentrations in European rainwater range from 100-150 ng/l. The concentrations in rainwater samples are similar to those calculated on degradation models. Hoekstra et al., 1999 [34] made a mass balance for Trichloroacetic acid in soils. TCAA is found soils and sources may be natural or anthropogenic, most likely via the degradation of tetrachloroethene. Although the degradation of tetrachlorethene in the atmosphere could be a source of TCAA is soils the mass balance calculations provide tentative evidence of formation within the soil itself. Von Sydow et al., 1999 [33] analysed chloroactetates in samples of snow, firn and glacier ice in remote areas including Antarctica, the Russian tundra and northern Scandinavia. The levels found were too high to be explained by direct anthropogenic emissions of chloroacetic acids and their salts. It was also difficult to trace the occurrence of these compounds back to the degradation of compounds like 1,1,1-trichloroethane, trichloroethene and tetrachloroethene.

3.16. Expected atmospheric degradation products of other substances.

Compound	Cas rn.	$K_{OH} \times 10^{12}$	$K_{O3} \times 10^{18}$	Photolysis probability	Physical removal probability	Residence time [days]	Possible reaction products
Ally chloride	107-05-1	28	18.3	Possible	Unlikely	0.3	HCO_2H, H_2CO, $ClCH_2CHO$, $ClCH_2CO_2H$, chlorinated hydroxyl carbonyls
Benzyl chloride	100-44-7	3	0.004	Possible	Unlikely	3.9	ϕCHO, chloromethylphenols, ring cleavage products
Bis(chloromethyl)ether	542-88-1	4	-	Possible	Probable	0.02 – 2.9	HCl, H_2CO, chloromethylformate, ClHCO
Carbon tetrachloride	56-23-5	< 0.001	-	-	Unlikely	>11,000	Cl_2CO
Chlorobenzene	108-90-7	0.4	$< 5\times10^{-5}$	Possible	Unlikely	28	Chlorophenols, ring cleavage products
Chloroform	67-66-3	0.1	-	-	Unlikely	120	Cl_2CO
Chloromethyl methyl-ether	107-30-2	3	-	Possible	Probable	0.004 – 3.9	Decomposition products, chloromethyl, methyl formate, ClHCO
Chloroprene	126-99-8	46	8	Probable	Unlikely	0.3	H_2CO, H_2C=CClCHO, OHCCHO, ClCOCHO, H_2CCHCClO, chlorohydroxyl acid, aldehydes
Epichlorhydrin	106-89-8	2	-	Possible	Unlikely	5.8	H_2CO, OHCOCHO, ClCH2C(O)OHCO
Ethylene dichloride	25323-30-2	0.22	-	Possible	Unlikely	53	ClHCHO, H_2CClCOCl, H_2CO, H_2CClCHO
Hexachlorocyclopentadiene	44-47-4	59	8	Probable	-	0.2	Cl_2CO, diacylchlorides, ketones
Methyl chloride	74-87-3	0.14	-	Possible	Unlikely	83	Cl_2CO, CO, ClHCO
Methyl chloroform	71-55-6	0.012	-	Possible	Unlikely	970	H_2CO, Cl_2CO
Perchloroethylene	127-18-4	0.17	0.002	Possible	Unlikely	67	Cl_2CO, $Cl_2C(OH)COCl$
Phosgene	75-44-5	0	-	-	Possible	-	CO_2, HCl
Polychlorinated biphenyl	1336-36-3	< 1	5×10^{-5}	Possible	Unlikely	> 11	Hydroxy PCB's, ring cleavage products
Trichloroethylene	79-01-6	2.2	0.006	Possible	Unlikely	5.2	Cl_2CO, ClHCO, CO
Vinylidene chloride	75-35-4	4	0.04	Possible	Unlikely	2.9	H_2CO, Cl_2CO, HCO_2H

Table 10 Reaction products of some chlorinated aliphatic compounds with ·OH and ·Cl radicals [16].

Compound	cas rn	Products after reaction with ·OH	Products after reaction with ·Cl
CH_3Cl	74-87-3	$HCOCl$, CH_2ClO_2H	
CH_2Cl_2	5-09-2	$HCOCl$, $CHCl_2O_2H$, $COCl_2$	
CH_3CCl_3	25323-89-1	CH_3COCl, CCl_3CHO, $COCl_2$	
CH_2=CHCl	75-01-4	HCHO, HCOCl	
CHCl=CHCl	540-59-0	HCOCl	
CH_2=CCl_2	75-35-4	HCHO, $COCl_2$	$CH_2ClCOCl$
CHCl=CCl_2	79-01-6	HCOCl, $COCl_2$	$CHCl_2COCl$
CCl_2=CCl_2	127-18-4	$COCl_2$	CCl_3COCl

4. Conclusions

In this literature study degradation pathways and products of high emission chlorinated compounds in the Netherlands have been identified. Degradation pathways depend on the initial emission compartment on the type of the emission (free compound or adsorbed to particles) and on the environmental conditions such as temperature, intensity and availability of solar radiation and availability of micro-organisms. Degradation products of low emission compounds, including a large number of emissions to surface water, were not studied. Degradation products of substances which are emitted to air and transformed in the environment can be expected to end up in other environmental compartments.

An overview of the result of this study is given in the table on the next page. It contains the main degradation products of all the substances discussed in the atmosphere or soil / water system. Main purpose of this table is to give a quick overview of the substances which can be detected in the environment for a long time to come. The persistence of the original substance and its degradation products is denoted qualitative by a +, ++ or +++. A '+' sign means that the substance has transformed within approximately one week, a '++' sign means that the substance will be transformed in several weeks time and a '+++' means that it will take months or more for the substance to be transformed. Degradation is in the soil / water system discriminated between aerobic and anaerobic conditions.

Substance	*In the atmosphere*			*In soil or water*		
	Persistence original compound	Degradation products	persistence degradation product	Persistence original compound aerobic/anearobic	Degradation products	persistence of degradation product
Chlorophenol	?	?	?	++	chlorophenols, tetrachlororesorcinol various dimeric benzoquinones	++
1,1,2-trichloroethane	+++	phosgene, Cl_2, HCl, CO_2	+	+++/+++	Chloroacetic Acid, glyoxylic acid, Vinyl chloride	+
1,1,1-trichloroethane	+++	phosgene, Cl_2, HCl, CO_2	+	+++/+++	1,2-dichloroethane	
dichloromethane	+++	phosgene	+	+/+	methyl chloride	+
1,1-dichloroethane	+++	formylchloride	?	?	?	?
HCFC-22	+++	HCl, CO_2 stratospheric	?	?	?	?
Vinylchloride	++	chloroacetyl aldehyde formylchloride	+	+++/++	glycolic acid CO_2	+
1,1-dichloroethene	+	phosgene, CO, chloroacetyl chloride	+	+++/++	vinylchloride	+++
1,2-dichloropropane	+	?	?	+++	?	?
1,3-dichloropropene	+	?	?	+/?	3-chloroallyl alcohol, 3-chloroacrylic acid	?
polychlorinated biphenyl	+++	?	?	+++/+++	3-chlorobenzoicacid, methyl-sulfonyl compounds, hydroxy-PCB's	+++
CFC-113	+++	HCl CO_2 (stratospheric)	?	+++/+++	HCFC-133, HCFC-133b	?
Carbon tetrachloride	+++	$COCl_2$	+	++/+	$HCCl_3$, CS_2	+
tetrachloroethene	+	trichloroacetic acid	++	+++	trichloroethene,	+++
trichloroethene	+	dichloroacetic acid	++	+++	1,2-dichloroethene, chloroethane, dichloromethane	+

5. References

1- Annachhatre, A.; Gheewala, S., Biodegradation of chlorinated phenolic compounds. *Biotechnology Advances.* **14** (1996) 35-56.
2- Liber, K.; Solomon, K.; Carey, J., Persistence and fate of 2,3,4,6-tetrachlorophenol and pentachlorophenol in Limnocorrals. *Environmental Toxicology and Chemistry.* **16** (1997) 293-305.
3- Zaborina, O.; Baskunov, B.; Baryshnikova, L.; Golovleva, L., Degredation of pentachlorophenol in soil by streptomyces rochei 303. *Journal of Environmental Science and Health, Part B*, **32** (1997) 55-70.
4- Mergaert, K.; Vanhaecke, P., *Updating of data concerning the impact of certain dangerous substances on the aquatic environment*. 1991, Ecolas, Antwerpen, Belgium, 263p.
5- Slooff, W.; Ros, J., *Integrated criteria document dichloromethane*, RIVM rep. No. 758473009, 1988, RIVM, The Netherlands.
6- Hester, R.; Harrison, R., *Volatile organic compounds in the atmosphere*. The Royal Society of Chemistry, 1995, Letchworth, UK.
7- Manahan, S.E., *Environmental Chemistry*, 5th edition, 1991, Lewis Publishers, Chelsea, Michigan, USA.
8- Batzer, F.R.; Balcer, J.L.; Peterson, J.R.; Wolt, J.D., Fate of 1,3-dichloropropene in anaerobic soils. *ACS symposium series*. **652** (1997) 60-78.
9- Verschueren, K., *Environmental data on organic chemicals*, 3rd edition,
10- Lorah, M.M.; Olsen, L.D., Natural attenuation of chlorinated volatile organic compounds in a freshwater tidal wetland: field evidence of anaerobic biodegradation. *Water Resources Research.* **35** (1999) 3811-3827.
11- Lorah, M.M.; Olsen, L.D., Degradation of 1,1,2,2-tetrachloroethane in a freshwater tidal wetland: field and laboratory evidence. *Environmental Science and Technology.* **33** (1999) 227-234.
12- Kubatova, P.; Matucha, M.; Erbanova, P.; Novotny, C.; Vlasakova, V.; Sasek, V., Investigation into PCB biodegradation using uniformly C-14-labelled dichlorobiphenyl. Isotopes. *Environmental and Health Studies*. **34** (1998) 325-334.
13- Flanagan, W.P.; May, R.J., Metabolite Detection As Evidence For Naturally – Occurring Aerobic PCB. Biodegradation In Hudson River Sediments. *Environmental Science and Technology.* **27** (1993) 2207-2212.
14- Sinkkonen, S.; Paasivirta, J., Degradation half-life times of PCDDs, PCDFs and PCBs for environmental fate modelling. *Chemosphere.* **40** (2000) 943-949.
15- Zetzsch, C.; Becker, K.., Das luftchemische verhalten von Fluchtigen organohalogenverbindungen. 1989, VDI Bericht NO.745
16- Martin, J.; Franklin, J.; Hanson, M.; Solomon, K.; Mabury, S.; Ellis, D.; Scott, B.; Muir, D., Detection of chlorodifluoro-acetic acid in precipitation: A possible product of fluorocarbon degradation. *Environmental Science and Technology.* **34** (2000) 274-281.
17- Lesage, S.; Brown, S.; Hosler, K., Degradation of chlorofluorocarbon-113 under anaerobic conditions. *Chemosphere*, **24** (1992) 1225-1243.
18- Oremland, R.; Lonergan, D.; Culbertson, C.; Lovley. D., Microbial degradation of hydrochlorofluorocarbons ($CHCl_2F$ and $CHCl_2CF_3$) in soils and sediment. *Applied and Environmental Microbiology*. **62** (1996) 1818-1821.
19- Picardal, F.; Arnold, R.; Couch, H.; Little, A.; Smith, M., Involvement of cytochromes in the anaerobic biotransformation of tetrachloro methane by Shewanella-Putrefaciens 200. *Applied and Environmental Microbiology*, **59** (1993) 3763-3770.
20- Devlin, J.; Muller, D., Field and laboratory studies of carbon tetrachloride transformation in a sandy aquifer under sulphate reducing conditions. *Environmental Science and Technology*, **33** (1999) 1021-1027.
21- Franklin, J., Dow Chemical, Personal communication.
22- Atkinson, R., Atmospheric chemistry of PCBs, PCDDs and PCDFs. In: Hester, R.E.; Harrison, R.M. (1996) *Chlorinated Organic Micropollutants.* The royal society of chemistry, 183 p.
23- Engbersen. J.F.J.; de Groot, Æ., *Bio-organische chemie*, 1988, Pudoc wageningen, 476 p.

24- Tukker, A.; Kleijn, R.; Van der Voet, E. (red.), *Een chloorbalans voor Nederland*, Deel III: Achtergronden, bijlagen en Peer-review. TNO beleidstudies en advies, Apeldoorn 1995.
25- Midgley, P.M.; Fisher, D.A. The production and release to the atmosphere of chlorodifluoromethane (HCFC 22). *Atmospheric Environment*. **27A** (1993) 2215-2223.
26- Miyamoto, K.; Urano, K., Reaction rates and intermediates of chlorinated organic compounds in water and soil. *Chemosphere*. **32** (1996) 2399-2408.
27- Waid, J.S. (ed.) *PCBs and the environment*. 1986, CRC Press, Boca Raton.
28- De Voogt, P., Ecotoxicology of chlorinated aromatic hydrocarbons. In: Hester, R.E.; Harrison, R.M. (1996) *Chlorinated Organic Micropollutants.* The royal society of chemistry, 183 p
29- Seeger, M.;Timmis, K.N.; Hofer, B., Bacterial pathways for the degradation of polychlorinated biphenyls. *Marine Chemistry*. **58** (1997) 327-333.
30- Swackhamer, D.L., Studies of polychlorinated biphenyls in the great lakes. In : Hester, R.E.; Harrison, R.M. (1996) *Chlorinated Organic Micropollutants.* The royal society of chemistry, 183 p.
31- Macdonald, R.W.; Barrie, L.A.; Bidleman, T.F.; Diamond, M.L.; Gregor, D.J.; Semkin, R. G.; Strachan, W.M.J.; Li, Y.F.; Wania, F.; Alaee, M.; Alexeeva, L..B.; Backus, S.M.; Bailey, R.; Bewers, J.M.; Gobeil, C.; Halsall, C.J.; Harner, T.; Hoff, J.T.; Jantunen, L.M. M.; Lockhart, W.L.; Mackay, D.; Muir, D.C.G.; Pudykiewicz, J.; Reimer, K.J.; Smith, J.N.; Stern, G.A ; Schroeder, W.H.; Wagemann R.; Yunker, M.B., Contaminants in the Canadian Arctic: 5 years of progress in understanding sources, occurrence and pathways *The Science of the Total Environment*. **254** (2000) 93-234.
32- Von Sydow, L., Boren, H., Grimvall, A. Chloroacetates in snow, firn and glacier ice., *Chemosphere*, Dec. 1999, 39(14), p.2479-2488.
33- Hoekstra, E.J., de Leer, E.W.B. and Brinkman, V.A.Th. (1999): Mass Balance of Trichloroacetic Acid in the Soil Top Layer, *Chemosphere* 38, 551-563.
34- WHO (1987). Pentachlorophenol. Environmental Health Criteria 71. WHO Geneve.
35- WHO (1992). 1,1,1-trichloroethane. Environmental Health Criteria 136. WHO Geneve.
36- WHO (1996). Methylene Chloirde (second edition). Environmental Health Criteria 164. WHO Geneve.
37- WHO (1993). 1,3-Dichloropropene, 1,2-dichloropropane and mixtures. Environmental Health Criteria 146. WHO Geneve.
38- *The WHO Environmental Health Criteria Series, No. 208, Carbon tetrachloride*, 1999, World Health Organization, Geneva, 177 pages, ISBN 92 4 157208 6
39- *The WHO Environmental Health Criteria Series*, *No. 215, Vinyl Chloride*, 1999, World Health Organization, Geneva, 1999, 356 pages, ISBN 92 4 157215 9

1.8 Davis, E. S., 1969, “241-AY Tank Farm Expansion – Welding Quality Control,” (Letter to H. E. Eager, June 9), Vitro Hanford Engineering Services, Richland, Washington.

Vitro

letter recalled

file for record

H. E. Eager, Area Engineer

U. S. Atomic Energy Commission

E. S. Davis, Field Engineering

June 9 69

241-AY TANK FARM EXPANSION -
WELDING QUALITY CONTROL

Project IAP-614
Contract AT(45-1)-2124

On several occasions we have met on an informal basis with representatives of Pittsburgh-Des Moines, Atomic Energy Commission and Atlantic-Richland, Hanford Company and, through discussion, have attempted to improve the quality of the fabricator's welding program--specifically, to reduce the amount of repairs to welds on the primary tanks. These meetings have not resolved what we feel is the primary problem--the lack of quality control by the fabricator.

Recently, we have increased our inspection coverage of the welding of the 101 tank bottom. Whether or not this detail inspection coverage is the primary cause, the resulting number of weld repairs decreased from a ratio of 51% film repair incident on tank 102 to a ratio of less than 10% film repair incident for tank 101.

needs clarif.

Specification HWS 7789, Rev. 2, paragraph 12.6, requires that all weld passes be visually examined by the Commission for defects prior to deposit of subsequent passes. We are making every effort to conform to this requirement by having qualified inspection personnel on the site at all times. Paragraph 2.6 of the quality control procedure prepared by the fabricator for this project required that a continual visual inspection be carried on by the forman or his representative on all areas as noted in paragraph 12.6 of HWS-7789. This is not being done at the present time.

We feel that it is the intent of the fabricator to provide acceptable storage tanks. It is also recognized that he can perform as many repairs to welds as may be necessary to provide a "clear" radiographic film. We feel, however, that it would be to everyone's advantage if the fabricator would apply quality control effort with experienced personnel such as has been exhibited by their job foreman.

We recommend that you request the fabricator to restate the policy that he expects to follow regarding his quality control effort in order that we may adjust our efforts accordingly.

ESD:ms

cc: WC Armstrong/ARHCO
GK/WS Graves/V-HES
A. Short/V-HES
FE Proj. File
FE LB

1.9 Davis, E. S., 1970, "Willard Smith, Inc. Refractory Tests," (Letter to J. H. Slaughter, U.S. Atomic Energy Commission, October 2), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
DIVISION OF VITRO CORPORATION OF AMERICA

TO J. H. Slaughter, USAEC
2720E Bldg., 200-East Area

FROM E. S. Davis, Field Engineering

DATE October 2, 19 70

SUBJECT WILLARD SMITH, INC. - REFRACTORY TESTS JOB NO. Project IAP-614

The results of tests using materials subjected a second time to freezing conditions do not necessarily provide conclusive evidence that freezing alone has caused all the problems with load-carrying capability. The material used in the tests could have been subjected to several water saturations and freezings.

I agree with Mr. Smith that materials saturated with water and then subjected to freezing after curing are affected, and protection of this refractory material from freezing, if used in AZ tank construction, should be made mandatory.

E. S. Davis

ESD:ms

cc: FE Proj. File
GK/EFS
A. Short

A. E. C. RL OFFICE
RECEIVED
OCT 6 1970
PROJECT ENGR. BR.

1.10 Graves, W. S., 1969a, "PUREX Tank Farm Expansion IAP-614 Minimum Thickness Insulating Concrete," (Letter to C. W. Cardwell, February 14), Vitro Hanford Engineering Services, Richland, Washington.

February 14, 1969

C. W. Cardwell

W. S. Graves

Purex Tank Farm Expansion IAP-614

Minimum Thickness Insulating Concrete

Confirming discussions with A. Short and E. S. Davis, five inches of Kaolite insulating concrete is sufficient to protect the base concrete during stress-relieving of the primary tank. This judgement is based upon the Battelle report BNL-797, detail requirements on the similar project at Savannah River, tests run by Nooter in Saint Louis for the Savannah River project, and Vitro calculations.

It was with this information in mind that a "humped" bottom 3" in height could be accepted since this still left 5" of insulation available. The condition at the air inlet pipes requires a minimum thickness as shown, but in this limited area the steel plate of the secondary tank will spread the heat flow and thus lessen the intensity to a satisfactory level.

Please note that Pittsburgh-Des Moines is technically responsible for adequate thickness as required by their stress-relief procedure as noted in Specification HWS-7789 Para. 9. Our drawings specify only a minimum acceptable thickness at the air-inlet pipes.

Original Signed By
W. S. Graves
W. S. Graves

WSG:fwk

cc: GK/CAS
WSG/files

1.11 Graves, W. S., 1969b, “PUREX Tank Farm Addition,” (Letter to C. W. Cardwell, March 18), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

TO C.W. CARDWELL 2101M BLDG

FROM W.S. GRAVES

DATE 3/18/69 19

SUBJECT PUREX TANK FARM ADDITION JOB NO. IAP-614

AS DISCUSSED PREVIOUSLY THE 1 1/2" CLEATS SHOWN IN ZONE C-9 OF DRAWING H2-64449 SHOULD BE INCREASED IN LENGTH TO 5 INCHES TO ALLOW FOR THE 2" EXTRA THICKNESS OF KAOLITE AS PLACED, IN TANK 102. MAINTAIN PRESENT SLOPE AND CUT AT LOWER SIDE. PLEASE ISSUE FIELD CHANGE NOTICE TO PDM TO COVER CHANGE RESULTING FROM LEVEL DEVIATIONS OF SECONDARY TANK FLOOR AS ERECTED BY PDM.

cc: D. Squires, AEC.
W.C. Armstrong, ARHCO
GK/CAS

HES 8 (8-67) AEC-RL RICHLAND, WASH.

1.12 Hatch, P., 1967, "Trip Report – Savannah River Plant Waste Tank Discussions and ITT Stress Analysis Study," (Interoffice memorandum to G. C. Obert, December 1), Atlantic Richfield Hanford Company, Richland, Washington.

Atlantic Richfield Hanford Company

DATE: December 1, 1967

TO: G.C. Oberg

FROM: Paul Hatch

SUBJECT: TRIP REPORT - SAVANNAH RIVER PLANT WASTE TANK DISCUSSIONS AND IIT STRESS ANALYSIS STUDY

On November 14 and 15, 1967, Waste Tank discussions were held with representatives from ARHCO, RLO, E.I. duPont, SRO, and Savannah River Plant and with Professor K.P. Milbradt and Dr. Stuart Swartz of the Illinois Institute of Technology at Chicago, Illinois, respectively. The purpose of these meetings was to discuss the Savannah River Plant waste tank specifications and to inspect their current waste tank construction progress. The following information outlines the salient points of the discussions.

Savannah River Plant

Savannah River people stated the maximum opening requirement for periscoping, rodding, visual inspection, TV camera coverage, and pumping of the annular space in past waste tank operations has been a five-inch opening used for periscope observation, rodding and visual inspection and an eight to ten-inch opening for pumping. Maximum available opening is 36-inches. However, they have never had occasion to use this large diameter opening to date.

The Savannah River people have never observed a hydrogen build-up problem in the annular space and state that air is forced into the annulus to 1) keep the steel dry and to reduce oxidation; 2) to partially cool the contents of the tank; and 3) to bring leakage out from under the tank as quickly as possible in the event a tank leak occurs. A 6000 cfm forced air capacity is being provided for annulus purge of the new tanks. The Savannah River Plant Tanks 14 and 16 were receiving high-level waste at the time they developed cracks and subsequent moisture was detected in the annular space. Apparently the fine cracks acted as particulate filter since the moisture in the annular space carried mostly cesium. Most of the moisture was evaporated by increasing the air flow. The end result was a residue salt cake of six and twelve inches thick, respectively. There has been no heating problem because of this salt cake. An air flow of 1500 cfm has been more than adequate to dry excessive moisture from the annulus and heal the fine cracks. Pre-heating of the annulus air can be misleading because of a differential humidity between summer and winter. Humidity and temperature should be the prime considerations in design of the annulus air system.

E.E. Smith
M.H. Richardson
C.L. Taylor
C.A. Simon

54-6000-030 (8-67)
AEC-RL RICHLAND, WASH.

Atlantic Richfield Hanford Company

The moisture in the annular space is detected by a series of conductivity probes one being able to measure in one foot vertical increments for a total of six feet, the other two being at a lower distance probably one inch off the bottom of the tank. Savannah River Plant would recommend that prior to service, unused tanks be filled with water containing a rust inhibitor or that a recycle air dryer be installed to prevent excessive scaling of the tanks.

Discussion was held on the construction of the current tank and specifically SRP Specification 5098 for both primary and secondary steel liners on Project 981232. Craftsmanship remains the major problem with a reject weld-rate ranging between 10 to 20 percent. DuPont and Nooter both interpret the X-ray photographs along with a third party inspector, to determine poor weld locations. The heating-quenching process to lower the high spots to meet bottom liner flatness tolerances in the above specification is still applicable even though duPont authorized Nooter to use an interim criss-cross submerged arc process to expedite the construction schedule. SRP feels this is not the proper way to lower the high spots and would recommend using the heating-quenching processing to bring all plates back into specification. Savannah River Plant would recommend a tolerance of ± 1/4-inch on the concrete pad on which the secondary liner would lay and a tolerance of ± 1/4-inch on the refractory. E.E. Westerbrook of duPont stated there are companies that specialize in tank flattening and that Nooter did not necessarily possess all the techniques some of these companies might have. It would be worthwhile to contact some of these companies and incorporate some of their techniques into our specification. Mr. Westerbrook is going to forward the names of some companies who specialize in this field.

It was suggested that ARHCO might let some fabricator inspect the dome riser layout plan to determine if this layout could be adapted to burner locations for stress relieving. Above all, it was recommended the tank contractor be kept involved in construction of the tanks in every phase possible.

We requested that some of our experimental stress relief specimens be put in their tanks for stress relief. However, duPont pointed out that putting a specimen inside a tank would not be representative of tank annealing since the tank itself is only heated on one side and the specimen would be heated from two sides. ARHCO will forward a drawing of our specimen geometry for review from which four specimens will be made. Two specimens will be used for control and two for stress relieving by the method we select which we can then test at our own site.

The domes of the SRP tanks will be supported by a 2.3 ounce pressure per square inch during the stress relieving operation. Also, there will be

54-6000-031 (8-67)
AEC-RL RICHLAND, WASH.

a superstructure above the dome of the tank which will have hanger supports at selected points. These points will not necessarily coincide with the J-Bolt arrangement that duPont has selected for attaching the steel liner into the concrete. Nooter will remove all temporary hanging supports which they position during stress-relief.

A field inspection was made at the construction site. Construction is approximately ten percent complete. To expedite progress, the first tank, Tank 32, was accepted even though the bottom flatness tolerances on the secondary liner were not met. A compromise was made in that the contractor would add an extra thickness of insulation to off-set the half-inch out of tolerance. The second tank under construction, Tank 31, appears to have a similar problem in that Nooter has not been able to bring the tank back into flatness requirement in one location. Each time they bring it within specification in one location, the bulge moves to another location and seems to orient around the center column of the tank. Criss-cross, submerged arc-welds were used as a flattening method along with heating and quenching.

Waste Tank Evaluation Study by the Illinois Institute of Technology

The design of the new AY Tank Farm was discussed at length by Professor Milbradt, Dexter Lien, William C. Armstrong, and C.D. Compton and the author. Of particular interest was the subject of dome optimization and being able to analyze the steel tank with existing computer analyses. Professor Milbradt indicated that he could optimize the dome geometry for the least stress condition by December 10, 1967. The steel tank analyses is to be completed by December 4, 1967. These analyses will furnish minimum geometrical thicknesses and reinforcing steel requirements.

A cost estimate was made for computer analysis at the Illinois Institute of Technology on Project IAP-614 by Professor Milbradt. It was estimated that approximately $3,000 minimum would be needed for computer time and man hours. This is less than the budgeted amount of $6,000 already appropriated for this purpose.

Vitro/HES will keep close contact with Professor Milbradt during the finalization of the minimum plate thickness for the steel tanks and design concrete shell. This may involve additional trips to either Chicago or to Hanford by Vitro/HES or Professor Milbradt as the need arises. Professor Milbradt was advised that the AY Tank Farm design information was most critical at this particular point in time and that other work should be delayed temporarily.

Currently, the Illinois Institute of Technology has no capability for computer analyses of earthquake situations; they expect to have this capability within a year and anticipate that they will use the free-free mode of vibration analyses superimposed on the static load analysis. Professor Milbradt requested copies of the Housnier Report which has been submitted to the Hanford Project for earthquake analyses of reactors.

Professor Milbradt made a call to the Portland Cement Association to determine the heat effects on concrete to establish a realistic temperature point for stress relieving the inner liner. The following tabulation shows a comparison between temperature and permanent loss of compressive strength.

Concrete Temperature	Strength Loss
200 F	18%
500 F	40%
800 F	52%
1,000 F	80%

Cement Mortar Cube Temperature	Strength Loss
572 F	12%
930 F	50%
1,209 F	82%

Mel Abrahms, a PCA expert in firebrick and insulative concretes was contacted by Professor Milbradt. Mr. Abrahms recommended that the moisture be driven from the suggested Kaolite insulating mat under the primary tank. A 150 F temperature should be held for a two-week period. He felt that there would be some danger of destroying some of the properties of insulating mat if it were heated rapidly without previous drying.

Backfill around the tanks should be according to old HAPO specifications without specific compaction requirements.

Professor Milbradt indicated that the steel dome liner anchors could be J-Bolts hooked directly into the concrete shell without provisions for expansion. The worst situation would be local ripping of the dome which would not be a detrimental factor.

Atlantic Richfield Hanford Company

A general discussion was held on putting access ports through the concrete haunch area of the waste tank to the annular space. It was summarized that this would present some problems; however, they could be covercome by providing a specifically-designed collar to which all severed reinforcing steel could be welded. This collar would then transfer the loads around the opening and back into the opposing reinforcing steel.

PH:smf

Distribution: W.C. Armstrong
C.D. Compton - AEC
J.B. Fecht
W.S. Graves - HES
P. Hatch
D.G. Lien - HES
H.P. Shaw
E.E. Smith - HES

1.13 HES QA Report, 1969, Multiple QA Reports January to November, Vitro Hanford Engineering Services, Richland, Washington.

PROJECT IAP-614	Contract AT(45-1)-2124	E. S. Davis 1/17/69
FEATURE -2- Construction of secondary tank bottom	TANK 102	Inspected by: Ed Davis
		Date: 1-22-69

REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection drawings
HWS-7789, Rev. 2, Par. 2.0 - b, c and g.

Distribution:

W. S. Graves
A. Short
Project File
QC File (2)

OTHER DATA: PDM welding procedures 68-80, 63,110, 60-112, 68-80A
Welding procedure specification DB 119-197
Drawings 38570, sheets 1 and 8
Drawings 38570 QC-6

Requirements	Acceptance Yes	Acceptance No
1. Check equipment to ascertain capability of specific job performance. HWS-7789, Rev. 2, Par. 11.1; Par. 11.2 c.		
a. Automatic sub-arc MACHINE REJECTED - SEE LETTER TO AEC 12/31/68	SEE NOTE	
b. Welding machines (manual shielded arc)	X	
c. WELDOR PERFORMANCE QUALIFICATION & FIELD TEST	SEE NOTE	
2. Check mill and material certification and markings		
a. Plate material		
b. Weld rod		
c. Clips and miscellaneous steel		
d. Stencil marks on exterior of tank		
3. Check fabrication for:		
a. Joint geometry and spacing		
b. Welding sequence		
c. Welding procedures		
d. Handling		
e. Excessive distortion		
f. Good workmanship practices.		
1a SEE LETTER PDM TO AEC 12/30/68		
1b STANDARD WELDING EQUIPMENT IN USE		
1c QUALIFICATION PAPERS IN ORDER FOR SIX WELDORS IN TITLE III FILE ✓		

REMARKS AND/OR SAFETY FEATURES

1. Check for tank grounding OK
2. Ascertain that cribbing for supporting tank bottom is adequate and properly placed to prevent injury to personnel. OK
3. Wear hard hats, gloves, eye protection. OK

PROJECT IAP-614	Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/17/69
FEAT 'E -2- Construction of secondary tank bottom *102*		Inspected by: *E.S. DAVIS*
REFERENCES:	Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection drawings HWS-7789, Rev. 2, Par. 2.0 - b, c and g.	Date: *2-18-69*
OTHER DATA:	PDM welding procedures 68-80, 63,110, 60-112, 68-80A Welding procedure specification DB 119-197 Drawings 38570, sheets 1 and 8 Drawings 38570 QC-6	Distribution: W. S. Graves A. Short ~~Project File~~ *C. N. ZANGAR* QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Check equipment to ascertain capability of specific job performance. HWS-7789, Rev. 2, Par. 11.1; Par. 11.2 c.		
a. Automatic sub-arc		
b. Welding machines (manual shielded arc)		
2. Check mill and material certification and markings		
a. Plate material — *SEE ATTACHED LETTER*	✓	
b. Weld rod		
c. Clips and miscellaneous steel		
d. Stencil marks on exterior of tank		
3. Check fabrication for:		
a. Joint geometry and spacing		
b. Welding sequence		
c. Welding procedures		
d. Handling		
e. Excessive distortion		
f. Good workmanship practices.		

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REMARKS AND/OR SAFETY FEATURES

1. Check for tank grounding
2. Ascertain that cribbing for supporting tank bottom is adequate and properly placed to prevent injury to personnel.
3. Wear hard hats, gloves, eye protection.

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/17/69
FEATURE -2- Construction of secondary tank bottom TANK 102	Inspected by: E S Davis
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection drawings HWS-7789, Rev. 2, Par. 2.0 - b, c and g.	Date: 1-23-69
	Distribution: W. S. Graves A. Short Project File QC File (2)
OTHER DATA: PDM welding procedures 68-80, 63,110, 60-112, 68-80A Welding procedure specification DB 119-197 Drawings 38570, sheets 1 and 8 Drawings 38570 QC-6	

Requirements	Acceptance Yes	Acceptance No
1. Check equipment to ascertain capability of specific job performance. HWS-7789, Rev. 2, Par. 11.1; Par. 11.2 c.		
a. Automatic sub-arc		
b. Welding machines (manual shielded arc)		
2. Check mill and material certification and markings		
a. Plate material - CHECK CONTINUING - SEE NOTE		
b. Weld rod - FLEETWELD 5P E 6010 - SAMPLES RETAINED	X	
c. Clips and miscellaneous steel		
d. Stencil marks on exterior of tank		
3. Check fabrication for:		
a. Joint geometry and spacing	X	
b. Welding sequence	X	
c. Welding procedures - SEE NOTE		
d. Handling - SEE NOTE		
e. Excessive distortion		
f. Good workmanship practices.		
2A - FOUR BOTTOM PLATES HAVE YET TO BE MARKED AND IDENTIFIED. THESE PLATES APPARENTLY WERE CUT FROM LARGER PIECES WITHOUT HEAT NUMBERS BEING TRANSFERRED. COPIES OF MILL CERTS ARE ON FILE IN TITLE II OFFICE	2 - BP-12, 2 - BP-9	

RECEIVED JAN 3 1969 A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

REMARKS AND/OR SAFETY FEATURES

1. Check for tank grounding
2. Ascertain that cribbing for supporting tank bottom is adequate and properly placed to prevent injury to personnel.
3. Wear hard hats, gloves, eye protection.

3 - AUTOMATIC WELDOR USED ON SEAMS 1 & 2 - REMAINING SEAMS ALL MANUAL

3d - EDGES OF KNUCKLE PLATES COLD WORKED DURING RAISING OF BOTTOM SECTION - 8 PLACES NOTED -

VITRO-HES QUALITY ASSURANCE

PROJECT [illegible] Contract AT(45-1)-2124	Prepared by: E. B. Davis 1/20/6[illegible]
FEATURE 3 Preparation of secondary tank bottom for radiography magnetic particle and vacuum leak test. 101	Inspected by: [illegible]
REFERENCES: HEM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QD- 2 . Drawing 38570 MT- 6 . HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: MARCH 10, 196[illegible]
	Distribution: ZANGAR

OTHER DATA:

Radiation signs.

Requirements	Acceptance Yes	Acceptance No
1. Check acceptability of -		
a. Type and power of x-ray machine.	OK	
b. Type and size of x-ray film.		
c. Film developing and readout equipment.		
d. Range and polarity mag-flux equipment.		
e. Soap test equipment.		
2. Check -		
a. Temporary attachments removed (except lifting beams). *		
b. Gouges, weld scars, plate damage repaired.	OK	
c. Excessive distortion removed.		
d. Areas marked for mag-particle inspection.		
e. General condition of tank bottom assembly.		
3. Tools -		
Depth gauge.		
* ALL LIFTING BEAMS REMOVED BY THIS DATE		

HAZARDS AND/OR SAFETY FEATURES

Wear hard hat, gloves, eye protection.
Check cribbing, tank grounding.
Check condition of grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/2(
FEATURE	-3- Preparation of secondary tank bottom for radiography magnetic particle and vacuum leak test. 102	Inspected by: E.S DAVIS
REFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC- 6 . Drawing 38570 MT- 10 . HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: 2-12-69
OTHER DATA:	Radiation signs.	Distribution: GRAVES ZANGER SHORT QC FILE

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Requirements	Acceptance Yes	N
1. Check acceptability of -		
a. Type and power of x-ray machine.		
b. Type and size of x-ray films.		
c. Film developing and readout equipment.		
d. Range and polarity mag-flux equipment.	✓	
e. Soap test equipment. AMERICAN SEAM TESTER A100-613 AMERICAN PIPE & STEEL CO		
2. Check -		
a. Temporary attachments removed (~~except~~ lifting beams). *		
b. Gouges, weld scars, plate damage repaired. **		✓
c. Excessive distortion removed.		
d. Areas marked for mag-particle inspection. **		
e. General condition of tank bottom assembly.		
3. Tools -		
Depth gauge.		
1e- SIZE OF BOX 6"W x 28"L x 4" DEEP 2 INCH DIAMETER GAUGE REGISTERING POUNDS/SQ. IN. READ 4.9+* ON GAUGE TO EQUAL 10 INCHES MERCURY. ACCEPTABLE FOR TESTING WELDS IN FLAT PLANE. VACUUM CREATED BY USE OF AIR JET.		

REMARKS AND/OR SAFETY FEATURES

Wear hard hat, gloves, eye protection.
Check cribbing, tank grounding.
Check condition of grounding.

* TEMPORARY CLIPS HOLDING KAOLITE RETAINER RING (OUTER)

** THIS WORK CAN PROCEED AS SOON AS FLATTENING IS COMPLETE AND WATER CAN BE REMOVED FROM TANK BOTTOM.

ABOVE SUPPLEMENTS BY A SHORT.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/20/69
FEATURE	-3- Preparation of secondary tank bottom for radiography, magnetic particle, and vacuum leak test. TANK 102	Inspected by: DAVIS
REFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC- 6 . Drawing 38570 MT- 10 . HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: 1-30-69 Distribution: GRAVES, ZANGER, SHORT, QC FILE
OTHER DATA:	Radiation signs.	

Requirements	Acceptance Yes	Acceptance No
1. Check acceptability of -		
a. Type and power of x-ray machine.		
b. Type and size of x-ray films.		
c. Film developing and readout equipment.		
d. Range and polarity mag-flux equipment.		
e. Soap test equipment.		
2. Check -		
a. Temporary attachments removed (except lifting beams).		
b. Gouges, weld scars, plate damage repaired. — SEE NOTE	✓	
c. Excessive distortion removed.		
d. Areas marked for mag-particle inspection.		
e. General condition of tank bottom assembly.		
3. Tools -		
Depth gauge.		
2b. - 8 SPOTS OF PLATE DAMAGE TO UNDERSIDE OF BOTTOM PLATES NOTED AS BEING REPAIRED. DAMAGE APPEARED TO BE CAUSED BY HANDLING DEVICES. REPAIR WAS MADE BY WELDING & GRINDING.		

REMARKS AND/OR SAFETY FEATURES

Wear hard hat, gloves, eye protection.
Check cribbing, tank grounding.
Check condition of grounding.

OJECT	IAP-614 Contract AT(45-1)-2124	E. S. Davis 1/20/69
ATURE	-3- Preparation of secondary tank bottom for radiography magnetic particle and vacuum leak test TANK 102	Inspected by:
		Date:
ERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC- 6 . Drawing 38570 ME- 12 HWS 7789, Rev. 2, Section 12.0 weld inspection.	Distribution:
HER DATA:	Radiation signs.	

Requirements	Acceptance Yes	Acceptance No
1. Check acceptability of -		
a. Type and power of x-ray machine. 250 KVA PORTA-TUBE	X	
b. Type and size of x-ray films. 36" LENGTH USED	SEE NOTE	
c. Film developing and readout equipment.	X	
d. Range and polarity mag-flux equipment.		
e. Soap test equipment.		
2. Check -		
a. Temporary attachments removed (except lifting beams).		
b. Gouges, weld scars, plate damage repaired.		
c. Excessive distortion removed.		
d. Areas marked for mag-particle inspection.		
e. General condition of tank bottom assembly.		
3. Tools -		
Depth gauge.		
1b. QUALITY NOT ACCEPTABLE ON SEVERAL FILMS - SEE LETTER PDM TO VITRO 1-24-69 copy attached		

ARKS AND/OR SAFETY FEATURES

Wear hard hat, gloves, eye protection. OK
Check cribbing, tank grounding. OK
Check condition of grounding. OK

OJECT IAP-614 Contract AT(45-1)-2124

'TURE -4- Inspection (radiography-magnetic particle) and repair bottom secondary tank 101

Prepared by:
E. S. Davis 1/21/69

Inspected by:
[illegible signature]

Date:
MAR 10, 1969

Distribution:

ZANGAR

FERENCES:
PDM radiographic inspection procedure RP-1.
Magnetic particle inspection MP-4.
Drawing 38570 QC- 2 . Drawing 38570 MT- 6 .
HWS 7789, Rev. 2, Section 12.0 weld inspection.

HER DATA:

Radiation signs.

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all weld seams in bottom, knuckle plates and those adjoining first shell course.	OK	
2. Check for -		
a. Film and x-ray quality. b. Proper interpretation and marking of film. c. Recording of defects.	OK	
3. Repair all defective welds.		
a. Visually check all welds prior to repair. b. Ascertain that repair procedure is acceptable. c. Check and record x-ray film of repairs.	OK	
4. Visually witness all mag-particle testing.		
a. Continually check testing equipment. b. Record position and location of tests. c. Ascertain that all areas are repaired satisfactory.	OK	
5. Visually check all areas top and bottom for objectionable defects.	OK	

EMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, eye protection.
2. Check cribbing, tank grounding.
3. Maintain safe distance to prevent x-ray exposure.
4. Check scaffolding, brackets, ladders for safe access.

Rev. 0

ROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/21/69
EATURE	-4- Inspection (radiography-magnetic particle) and repair bottom secondary tank TANK 102	Inspected by: [signature]
EFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC-6. Drawing 38570 MT-12. HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: 1-22-69 Distribution: GRAVES ZANGAR SHORT QC FILE
THER DATA:	Radiation signs.	

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all weld seams in bottom, knuckle plates and those adjoining first shell course.		
2. Check for -		
a. Film and x-ray quality. — SEE NOTE		
b. Proper interpretation and marking of film.		
c. Recording of defects.		
3. Repair all defective welds.		
a. Visually check all welds prior to repair.		
b. Ascertain that repair procedure is acceptable		
c. Check and record x-ray film of repairs.		
4. Visually witness all mag-particle testing.		
a. Continually check testing equipment.		
b. Record position and location of tests.		
c. Ascertain that all areas are repaired satisfactory.		
5. Visually check all areas top and bottom for objectionable defects.		
2A. REJECTED 40 X-RAY EXPOSURES TAKEN NIGHT OF 1/20/69 DUE TO INCORRECT "PENNIES" USED - #5 "PENNY" USED - #7 PENNY REQUIRED		

MARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, eye protection.
2. Check cribbing, tank grounding.
3. Maintain safe distance to prevent x-ray exposure.
4. Check scaffolding, brackets, ladders for safe access.

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/21/
FEATURE	-4- Inspection (radiography-magnetic particle) and repair bottom secondary tank TANK 102	Inspected by: E A Davis
REFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC- 6 . Drawing 38570 MT- 10 . HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: 1-28-69 Distribution: GRAVES ZANGER SHORT QC FILE
OTHER DATA:	Radiation signs.	

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all weld seams in bottom, knuckle plates and those adjoining first shell course.		
2. Check for -		
a. Film and x-ray quality.		
b. Proper interpretation and marking of film.		
c. Recording of defects.		
3. Repair all defective welds.		
a. Visually check all welds prior to repair.		
b. Ascertain that repair procedure is acceptable. — SEE NOTE	✓	
c. Check and record x-ray film of repairs.		
4. Visually witness all mag-particle testing.		
a. Continually check testing equipment.		
b. Record position and location of tests.		
c. Ascertain that all areas are repaired satisfactory.		
5. Visually check all areas top and bottom for objectionable defects.		
3b CHECKS WITH READOUT EQUIPMENT INDICATE THAT PREHEATING OF ~~WELDS~~ PLATE IS NECESSARY EVERY 5 MINUTES PRIOR TO WELDING WITH TEMP. @ 2° AND WIND BLOWING 15 TO 20 MPH.		

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, eye protection.
2. Check cribbing, tank grounding.
3. Maintain safe distance to prevent x-ray exposure.
4. Check scaffolding, brackets, ladders for safe access.

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VITRO-HES QUALITY ASSURANCE

OJECT IAP-614	Contract AT(45-1)-2124	Prepared by: ES Davis 1/23/69
URE 9(1) Erection of secondary steel tank to elevation 654.83. Task 101		Inspected by: [signature]
EFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs., HWS-7789, Rev. 2, Par. 6.0, 11.0.		Date: May 9, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA: PDM Welding Procedures 46-114, 54-63, 65-19B, 60-26A. Welding procedure specification DB119-197. Dwg. 38570, sheet 1 and QC 1.		

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings. a. Plate material b. Weld rod c. Heat numbers on exterior of shell.	OK	
2. Check fabrication for: a. Joint geometry and spacing b. Welding procedures c. Weldor qualifications d. Handling e. Excessive distortion f. Goodworkmanship practices g. Cut out and replacement of temporary access hole.	OK	

EMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use.

Wear hard hats, gloves, and eye protection.

Check for tank grounding.

PROJECT IAP-614	Contract AT(45-1)-2124	Prepared by: ES Davis 1/23/69
FEATURE 9(1) Erection of secondary steel tank to elevation 654.83. Tank TANK 102 1ST COURSE		Inspected by: E S Davis
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs., HWS-7789, Rev. 2, Par. 6.0, 11.0.		Date: 1-23-69
OTHER DATA: PDM Welding Procedures 46-114, 54-63, 65-19B, 60-26A. Welding procedure specification DB119-197. Dwg. 38570, sheet 1 and QC 5.		Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings.		
a. Plate material	X	
b. Weld rod		
c. Heat numbers on exterior of shell.	X	
2. Check fabrication for:		
a. Joint geometry and spacing	X	
b. Welding procedures - SEE NOTE		
c. Weldor qualifications - SEE NOTE		
d. Handling		
e. Excessive distortion	X	
f. Goodworkmanship practices - SEE NOTE		
g. Cut out and replacement of temporary access hole.		

2b - WELD PROCEDURE 60-26A SUBSTITUTED FOR 63-26 AUTO ON SEAM H WITH 5 PASSES AS NORMAL. AUTOMATIC MACHINES RESTRICTED BY LIFTING BEAMS

2C - WELDOR TEST ON DOWNHAND PASS CONDUCTED IN FIELD. TESTS ACCEPTABLE

2F - AMBIENT TEMP. 3° (MINUS) PREHEATING PERFORMED PRIOR TO WELDING METAL WARM TO TOUCH OF HAND

REMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use. COULD BE BETTER

Wear hard hats, gloves, and eye protection.

Check for tank grounding. OK

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: ES Davis 1/23/69
FEATURE 9(1) Erection of secondary steel tank to elevation 654.83. Tank TANK 102 1ST COURSE	Inspected by: E S Davis
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs., HWS-7789, Rev. 2, Par. 6.0, 11.0.	Date: 1-24-69 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA: PDM Welding Procedures 46-114, 54-63, 65-19B, 60-26A. Welding procedure specification DB119-197. Dwg. 38570, sheet 1 and QC 5.	

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings.		
a. Plate material A515-67 60 STAMPED ON PLATES	✓	
b. Weld rod E6010 SAMPLE TAKEN - USED ON SEAM H-1	✓	
c. Heat numbers on exterior of shell. SEE NOTE		
2. Check fabrication for:		
a. Joint geometry and spacing YES		
b. Welding procedures YES		
c. Weldor qualifications YES		
d. Handling YES		
e. Excessive distortion YES		
f. Goodworkmanship practices SEE NOTE		
g. Cut out and replacement of temporary access hole.		
1C ALL HEAT NO STAMPED ON EXTERIOR OF SHELL. RECORDED ON DWG CERTIFICATION CHECKED ON 6 OF 8 SHELL PLATES		
2F. A CONTINUOUS CHECK WAS MADE OF PREHEAT TEMPERATURES IN WELD AREAS. PLATE HAD TO BE WARM TO A BARE HAND		

REMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use.

Wear hard hats, gloves, and eye protection.

Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: ES Davis 1/23/69
FEAT E 9(1) Erection of secondary steel tank to elevation 654.83. 102 Tank	Inspected by: E S DAVIS
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs., HWS-7789, Rev. 2, Par. 6.0, 11.0.	Date: 2-24-69
OTHER DATA: PDM Welding Procedures 46-114, 54-63, 65-19B, 60-26A. Welding procedure specification DB119-197. Dwg. 38570, sheet 1 and QC / .	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings.		
a. Plate material	✓	
b. Weld rod	✓	
c. Heat numbers on exterior of shell.	✓	
d. TEMPORARY ATTACHMENTS - PARA 7.0 b HWS 7789	✓	
2. Check fabrication for:		
a. Joint geometry and spacing	✓	
b. Welding procedures	✓	
c. Weldor qualifications	✓	
d. Handling	✓	
e. Excessive distortion	✓	
f. Goodworkmanship practices	✓	
g. Cut out and replacement of temporary access hole. (REPLACEMENT LATER)	✓	
1 d ATTACHED LETTER PDM TO VITRO DATED 2-18-69		

REMARKS AND/OR SAFETY FEATURES

<u>Danger</u> - Check access ladders and platforms for safe use.

Wear hard hats, gloves, and eye protection.

Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: ES Davis 1-28-69
FEATURE	9(2) Secondary Steel Shell X-Ray and Magnetic Particle. Tank 102	Inspected by: [signature] Date: 3/28/69
REFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. DWG. 38570, QC 586. Dwg. 38570 MT 11812. HWS-7789, Rev. 2, Section 12.0 weld inspection.	Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA:	Radiation signs. ASME Boiler and Pressure Code, Section VIII, page 230.	

Requirements	Acceptance Yes	Acceptance No
1. Acceptability of equipment		
a. X-ray machine or source (record data) b. Type and size of film c. Film development and readout equipment d. Range and polarity of magnetic particle equipment.	OK	
2. Check		
a. Tempory attachments removed b. Gouges, weld scars, plate damage repaired SEE NOTE c. Excessive distortion d. Areas marked for magnetic particle inspection e. Repair of temporary opening.	OK	
3. Check		
a. Quality of radiographs GENERALLY GOOD b. Welds requiring repair c. Records of radiographic testing and repair d. Visually witness magnetic particle test.	OK	
NOTE: SOME WELD SCARS REMAIN, BUT WILL BE REPAIRED AFTER ERECTION OF PRIMARY SHELL. SPOT RADIOGRAPHS WERE MADE AT RANDOM LOCATIONS.		

REMARKS AND/OR SAFETY FEATURES

1. Stay clear of radiograph work.
2. Check cribbing, tank grounding.
3. Exercise care in scaling tank walls.
4. Wear hard hats, gloves and eye protection.

VITRO-HMS QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124

FEATURE 9(2) Secondary Steel Shell X-Ray and Magnetic Particle. Tank *101*

REFERENCES: FMM radiographic inspection procedure RP-1.
Magnetic particle inspection MP-4.
DWG. 38570, QC *1* . Dwg. 38570 MT *5* .
HWS-7789, Rev. 2, Section 12.0 weld inspection.

OTHER DATA: Radiation signs.
ASME Boiler and Pressure Code, Section VIII, page 230.

Prepared by: HB Davis 1-28-6[illegible]
Inspected by: *[illegible]*
Date: *Oct. 15, 19*
Distribution:

Requirements	Acceptance Yes	
1. Acceptability of equipment		
a. X-ray machine or source (record data)	*OK*	
b. Type and size of film		
c. Film development and readout equipment		
d. Range and polarity of magnetic particle equipment.		
2. Check		
a. Tempory attachments removed *		*a*
b. Gouges, weld scars, plate damage repaired *		*b*
c. Excessive distortion *OK*		
d. Areas marked for magnetic particle inspection *		*d*
e. Repair of temporary opening. *OK*		
3. Check		
a. Quality of radiographs	*a - OK*	
b. Welds requiring repair	*b - OK*	
c. Records of radiographic testing and repair	*c - OK*	
d. Visually witness magnetic particle test.		*d*

* *CAN NOT BE COMPLETED UNTIL SCAFFOLD BRACKETS ARE REMOVED FROM ANNULUS.*

REMARKS AND/OR SAFETY FEATURES

1. Stay clear of radiograph work.
2. Check cribbing, tank grounding.
3. Exercise care in scaling tank walls.
4. Wear hard hats, gloves and eye protection.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/30/69
FEATURE	-7- Installation of materials to be imbedded in tank bottom insulation. Tank - 101 .	Inspected by: SEE BELOW
REFERENCES:	Contract Spec. HWS-7789, Para. 8.0 for carbon steel pipe: PDM Dwg. 38570-9, Rev. 3, for placement of pipe; HWS-7793, Rev. 3, for thermocouples; PDM Dwg. 38570-10 for placement of conduit. Note: For orientation of conduit and thermocouples for tank 101; see PDM Dwg. 38570-11.	Date: Distribution: WS Graves CN Zanga[illegible] A. Short QC File
OTHER DATA:	See PDM Dwg. 38570, Rev. 3, for insulation retaining ring details and drain slot details. Important - check office on latest data pertaining to any of the above items.	

Requirements	Acceptance Yes	Acceptance No
Pipe: Size 4" schedule 40 carbon steel.	✓	
Welding of pipe - requirements - none - obtain structurally sound weld. 3/13/69	SEE NOTE ①	
Wrap pipe with 10 mil polyethylene sheets.	✓	
Tape sheets at joints and pipe ends. 3-14-69 THROUGH 3/21/69	✓	
Support pipe on prefabricated insulation blocks.	✓	
Minimum clearance 1" on bottom, $2\frac{1}{2}$" on top.	✓	
Conduit: 1/2" rigid, galvanized; 7" radii bends; maintain clearance from tank shell for insulation. 3-13-69 CONDUIT LAY ON TANK SHELL	✓	
Insulation Retainer Rings: 3-11-69 Inner ring - drain slots - 18 - 3" X $1\frac{1}{2}$" deep; 4 - 4-5/8" holes @ 90°.	✓	
Outer ring - contoured to fit shell bottom	SEE NOTE ②	
General: Check for quantity of pipes 4 and conduits 25, orientation and location of embedments, temp. covers for ends of all openings prior to placement of concrete, all embedments secured. 3-14-69	✓	

NOTE ① PIPE ORIENTATION OUTSIDE KAOLITE RING WAS INCORRECT. PDM'S DWG WAS ALSO INCORRECT. PIPE ORIENTATION CORRECTED IN FIELD

NOTE ② OUTER RING TACKED TO SHELL @ HIGH POINTS. CRACKS BETWEEN RING & PLATE TEMPORARILY BLOCKED WITH WOOD.

REMARKS AND/OR SAFETY FEATURES

Danger - Exercise caution in scaling ladders.
Check access ladders and platforms for safe use.
Wear hard hats, gloves, eye protection.

M. BERRY
A. SHORT
R. CLOUD
[signature]

Pipe / Kaolite Height

SEE PREVIOUS REPORT

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/30/69
FEATURE	-7- Installation of materials to be imbedded in tank bottom insulation. Tank - 101 .	Inspected by: E.S. DAVIS Date: SEE BELOW
REFERENCES:	Contract Spec. HWS-7789, Para. 8.0 for carbon steel pipe: PDM Dwg. 38570-9, Rev. 3, for placement of pipe; HWS-7793, Rev. 3, for thermocouples; PDM Dwg. 38570-10 for placement of conduit. Note: For orientation of conduit and thermocouples for tank 101; see PDM Dwg. 38570-11.	Distribution: WS Graves CN Zangar A. Short QC File
OTHER DATA:	See PDM Dwg. 38570, Rev. 3, for insulation retaining ring details and drain slot details. Important - check office on latest data pertaining to any of the above items.	

Requirements	Acceptance Yes	Acceptance No
Pipe: Size 4" schedule 40 carbon steel.	✓	
Welding of pipe - requirements - none - obtain structurally sound weld.	✓	
Wrap pipe with 10 mil polyethylene sheets. TWO WRAPS 6 MIL 3-17-69	✓	
Tape sheets at joints and pipe ends. 3-17-69	✓	
Support pipe on prefabricated insulation blocks. 3-18-69	✓	
Minimum clearance 1" on bottom, 2½" on top. 3-18-69 - 3-25-69	✓	
Conduit: 1/2" rigid, galvanized; 7" radii bends; maintain clearance from tank shell for insulation. 3-13-69 LMB	✓	
Insulation Retainer Rings: Inner ring - drain slots - 18 - 3" X 1½" deep; 4 - 4-5/8" holes @ 90°. Outer ring - [redacted] to fit shell bottom HIGH SPOTS	✓	
General: Check for quantity of pipes 4 and conduits 25, orientation and location of embedments, temp. covers for ends of all openings prior to placement of concrete, all embedments secured.	✓	
ELEVATION OF PIPES - NOTE		

REMARKS AND/OR SAFETY FEATURES

Danger - Exercise caution in scaling ladders.
Check access ladders and platforms for safe use.
Wear hard hats, gloves, eye protection.

NOTE - ELEVATION OF PIPES, BOTTOM PLATES ARE INDICATED ON PREPARED DRAWING.

VITRO-HES QUALITY ASSURANCE

OJECT IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis 1/30/69
A( )E -7- Installation of materials to be imbedded in tank bottom insulation. Tank (102).	Inspected by: E S DAVIS
FERENCES: Contract Spec. HWS-7789, Para. 8.0 for carbon steel pipe: PDM Dwg. 38570-9, Rev. 3, for placement of pipe; HWS-7793, Rev. 3, for thermocouples; PDM Dwg. 38570-10 for placement of conduit. Note: For orientation of conduit and thermocouples for tank 101; see PDM Dwg. 38570-11.	Date: SEE BELOW Distribution: WS Graves CN Zangar A. Short QC File
HER DATA: See PDM Dwg. 38570, Rev. 3, for insulation retaining ring details and drain slot details. Important - check office on latest data pertaining to any of the above items.	

Requirements	Acceptance Yes	Acceptance No
Pipe: Size 4" schedule 40 carbon steel.	✓	
Welding of pipe - requirements - none - obtain structurally sound weld.	✓	
Wrap pipe with 10 mil polyethylene sheets. TWO WRAPS 6 MIL 2/24/69	✓	
Tape sheets at joints and pipe ends. 2/24/69	✓	
Support pipe on prefabricated insulation blocks. 2/26/69	✓	
Minimum clearance 1" on bottom, 2½" on top. 2/25/69	✓	
Conduit: 1/2" rigid, galvanized; 7" radii bends; maintain clearance from tank shell for insulation. 2-20-69 LMB	✓	
Insulation Retainer Rings: Inner ring - drain slots - 18 - 3" X 1½" deep; 4 - 4-5/8" holes @ 90°. Outer ring - [redacted] to fit shell bottom HIGHSPOTS	✓	
General: Check for quantity of pipes 4 and conduits 25, 2-25-69 orientation and location of embedments, temp. covers for ends of all openings prior to placement of concrete, all embedments secured.	✓	
Elevation of pipes -	NOTE	

EMARKS AND/OR SAFETY FEATURES

Danger - Exercise caution in scaling ladders.
Check access ladders and platforms for safe use.
Wear hard hats, gloves, eye protection.

NOTE: ELEVATION OF PIPES, BOTTOM PLATES, INDICATED ON MARKED P.D.M DWG Q-6

VITRO-HES QUALITY ASSURANC

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 2/10/69
FEATURE -5- Cleanup and Placement of Secondary Tank Bottom 101	Inspected by: [signature] Short
REFERENCES: PDM Dwg. 38570-4, Rev. 6 Dwg. H-2-64306, Rev. 3, Tank Foundation Plan	Date: March 10, 1969 Distribution: WS Graves CN Zangar A. Short QC File
OTHER DATA:	

Requirements	Acceptance Yes	Acceptance No
1. See that 1/2" X 6" X 2'-10" O.D. ring W/4-1/2" holes is properly located and welded on the inside of the ring to the bottom side of the secondary bottom tank.	OK	
2. Remove protection cover for concrete foundation slab.	OK	
3. Completely clean all extraneous material from foundation slab and drain slots.	OK	
4. Fill central drainage well with ceramic fiber insulation per note - Detail 6, drawing H-2-64449 before lowering secondary tank bottom. Note type and manufacturer of insulation used.	OK	
5. Maintain cleanliness of foundation slab during lowering of secondary tank bottom.	OK	
6. Remove lifting beam and attachment (see feature number 3 for repairs and feature number 4 for magnetic particle tests of weld scars).	OK	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves, eye protection.

2. Check cribbing, stay clear of jacks and/or crane.

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 2/10/69
FEATURE -5- Cleanup and Placement of Secondary Tank Bottom *102*	Inspected by: *E.S. DAVIS*
REFERENCES: PDM Dwg. 38570-4, Rev. 6 Dwg. H-2-64306, Rev. 3, Tank Foundation Plan	Date: *2/10/69*
	Distribution: WS Graves CN Zangar A. Short QC File
OTHER DATA:	

Requirements	Acceptance Yes	Acceptance No
1. See that 1/2" X 6" X 2'-10" O.D. ring W/4-1/2" holes is properly located and welded on the inside of the ring to the bottom side of the secondary bottom tank.	✓	
2. Remove protection cover for concrete foundation slab.	✓	
3. Completely clean all extraneous material from foundation slab and drain slots.	✓	
4. Fill central drainage well with ceramic fiber insulation per note - Detail 6, drawing H-2-64449 before lowering secondary tank bottom. Note type and manufacturer of insulation used.	✓	
5. Maintain cleanliness of foundation slab during lowering of secondary tank bottom.	✓	
6. Remove lifting beam and attachment (see feature number 3 for repairs and feature number 4 for magnetic particle tests of weld scars).	✓	
3. ICE MELTED FROM DRAINS BY USE OF PROPANE HEATERS		

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves, eye protection.

2. Check cribbing, stay clear of jacks and/or crane.

NOTE - SEE REPORT DATED 2-6-69 FOR COMPLETE DETAILS ON PLACEMENT OF SECONDARY TANK BOTTOM. DETAILED REPORT PREPARED BY A. SHORT

copy attached [illegible] 2/12/69

ROJECT	IAP-614 - **Work Order AEC-9075**	Prepared by: E. S. Davis 2-18-69
T 'RE	101 - Leak detection risers and spray rings	Inspected by: [signature]
EFERENCES:	Dwgs: H-2-64318, Rev. 1 H-2-64325, Rev. 0 H-2-64428, Rev. 0 H-2-64430, Rev. 0	Date: 2 24 69
THER DATA:	HWS-7792, Process and Service Piping USAS B31.1.0 - 1967, Power Piping Number required - 3	Distribution: WS Graves CN Zangar A. Short QC File

RECEIVED APR 23 A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

Requirements	Acceptance Yes	Acceptance No
1. Material:	as per P.O.	
a. ASTM A53 or A120 - certified and marked.	yes	
b. 6", 24" and 30" - schedule 20.	"	
c. 1" - schedule 40.	"	
d. Factory-applied, coal-tar enamel. *wrapped*		
2. Fabrication:		
a. Welding procedures - list.		
b. Weldor qualifications - examined.	OK	
c. Welds inspected - HWS 7792, page 25.	OK	
d. Overall length - adjusted to field conditions - approximate elevation 623.25 to 668.79.	OK	
e. Pipe penetrations - note detail 90, Dwg. H-2-64325, has one less penetration. ?	NO	
f. Pipe braces.	OK	
g. Spray ring:	OK	
(1) Nozzle mfg. - SST material.	yes	
(2) Plate material - ASTM A36.		
(3) Pressure test 150 psi.	yes	
h. All dimensions checked.	OK	
i. Workmanship	OK	

(continued on sheet 2)

EMARKS AND/OR SAFETY FEATURES

Safety:

Wear hard hats, eye protection and gloves.

NOTE - 2d - TANK 101 NORTH RISER EXISTING ELEV IS 623.24
" 101 SOUTH RISER " " " 623.57 - ?
TANK 102 RISER " " " 623.32 ~~at~~ 7/8"

PROJECT	IAP-614 - Work Order AEC-9075
FEATURE	101 - Leak detection, risers and spray rings.

Requirements	Acceptance Yes	Acceptance No
(continued from sheet 1)		
3. Installation:		
a. Welds inspected	✓	
b. Connecting or penetrating piping and supports installed.	✓	
c. Elevation checked.	✓	
d. Protective coating applied at weld joints and repaired.	✓	
e. Protective cover maintained.	✓	
f. Workmanship	OK	

VITRO-HES QUALITY ASSURANCE

ROJECT	IAP-614 - Work Order AEC-9075	Prepared by: E. S. Davis 2-18-69
ATURE	102 - Leak detection pit floor flanges and pipe anchors Tanks 101 + 102	Inspected by: Al Short
EFERENCES:	Dwg. H-2-64319, Rev. 1, Details 63 and 65. Dwg. H-2-64426, Part 2, trunnion guides. HWS 7792, pages 23 and 25. USAS B31.1.0-1967, Power Piping	Date: Jan. 30 - 1970 Distribution: WB Graves CN Zangar A. Short QC File
HER DATA:	Weld detail, H-2-64319, Rev. 1, Detail 64. Pit detail - structural - H-2-64325, Rev. 0. Quantity required - 3 each.	

Requirements	Acceptance Yes	Acceptance No
1. Material: ASTM A36 - certified.	OK	
2. Fabrication:		
a. Weld procedures - list. ✓ b. Weldor qualifications - checked. ✓ c. Weld inspection. ✓ d. Dimensions checked. ✓ e. Workmanship. ✓	OK	
3. Installation:		
a. Elevation and alignment checked. ✓ * b. Weld inspection. ✓ c. Underside of pipe anchors coated with coal tar enamel. ✓	OK	
* BACKFILLING PROCEDURES RESULTED IN ENCASEMENT LEAK DETECTION RISER BEING DEFLECTED 2" TO THE EAST.		

MARKS AND/OR SAFETY FEATURES

1. Wear hard hat, eye protection and gloves.

VITRO-HES QUALITY ASSURANCE

OJECT	IAP-614 - Work Order AEC-9075	Prepared by: E. S. Davis 2-18-69
RE	102 - Leak detection pit floor flanges and pipe anchors	Inspected by:
FERENCES:	Dwg. H-2-64319, Rev. 1, Details 63 and 65. Dwg. H-2-64426, Part 2, trunnion guides. HWS 7792, pages 23 and 25. USAS B31.1.0-1967, Power Piping	Date: Distribution: WS Graves CN Zangar A. Short QC File
HER DATA:	Weld detail, H-2-64319, Rev. 1, Detail 64. Pit detail - structural - H-2-64325, Rev. 0. Quantity required - 3 each.	

Requirements	Acceptance Yes	Acceptance No
1. Material: ASTM A36 - certified.		
2. Fabrication:		
a. Weld procedures - list.		
b. Weldor qualifications - checked.		
c. Weld inspection.		
d. Dimensions checked.		
e. Workmanship.		
3. Installation:		
a. Elevation and alignment checked.		
b. Weld inspection.		
c. Underside of pipe anchors coated with coal tar enamel.		

MARKS AND/OR SAFETY FEATURES

1. Wear hard hat, eye protection and gloves.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Work Order AEC-9075	Prepared by: E. S. Davis 2-18-69
F[illegible]URE	106 - Sluicing and pump mounting rings.	Inspected by:
REFERENCES:	Dwg. H-2-64315, Rev. 1. HWS 7792, pages 23 and 25. Dwg. H-2-64316, Dowel details Dwg. H-2-64313, pump pit, structural concrete. Dwg. H-2-64314, sluicing pit, structural concrete. USAS B31.1.0-1967, Power Piping	Date: Distribution: WS Graves CN Zangar A. Short QC File
OTHER DATA:	Sluice mounting rings - use with Dwg. H-2-64447, Rev. 3, part 1, and Dwg. H-2-64448, Rev. 2, detail 13. 8 required. Pump mounting rings - use with Dwg. H-2-64447, Rev. 3, parts 6 and 7, and Dwg. H-2-64448, Rev. 2, detail 14A and 14B. 2 req'd.	

Requirements	Acceptance Yes	Acceptance No
1. Material - certified:		
a. Plate - ASTM A36, pipe - ASTM A53, dowels - AISI416 - heat-treated, studs - AISI Type 431 - heat-treated - all certified.		
2. Fabrication:		
a. Weld procedures - list.		
b. Weldor qualifications - ascertain.		
c. Check all dimensions - consider fabricating template to check alignment of dowels and studs.		
d. 72-3/16" holes in sluicing ring.		
e. Check finish and flatness tolerances.		
f. Provide as-built details.		
g. Workmanship.		
3. Installation:		
a. Check elevation and centerline - record.		
b. Weld procedure - list.		
c. Weldor qualification - ascertain.		
d. Check orientation.		
e. Workmanship.		

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 AEC-9075	Prepared by: E. S. Davis 3-13-69
FEATURE -110- Heater Risers and Plugs *[signature] 10/7/02*	Inspected by: *[signature] Short*
REFERENCES: H-2-64419, Rev. 4 - 2 ea., slipon flanges for risers #7 and #24; 4 ea, Detail 1, 37½" dia.; 44 ea., Detail 1, 12½" dia; 24 ea., 3" riser plug; 6 ea., 4" riser plug; 14 ea., 6" riser plug; 4 ea., 12" riser plug; 2 ea., 16" riser plug; 4 ea., 24" riser plug; 4 ea., 42" riser plug; 44 ea., 5-5/8" O.D. X 2" I.D. X 1/8" plates for riser #2. H-2-64424, Rev. 0 - 2 ea., Details 1, 2 and 3.	Date: *MAR. 2-1970* Distribution: CN Zangar WS Graves A. Short QC File
OTHER DATA: H-2-64447, Rev. 3, Penetration Schedule H-2-64448, Rev. 2, Tank Penetration Details HWS-7792, Paint Schedule, Page 104	

Requirements	Acceptance Yes	Acceptance No
1. Material - (check for identification)	*OK*	
a. Pipe and pipe fittings - ASTM A53, carbon steel (type E or S). ✓		
b. Flanges ASTM A181, Grade I, carbon steel (A-36 if cut from plate). ✓		
c. Plate and flatbar, ASTM A36, carbon steel. ✓		
d. Rod ASTM A107, carbon steel. ✓		
e. Concrete - 3000 psi. ✓		
2. Fabrication	*OK*	
a. Weld procedures - list. ✓		
b. Weldor qualifications - ascertain. ✓		
c. Check all dimensions - ascertain within 1/8" tolerance. ✓		
d. Reinforcing steel - size and placement. ✓		
e. Workmanship. ✓		
f. As-built details ✓		
g. Painting - zinc chromate on exposed surfaces. *		
3. Installation		
a. Check for proper fit.		
b. Painting - 2 finish coats - gloss enamel on exposed surfaces. *		
** PAINTING HAS NOT BEEN COMPLETED*		

REMARKS AND/OR SAFETY FEATURES

Wear hard hats and glasses.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 AEC-9075

FEATURE -110- Heater Risers and Plugs

Prepared by: E. S. Davis 3-13-69

Inspected by:

Date:

REFERENCES: H-2-64419, Rev. 4 - 2 ea., slipon flanges for risers #7 and #24; 4 ea, Detail 1, 37½" dia.; 44 ea., Detail 1, 12½" dia; 24 ea., 3" riser plug; 6 ea., 4" riser plug; 14 ea., 6" riser plug; 4 ea., 12" riser plug; 2 ea., 16" riser plug; 4 ea., 24" riser plug; 4 ea., 42" riser plug; 44 ea., 5-5/8" O.D. X 2" I.D. X 1/8" plates for riser #2.
H-2-64424, Rev. 0 - 2 ea., Details 1, 2 and 3.

Distribution:
CN Zangar
WS Graves
A. Short
QC File

OTHER DATA: H-2-64447, Rev. 3, Penetration Schedule
H-2-64448, Rev. 2, Tank Penetration Details
HWS-7792, Paint Schedule, Page 104

Requirements	Acceptance Yes	Acceptance No
1. Material - (check for identification)		
a. Pipe and pipe fittings - ASTM A53, carbon steel (type E or S).		
b. Flanges ASTM A181, Grade I, carbon steel (A-36 if cut from plate).		
c. Plate and flatbar, ASTM A36, carbon steel.		
d. Rod ASTM A107, carbon steel.		
e. Concrete - 3000 psi.		
2. Fabrication		
a. Weld procedures - list.		
b. Weldor qualifications - ascertain.		
c. Check all dimensions - ascertain within 1/8" tolerance.		
d. Reinforcing steel - size and placement.		
e. Workmanship.		
f. As-built details		
g. Painting - zinc chromate on exposed surfaces.		
3. Installation		
a. Check for proper fit.		
b. Painting - 2 finish coats - gloss enamel on exposed surfaces.		

REMARKS AND/OR SAFETY FEATURES

Wear hard hats and glasses.

VITRO-HES QUALITY ASSURANCE

ROJECT IAP-614 AEC-9075	Prepared by: E. S. Davis 3-14-69
EATURE -107- Pump and Sluice Pit Adaptor Flanges Tanks 101+102	Inspected by: A Short
EFERENCES: H-2-64425, Rev. 0 - one each, Details 1 and 2. H-2-57331 - long & short dowels, parts 7 and 8. H-2-57332 - stud, part 1; locking pin, part 10. H-2-3146 - nut retainer, part 5. H-2-64426 - trunnion and trunnion guides	Date: FEB. 6 - 1970 Distribution: WS Graves CN Zangar A. Short QC File (1)
THER DATA: H-2-44615 - pump adaptor flange assembly H-2-41304 - Hanford sluicer. H-2-64315 - sluicing & pump mounting rings.	

Requirements	Acceptance Yes	No
1. Material (check for identification)	OK	
a. Flanges, gusset, trunnion guide - ASTM A-36 C'stl. ✓		
b. Dowels - AISI 416 S.S., quench and stress relieved to 35-40 ✓ Rockwell.		
c. Studs - AISI, Type 431 S.S. ✓		
d. Locking pin - AISI 304 or 304L. ✓		
e. Trunnion, bar bail - ASTM A107. ✓		
Fabrication	OK	
a. Weld procedure. ✓		
b. Weldor qualifications. ✓		
c. Check all dimensions; ascertain within tolerances. ✓		
d. Workmanship - finish. ✓		
e. As-built details. ✓		
3. Installation	OK	
a. Check fit up and remotability. (REMOTABILITY WILL BE CHECKED AT A LATER DATE)		

REMARKS AND/OR SAFETY FEATURES

Wear hard hats and eye protection.

VITRO-HES QUALITY ASSURANCE

ROJECT	IAP-614 AEC-9075	Prepared by: E. S. Davis 3-14-69
TURE	-107- Pump and Sluice Pit Adaptor Flanges	Inspected by:
EFERENCES:	H-2-64425, Rev. 0 - one each, Details 1 and 2. H-2-57331 - long & short dowels, parts 7 and 8. H-2-57332 - stud, part 1; locking pin, part 10. H-2-3146 - nut retainer, part 5. H-2-64426 - trunnion and trunnion guides	Date:
THER DATA:	H-2-44615 - pump adaptor flange assembly H-2-41304 - Hanford sluicer. H-2-64315 - sluicing & pump mounting rings.	Distribution:

Requirements	Acceptance Yes	Acceptance No
1. Material (check for identification)		
a. Flanges, gusset, trunnion guide - ASTM A-36 C'stl.		
b. Dowels - AlSl 416 S.S., quench and stress relieved to 35-40 Rockwell.		
c. Studs - AlSl, Type 431 S.S.		
d. Locking pin - AlSl 304 or 304L.		
e. Trunnion, bar bail - ASTM A107.		
2. Fabrication		
a. Weld procedure.		
b. Weldor qualifications.		
c. Check all dimensions; ascertain within tolerances.		
d. Workmanship - finish.		
e. As-built details.		
3. Installation		
a. Check fit up and remotability.		

EMARKS AND/OR SAFETY FEATURES

Wear hard hats and eye protection.

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VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AEC-9075

FEATURE 11 Placement of concrete shell to elevation 651.36. Tank 101

REFERENCES: Drawing H-2-64310
HWS-7791

Prepared by: ES Davis 3-17-69

Inspected by: ES Davis

Date: 4-15-69 TO 5-20-69

Distribution:
WS Graves
CN Zangar [redacted]
A. Short
QC File (2)

OTHER DATA:

Reinforcing steel fabricator's cut sheets

Requirements	Acceptance Yes	Acceptance No
1. Check primary tank shell for completeness		
a. Reinforcing rings - LOCATED TO MISS FORM ANCHORS LOCATED ON	✓	
b. Form anchors 2'-0 CENTERS STARTING 1'-0" ABOVE FDN.	✓	
c. Foundation slide plate and tank skirt } SLIGHT VARIATION WITH RESPECT TO VERTICAL LINE OF SHELL WALL	✓	
d. Expansion space. PROTECTED WITH PLYWOOD	✓	
2. Check placement of reinforcing steel		
a. Spacing ESD	✓	
b. Number and size of bars. ESD	✓	
3. Check formwork		
a. Spacing and tie rods	✓	
b. Bracing		
c. Construction joint - WET CUT LAITANCE AT EACH JOINT	✓	
d. Sign pour slip. ESD	✓	
4. Check placing of concrete - PLACED IN THREE LIFTS		
a. Slump of concrete - 2 ½ TO 4" ESD	✓	
b. Height of concrete drop - USED SPECIAL EQUIPMENT		
c. Rate of placement and vibration 2' PER HR. MAXIMUM ESD	✓	
d. Cold joints - NONE		
e. Test cylinders. ONE CYLINDER TAKEN EVERY OTHER 2' LIFT	✓	

(continued on sheet 2)

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check scaffolding and ladders before using.
3. Stay clear of cranes handling material.

PROJECT Project IAP-614 Contract AEC-9075

1 TURE 11 Placement of concrete shell to elevation 651.36. Tank 101

Requirements	Acceptance Yes	Acceptance No
5. Curing of concrete	✓	
a. Protection - NO SPECIAL PROTECTION REQUIRED		
6. Form removal		
7. Repair of concrete and filling of tie-bolt holes. ESD	✓	
8. Installation of sealant in expansion space ESD	✓	

NOTES MADE ON TANK 102 APPLY TO TANK 101.
THE FOLLOWING IS ADDED TO NOTE NO 1

USE OF THE SQEEZE CRETE MACHINE IS VERY SATISFACTORY FOR THIS TYPE OF CONCRETE POUR, HOWEVER, SHOULD A BREAKDOWN OCCUR (AS DID HAPPEN HERE) A STANDBY CRANE AND EQUIPMENT IS NECESSARY TO PREVENT COLD JOINTS
ESD

PROJECT IAP-614 Contract AEC-9075

FEATURE 11 Placement of concrete shell to elevation 651.36. Tank 107

REFERENCES: Drawing H-2-64310
HWS-7791

Prepared by: ES Davis 3-17-69

Inspected by: E S Davis

Date: 3-24-69 to 5-20-69

Distribution:
WS Graves
CN Zangar
A. Short
QC File (2)

OTHER DATA:

Reinforcing steel fabricator's cut sheets

Requirements	Acceptance Yes	Acceptance No
1. Check primary tank shell for completeness		
a. Reinforcing rings LOCATED TO MISS FORM ANCHORS LOCATED ON	✓	
b. Form anchors 2' CENTERS STARTING 1'-0" ABOVE FDN.	✓	
c. Foundation slide plate and tank skirt } SLIGHT VARIATION WITH RESPECT TO VERTICAL LINE OF SHELL WALL.	✓	
d. Expansion space. - PROTECTED WITH PLYWOOD	✓	
2. Check placement of reinforcing steel		
a. Spacing ESD.	✓	
b. Number and size of bars. ESD.	✓	
3. Check formwork		
a. Spacing and tie rods DIFFICULTY - DUE TO ERRORS IN PLACEMENT OF ANCHORS ESDavis	✓	
b. Bracing	✓	
c. Construction joint - WET CUT LAITANCE @ EACH JOINT	✓	
d. Sign pour slip.	✓	
4. Check placing of concrete - PLACED IN THREE LIFTS		
a. Slump of concrete - 2 1/2" TO 3 1/2" ESD.	✓	
b. Height of concrete drop - USED SPECIAL EQUIPMENT	✓	
c. Rate of placement and vibration 2' PER HR MAXIMUM.	✓	
d. Cold joints - NONE	✓	
e. Test cylinders. ONE CYLINDER TAKEN EACH 2' LIFT.	✓	

(continued on sheet 2)

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.

2. Check scaffolding and ladders before using.

3. Stay clear of cranes handling material.

PROJECT Project IAP-614 Contract AEC-9075

FEATURE 11 Placement of concrete shell to elevation 651.36. Tank 102

Requirements		Acceptance Yes	Acceptance No
5. Curing of concrete		✓	
a. Protection - NO SPECIAL PROTECTION REQUIRED			
6. Form removal		✓	
7. Repair of concrete and filling of tie-bolt holes.	EAD	✓	
8. Installation of sealant in expansion space	EAD	✓	

NOTES

1. "SQUEEZE-CRETE" MACHINE USED TO PLACE CONCRETE IN FORMS. HOSE WAS EXTENDED DOWN INSIDE FORMWORK ELIMINATING NEED FOR TREMMIES.

2. FORM COAT USED - MAGIC KOTE - CONCRETE RELEASING AGENT MFG BY SYMONS MFG CO

3. HUNTS CURING COMPOUND USED FOR CONCRETE CURING AFTER FORM REMOVAL

4. VERY LITTLE CONCRETE REPAIR WAS NECESSARY. TIE BOLT HOLES WERE FILLED WITH THIOKOL SEALANT. ALL REPAIR WORK WAS PERFORMED AS BACKFILL PROGRESSED.

5. THIOKOL SEALANT PLACED IN EXPANSION SPACE IS A ONE-COMPONENT THIOKOL SEALANT MFG BY THE GRACE CO. (HORNFLEX ONE)

EAD

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 3/27/69
FEATURE 6 - Correction of secondary tank bottom TANK 101 to flatness tolerance	Inspected by: E. S. DAVIS
REFERENCES: Specification HWS 7789, Paragraph 14.3, Bottoms	Date: SEE BELOW
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

OTHER DATA: ELEVATIONS ARE CHARTED ON DRAWING PREPARED BY VITRO/HES SURVEY CREW. DWG IS ADAPTED FROM PDM DWG QC 4

Requirements	Acceptance Yes	Acceptance No
1. **Flatness:** a. Peak-to-valley not to exceed 2". b. One peak-to-valley tolerance of 3" in 30 sq. ft. 2. **Distortions:** a. Slopes shall not exceed 3/8" per foot. SURVEY MADE ON 3-10-69 1a. SIX PLACES EXCEED 2" TOLERANCE b. ONE PLACE HAS PEAK TO VALLEY TOLERANCE OF 3" 2. SLOPE EXCEEDS 3/8"/FOOT AS NOTED ON SURVEY. ABOVE CONDITIONS ACCEPTED ON 3/11/69	✓	

REMARKS AND/OR SAFETY FEATURES

OK - Al Short

1. Wear hard hats, gloves and eye protection.
2. Check access ladders to platforms for safe use.

VITRO-HES QUALITY ASSURANCE

ROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 3/27/69
EATURE 6 - Correction of secondary tank bottom to flatness tolerance TANK 101	Inspected by: E. S. DAVIS
EFERENCES: Specification HWS 7789, Paragraph 14.3, Bottoms	Date: SEE BELOW
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

THER DATA: ELEVATIONS ARE CHARTED ON DRAWING PREPARED BY VITRO/HES SURVEY CREW. DWG IS ADAPTED FROM PDM DWG QC 4

Requirements	Acceptance Yes	Acceptance No
1. **Flatness:** a. Peak-to-valley not to exceed 2". b. One peak-to-valley tolerance of 3" in 30 sq. ft.		
2. **Distortions:** a. Slopes shall not exceed 3/8" per foot.		
SURVEY MADE ON 3-10-69		
1a. SIX PLACES EXCEED 2" TOLERANCE		
b. ONE PLACE HAS PEAK TO VALLEY TOLERANCE OF 3"		
2. SLOPE EXCEEDS 3/8"/FOOT AS NOTED ON SURVEY.		
ABOVE CONDITIONS ACCEPTED ON 3/11/69	✓	

MARKS AND/OR SAFETY FEATURES

OK- Al Short

1. Wear hard hats, gloves and eye protection.

2. Check access ladders to platforms for safe use.

VITRO-HES QUALITY ASSURANCE

JECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 3/27/69
6 - Correction of secondary tank bottom to flatness tolerance (TANK 102)	Inspected by: E. S. DAVIS
ERENCES: Specification HWS 7789, Paragraph 14.3, Bottoms	Date: SEE BELOW
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

ER DATA:
PEAK TO VALLEY ELEVATIONS CHARTED ON POM DWG QC 6 BY VITRO FIELD SURVEY CREW ON 2-19-69

Requirements	Acceptance Yes	Acceptance No

1. **Flatness:**

   a. Peak-to-valley not to exceed 2".
   b. One peak-to-valley tolerance of 3" in 30 sq. ft.

2. **Distortions:**

   a. Slopes shall not exceed 3/8" per foot.

1a. 22 PLACES EXCEEDED 2" PEAK-TO-VALLEY TOLERANCE.

1b. NONE EXCEEDED 3" TOLERANCE.

2a. SLOPE APPROACHED 1" IN SEVERAL LOCATIONS.

THESE CONDITIONS ACCEPTED BY VITRO DESIGN REPRESENTATIVES AND ARCHO REPRESENTATIVE

OK - A. Short

ARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check access ladders to platforms for safe use.

ROJECT	IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Dawie 4/3/69
EATURE	10 (1) Installation of protective covering over Kaolite Insulation	Inspected by: A Short
EFEI ES:	HWS 7789, Paragraph 13.0 n TK 101	Date: 6-12-69
		Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
THER DATA:		

Requirements	Acceptance Yes	Acceptance No
1. Check that conduit risers for thermocouples are cut off level with surface of insulating concrete and exposed ends covered to prevent entry of debris. *	OK	
2. Check protection of insulation concrete by use of plywood and 2" X 10" timber supports.	OK	
3. Check that ends of air piping have protective covering to prevent entry of debris.	OK	

*(CONDUIT ENDS CHECKED PRIOR TO INSTALLATION OF PLYWOOD, RECHECKED AFTER REMOVAL OF PLYWOOD - SEE DAILY LOG 6-11-69)

EMARKS AND/OR SAFETY FEATURES

Wear hard hats, eye protection and gloves.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis 4/3/69
FEATURE 10 (2) Assembly of primary tank bottom up to top of knuckle plates	Inspected by: [signature] Short
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection drawings. HWS 7789, Rev. 2, Par. 2.0 -b, -c and -g. TK 101	Date: June 10 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA: PDM Welding Procedures 57-34A manual, 68-81A auto, 68-81 auto, (manual welding permissible - see letter AEC to PDM, dated 3/18). Welding Procedure Specification DB 119-197. PDM Dwg. 38570, sheet 7. PDM Dwg. 38570 QC 4 or 8.	

Requirements	Acceptance Yes	Acceptance No
1. Check equipment to ascertain capability of specific job performance. HWS 7789, Rev. 2, Par. 11.1; Par. 11.2 c: a. Automatic sub-arc. b. Welding machines (manual shielded arc.)	OK	
2. Check mill and material certification and markings: a. Plate material. b. Weld rod. c. Clips and miscellaneous steel. d. Stencil marks on exterior of tank.	OK	
3. Check fabrication for: a. Joint geometry and spacing. b. Welding sequence. c. Welding procedures. d. Handling. e. Excessive distortion. f. Good workmanship practices.	OK	
4. Review handling procedure for raising tank bottom.	OK	

REMARKS AND/OR SAFETY FEATURES

1. Check for tank grounding.
2. Ascertain that cribbing for supporting tank bottom is adequate and properly placed to prevent injury to personnel.
3. Wear hard hats, gloves and eye protection.

WITH THE EXCEPTION OF PORTIONS OF THREE LONG SEAMS, AF, AG, & AK, MANUAL WELDING WAS EMPLOYED ON THE UPPER SIDES OF ALL JOINTS,

PROJECT	IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis 4/3/69
FEATURE	10 (1) Installation of protective covering over Kaolite Insulation	Inspected by: [signature] Short
REFERENCES:	TK 102 HWS 7789, Paragraph 13.0 n	Date: 5-12-69
		Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA:		

Requirements	Acceptance Yes	Acceptance No
1. Check that conduit risers for thermocouples are cut off level with surface of insulating concrete and exposed ends covered to prevent entry of debris.	OK	
2. Check protection of insulation concrete by use of plywood and 2" X 10" timber supports.	OK	
3. Check that ends of air piping have protective covering to prevent entry of debris.	OK	
(SEE DETAILS IN DAILY LOG - 5/12/69)		

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, eye protection and gloves.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 - Contract AT(45-1)-2124 TANK 102

Prepared by: E. S. Davis 4/3/69

FEATURE 10 (2) Assembly of primary tank bottom up to top of knuckle plates

Inspected by: [signature]

Date: As req'd.

REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection drawings.
HWS 7789, Rev. 2, Par. 2.0 -b, -c and -g.

Distribution:

WS Graves
CN Zangar
A. Short
QC File (2)

OTHER DATA: PDM Welding Procedures 57-34A manual, 68-81A auto, 68-81 auto, (manual welding permissible - see letter AEC to PDM, dated 3/18).
Welding Procedure Specification DB 119-197.
PDM Dwg. 38570, sheet 7.
PDM Dwg. 38570 QC 4 or 8.

Requirements	Acceptance Yes	Acceptance No
1. Check equipment to ascertain capability of specific job performance. HWS 7789, Rev. 2, Par. 11.1; Par. 11.2 c:		
a. Automatic sub-arc.	OK ES	
b. Welding machines (manual shielded arc.)	OK ES	
2. Check mill and material certification and markings:		
a. Plate material.	OK ES	
b. Weld rod.	OK ES	
c. Clips and miscellaneous steel.	OK ES	
d. Stencil marks on exterior of tank.	OK ES	
e. AUTOMATIC SUB-ARC WELDING FLUX	OK ES	
3. Check fabrication for:		
a. Joint geometry and spacing.	OK ES	
b. Welding sequence.	OK ES	
c. Welding procedures.	OK ES	
d. Handling.	OK ES	
e. Excessive distortion. -NO	OK ES	
f. Good workmanship practices.	OK ES	
4. Review handling procedure for raising tank bottom. - OK	OK ES	

REMARKS AND/OR SAFETY FEATURES

1. Check for tank grounding.
2. Ascertain that cribbing for supporting tank bottom is adequate and properly placed to prevent injury to personnel.
3. Wear hard hats, gloves and eye protection.

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VITRO-HES QUALITY ASSURANCE

OJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 4/14/69
ATU.	10 (4) Inspection (Radiography-Magnetic Particle) and Repair Bottom Primary Tank	Inspected by: A Short
FERENCES:	FDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC-7 & 8, Drawing 38570 MT- 9 & 10. HWB 7789, Rev. 2, Section 12.0 weld inspection. TK 102	Date: MAY 9, 1969. Distribution: WB Graves; CN Zangar; A. Short; QC File (2)

THER DATA:

Radiation signs.

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all weld seams in bottom, knuckle plates and those adjoining first shell course.	OK	
2. Check for -		
a. Film and x-ray quality.	OK	
b. Proper interpretation and marking of film. SEE NOTE 1	OK	
c. Recording of defects.	OK	
3. Repair all defective welds.		
a. Visually check all welds prior to repair. b. Ascertain that repair procedure is acceptable. c. Check and record x-ray film of repairs.	OK	
4. Visually witness all mag-particle testing.		
a. Continually check testing equipment. b. Record position and location of tests. (PDM RECORDS) c. Ascertain that all areas are repaired satisfactorily.	OK	
5. Visually check all areas top and bottom for objectionable defects.	OK	

NOTE 1 - OF 343 REJECTABLE DEFECTS FOUND IN THIS BOTTOM, THE CONAM RADIOGRAPHER FOUND ON 294. THE REASON APPEARS TO BE THE FLUORESCENT BULB TYPE VIEWER HE USES DOES NOT SEEM TO PROVIDE SUFFICIENT ILLUMINATION.

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check cribbing, tank grounding.
3. Maintain safe distance to prevent x-ray exposure.
4. Check scaffolding, brackets, ladders for safe access.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 4/14/69
FE RE	10 (4) Inspection (Radiography-Magnetic Particle) and Repair Bottom Primary Tank TANK 101	Inspected by: Al Short
REFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4. Drawing 38570 QC- 4, Drawing 38570 MP- 3-4. HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: 6-20-69 Distribution: WS Graves CN Zangar A. Short QC File (2)

OTHER DATA:

Radiation signs.

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all weld seams in bottom, knuckle plates and those adjoining first shell course.	✓	
2. Check for -		
a. Film and x-ray quality.	✓	
b. Proper interpretation and marking of film. *	✓	
c. Recording of defects.	✓	
3. Repair all defective welds.		
a. Visually check all welds prior to repair.	✓	
b. Ascertain that repair procedure is acceptable.	✓	
c. Check and record x-ray film of repairs.	✓	
4. Visually witness all mag-particle testing.		
a. Continually check testing equipment.	✓	
b. Record position and location of tests.	✓	
c. Ascertain that all areas are repaired satisfactorily.	✓	
5. Visually check all areas top and bottom for objectionable defects.	✓	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check cribbing, tank grounding.
3. Maintain safe distance to prevent x-ray exposure.
4. Check scaffolding, brackets, ladders for safe access.

* IN SEVERAL AREAS OF AW SEAM DYE PENETRANT WAS USED AS A SUPPLEMENT TO RADIOGRAPHY.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 4/15/69
ATURE	10 (3) Preparation of Primary Tank Bottom for Radiography, Magnetic Particle, and Vacuum Leak Test. TANK 101	Inspected by: [signature] Short
REFERENCES:	PDM radiographic inspection procedure RP-1. Magnetic particle inspection MP-4 Drawing 38570 QC- 4 . Drawing 38570 MT- 3&4 . HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: 6/20/69 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA:	Radiation signs.	

Requirements	Acceptance Yes	Acceptance No
1. Check acceptability of -		
a. Type and power of x-ray machine.	✓	
b. Type and size of x-ray films.	✓	
c. Film developing and readout equipment.	✓	
d. Range and polarity mag-flux equipment.	✓	
e. Soap test equipment. NOT USED YET	[illegible]	
2. Check -		
a. Temporary attachments removed (~~except~~ AND lifting beams).	✓	
b. Gouges, weld scars, plate damage repaired.	✓	
c. Excessive distortion removed. NOT REQUIRED	✓	
d. Areas marked for mag-particle inspection.	✓	
e. General condition of tank bottom assembly.	✓	
3. Tools -		
Depth gauge.		

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves and eye protection.
2. Check cribbing, tank grounding.
3. Check condition of grounding.

VITRO-HWS QUALITY ASSURANCE

ROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 4/15/69
MAT 10 (3) Preparation of Primary Tank Bottom for Radiography, Magnetic Particle, and Vacuum Leak Test.	Inspected by: Al Short
EFERENCES: PDM radiographic inspection procedure RP-1. TK 102 Magnetic particle inspection MP-4 Drawing 38570 QC-7 & 8. Drawing 38570 MT- 9 & 10 HWS 7789, Rev. 2, Section 12.0 weld inspection.	Date: May 16, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
THER DATA: Radiation signs.	

Requirements	Acceptance Yes	Acceptance No
1. Check acceptability of -		
a. Type and power of x-ray machine. b. Type and size of x-ray films. c. Film developing and readout equipment. d. Range and polarity mag-flux equipment. e. Soap test equipment. (NOT PERFORMED YET)	OK	
2. Check -		
a. Temporary attachments removed (except lifting beams). b. Gouges, weld scars, plate damage repaired. c. Excessive distortion removed. (ALL WITHIN TOLERANCE) AS d. Areas marked for mag-particle inspection. (SEE NOTE) e. General condition of tank bottom assembly. GOOD	OK	
3. Tools - Depth gauge.		
NOTE: MAG-PARTICLE TESTING COMPLETED ON ALL HORIZONTAL BOTTOM AREAS	OK	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves and eye protection.
2. Check cribbing, tank grounding.
3. Check condition of grounding.

PROJECT IAP-614 - Contract AT(45-1)-2124 - Tank 102

FEATURE 10(5) Cleanup and placement of primary tank bottom

REFERENCES: P-DM Dwg. 38570-9 - For insulation
P-DM Dwg. 38570-10 - For instrumentation
P-DM Dwg. 38570-4, Rev. 7 - For cleats
HWS 7789, Rev. 2 - Steel tanks
HWS 7793 - Instrumentation

Prepared by: E. S. Davis 4/28/69
Inspected by: Al Short
Date: MAY 13, 1969
Distribution:
WS Graves
CN Zangar
A. Short
QC File (2)

OTHER DATA:
Review manufacturer's recommendation for installation of strain gages.

Requirements	Acceptance Yes	Acceptance No
1. See that 18 cleats are completely installed.	OK	
2. Remove protection cover from insulating concrete.	OK	
3. Visually check concrete for damage and/or necessary repairs.	OK	
4. Check all air piping, central air chamber and air slots for cleanliness.	OK	
5. Check installation of thermocouples in insulating concrete. Check resistance and identification.	OK	
6. Check installation of ~~one or~~ two strain gage elements on each side of primary shell.	OK	
7. Maintain cleanliness as tank bottom is ~~covered~~ LOWERED.	OK	
8. Check insertion of cleats into central air chamber.	OK	
9. Maintain safe distance during lowering of tank bottom.	OK	
10. Remove lifting beams and attachments (see feature number 10 (3) for repairs and feature number 10(4) for magnetic particle tests of weld scars).	OK	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves and eye protection.

2. Check cribbing, stay clear of jacks and/or crane.

VITRO-HES QUALITY ASSURANCE

OJECT IAP-614 - Contract AT(45-1)-2124 - Tank 101	Prepared by: E. S. Davis 4/28/69
AT E 10(5) Cleanup and placement of primary tank bottom	Inspected by: Al Short
FERENCES: P-DM Dwg. 38570-9 - For insulation P-DM Dwg. 38570-11 - For instrumentation P-DM Dwg. 38570-4, Rev. 7 - For cleats HWS 7789, Rev. 2 - Steel tanks HWS 7793 - Instrumentation	Date: June 13, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
HER DATA: Review manufacturer's recommendation for installation of strain gages.	

Requirements	Acceptance Yes	Acceptance No
1. See that 18 cleats are completely installed.	✓	
2. Remove protection cover from insulating concrete.	✓	
3. Visually check concrete for damage and/or necessary repairs.	✓	
4. Check all air piping, central air chamber and air slots for cleanliness.	✓	
5 Check installation of thermocouples in insulating concrete. Check resistance and identification.	✓	
6. Check installation of one or two strain gage elements on each side of primary shell.	✓	
7. Maintain cleanliness as tank bottom is ~~covered~~ LOWERED.	✓	
8. Check insertion of cleats into central air chamber.	✓	
9. Maintain safe distance during lowering of tank bottom.	✓	
10. Remove lifting beams and attachments (see feature number 10 (3) for repairs and feature number 10(4) for magnetic particle tests of weld scars).		✓

EMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves and eye protection.
2. Check cribbing, stay clear of jacks and/or crane.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Contract AT(45-1)-2124 - Tank 101	Prepared by: E. S. Davis 4/28/69
FE( )RE	10(5) Cleanup and placement of primary tank bottom	Inspected by:
REFERENCES:	P-DM Dwg. 38570-9 - For insulation P-DM Dwg. 38570-11 - For instrumentation P-DM Dwg. 38570-4, Rev. 7 - For cleats HWS 7789, Rev. 2 - Steel tanks HWS 7793 - Instrumentation	Date: Distribution: WS Graves CN Zangar A. Short QC File (2)
)THER DATA:	Review manufacturer's recommendation for installation of strain gages.	

Requirements	Acceptance Yes	Acceptance No
1. See that 18 cleats are completely installed.		
2. Remove protection cover from insulating concrete.		
3. Visually check concrete for damage and/or necessary repairs.		
4. Check all air piping, central air chamber and air slots for cleanliness.		
5. Check installation of thermocouples in insulating concrete. Check resistance and identification.		
6. Check installation of one or two strain gage elements on each side of primary shell.		
7. Maintain cleanliness as tank bottom is ~~covered~~ LOWERED.		
8. Check insertion of cleats into central air chamber.		
9. Maintain safe distance during lowering of tank bottom.		
10. Remove lifting beams and attachments (see feature number 10 (3) for repairs and feature number 10(4) for magnetic particle tests of weld scars).		

MARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves and eye protection.
2. Check cribbing, stay clear of jacks and/or crane.

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VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Contract AT(45-1)-2124 - Tank 102	Prepared by: E. S. Davis 4/28/69
FEATURE	10(5) Cleanup and placement of primary tank bottom	Inspected by:
		Date:
REFERENCES:	P-DM Dwg. 38570-9 - For insulation P-DM Dwg. 38570-10- For instrumentation P-DM Dwg. 38570-4, Rev. 7 - For cleats HWS 7789, Rev. 2 - Steel tanks HWS 7793 - Instrumentation	Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA:	Review manufacturer's recommendation for installation of strain gages.	

Requirements	Acceptance Yes	Acceptance No
1. See that 18 cleats are completely installed.		
2. Remove protection cover from insulating concrete.		
3. Visually check concrete for damage and/or necessary repairs.		
4. Check all air piping, central air chamber and air slots for cleanliness.		
5. Check installation of thermocouples in insulating concrete. Check resistance and identification.		
6. Check installation of one or two strain gage elements on each side of primary shell.		
7. Maintain cleanliness as tank bottom is ~~covered~~ LOWERED.		
8. Check insertion of cleats into central air chamber.		
9. Maintain safe distance during lowering of tank bottom.		
10. Remove lifting beams and attachments (see feature number 10 (3) for repairs and feature number 10(4) for magnetic particle tests of weld scars).		

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves and eye protection.
2. Check cribbing, stay clear of jacks and/or crane.

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VITRO-HES QUALITY ASSURANCE

[PROJ]ECT IAP-614 Contract AEC-9075	Prepared by: ES Davis 5-5-69
[FEAT]URE 12 Backfill tank farm area to elevation 654.83 TANKS 101 & 102	Inspected by: SEE BELOW
REFERENCES: Dwg. H-2-64301 and H-2-64302 HWS 7792, Rev. 1, Division I	Date: SEE BELOW
OTHER DATA:	Distribution: WS Graves CM Zangar A. Short QC File (2)

Requirements		Acceptance Yes	No
1. Check area for cleanup of foreign materials.	ESD	5-12-69	
2. Review and checkout contractor's compaction procedure.	ESD	5-9-69	
3. Review and approve contractor's backfill procedure.	ESD	5-9-69	
4. Check size and intended use of all heavy-duty equipment.	ESD	5-9-69	
5. Check borrow area for foreign materials.	ESD	5-12-69	
6. Check depth and levelness of each layer of backfill.	ESD & J.E.F.	✓	
7. Obtain samples and analysis of compacted material at various locations and elevations. SEE NOTE		✓	
8. See that contractor exercises extreme care with moving equipment in the immediate vicinity of the tanks and that heavy-duty equipment is not used within 8' of tank.	ESD & J.E.F.	✓	
9. See that thermocouples are extended to future grade, checked for continuity, and protected from damage prior to start of backfill operation. SEE NOTE	R.A.N., A.S., E.S.D.	✓	
10. Check plumbness of leak detection risers during backfill operation.	ESD & A.S	✓	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, and eye protection.
2. Be aware of moving equipment.

VITRO-HES QUALITY ASSURANCE sheet 2

PROJECT FAP 614

FEATURE 12 BACKFILL TANK FARM AREA TO ELEVATION 654.83

Requirements	Acceptance Yes	Acceptance No
NOTES:		
GENERAL: BACKFILL WORK WAS PERFORMED ON SWING SHIFT BEGINNING 5-12-69 AND COMPLETED ON 5-23-69, AVERAGING APPROX THREE (3) FEET PER SHIFT EAD		
7. COMPACTION SAMPLES TAKEN AT RANDOM, ONE SAMPLE FAILED - BUT ANOTHER SAMPLE TAKEN IN THE SAME LOCATION INDICATED COMPACTION WAS ACCEPTABLE EAD		
9. FOUNDATION THERMOCOUPLES WERE BROUGHT UP SIDE OF CONCRETE WALL IN CONDUIT TO 24"x24"x6" STEEL BOX LOCATED AT APPROX ELEV. 649.00 EAD		

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AEC-9075	Prepared by: ES Davis 5-5-69 (Rev 0)
FEATURE 12 Backfill tank farm area to elevation 654.83 TANKS 101 & 102	Inspected by: SEE BELOW
REFERENCES: Dwg. H-2-64301 and H-2-64302 HWS 7792, Rev. 1, Division I	Date: SEE BELOW
OTHER DATA:	Distribution: WS Graves CN Zangar A. Short QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Check area for cleanup of foreign materials. EAD	5-12-69	
2. Review and checkout contractor's compaction procedure. EAD	5-9-69	
3. Review and approve contractor's backfill procedure. EAD	5-9-69	
4. Check size and intended use of all heavy-duty equipment. EAD	5-9-69	
5. Check borrow area for foreign materials. EAD	5-12-69	
. Check depth and levelness of each layer of backfill. EAD & J.E.F.	✓	
7. Obtain samples and analysis of compacted material at various locations and elevations. SEE NOTE	✓	
8. See that contractor exercises extreme care with moving equipment in the immediate vicinity of the tanks and that heavy-duty equipment is not used within 8' of tank. EAD & J.E.F	✓	
9. See that thermocouples are extended to future grade, checked for continuity, and protected from damage prior to start of backfill operation. SEE NOTE RAN., A.S., E.S.D.	✓	
10. Check plumbness of leak detection risers during backfill operation. EAD & A.S	✓	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, and eye protection.
2. Be aware of moving equipment.

VITRO-HES QUALITY ASSURANCE

PROJECT FAP 614

FEATURE 12 BACKFILL TANK FARM AREA TO ELEVATION 654.83

Requirements	Acceptance Yes	Acceptance No
NOTES:		
GENERAL: BACKFILL WORK WAS PERFORMED ON SWING SHIFT BEGINNING 5-12-69 AND COMPLETED ON 5-23-69, AVERAGING APPROX THREE (3) FEET PER SHIFT EAK		
7. COMPACTION SAMPLES TAKEN AT RANDOM, ONE SAMPLE FAILED - BUT ANOTHER SAMPLE TAKEN IN THE SAME LOCATION INDICATED COMPACTION WAS ACCEPTABLE EAK		
7. FOUNDATION THERMOCOUPLES WERE BROUGHT UP SIDE OF CONCRETE WALL IN CONDUIT TO 24"X24"X [illegible] STEEL BOX LOCATED AT APPROX ELEV. 649.00 EAK		

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2184 TANK 102	Prepared by: E. S. Davis 5/19/6[illegible]
FEATURE	10(6) - Correction of primary tank bottom to flatness tolerance	Inspected by: [signature] Short
REFERENCES:	Specification HWS 7789, Paragraph 14.3, Bottoms	Date: 8-1-69
		Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA:		

Requirements	Acceptance Yes	Acceptance No
1. **Flatness:**		
a. Peak-to-valley not to exceed 2".	✓	
b. One peak-to-valley tolerance of 3" in 30 sq. ft.	✓	
2. **Distortions:**		
a. Slopes shall not exceed 3/8" per foot.	✓	
ALL WELD SEAMS UP TO THE TOP OF THE BOTTOM KNUCKLES, WERE VACUUM TESTED AND FOUND TO BE WITHOUT DEFECTS.		

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check access ladders to platforms for safe use.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 5/19/69
F URE	10(6) - Correction of primary tank bottom to TANK 101 flatness tolerance	Inspected by: Al Short
REFERENCES:	Specification HWS 7789, Paragraph 14.3, Bottoms	Date: JULY 10, 1969
		Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

OTHER DATA:

Requirements	Acceptance Yes	Acceptance No
1. Flatness:		
a. Peak-to-valley not to exceed 2".	OK	
b. One peak-to-valley tolerance of 3" in 30 sq. ft.	OK	
2. Distortions:		
a. Slopes shall not exceed 3/8" per foot.	OK	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check access ladders to platforms for safe use.

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VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 - Contract AT(45-1)-2124

Prepared by: E. S. Davis

FEATURE -8- Insulation in Bottom of Tanks. Tank 101.

Inspected by: See below

Date: 3-29-69

REFERENCES: PDM Drawing 38570-4 and 38570-9.
PDM submittal, Willard Smith, dated 2-12-69.
Drawing H-2-64307, Rev. 2.
Specification HWS-7789, Paragraph 9.0.

Distribution:
WS Graves
CN Zangar
A. Short
QC File

OTHER DATA:
Battelle - Evaluation of Kaolite-2200.

Requirements	Acceptance Yes	Acceptance No
1. Review feature No. 7 as a check on embedded materials.	✓	
2. Conditions of environs pertaining to:		
a. Protection of tank bottom and materials. ENTIRE WORK AREA COVERED WITH TARPAULIN	✓	
b. Temperature (60-70°)(steel 50°+). TEMP IN WORK AREA RANGED FROM 48° TO 80°	✓	
3. Formwork:		
a. Maintain minimum 1" under pipe and 2½" over pipe thickness of insulation at the four 4-inch vent pipes. All other places - minimum of 5" thick insulation. MIN. 7" MAX APPROX 10½" AVE 9"	✓	
b. Joints - configuration and treatment to maintain strength and thermal characteristics. KEPT ADJOINING SURFACES WET.	✓	
c. Screeds and blockouts - air trenches and straingages.	✓	
4. Placement:		
a. Mixing - 78 qts./water/6-40# bags (3 to 5 minutes). 3 MIN. AVE 15½ GAL / BATCH	✓	
b. Each batch placed within 20 minutes - vibrator. AVE 7 MIN. / BATCH	✓	
c. Obtain samples - one each 10 batches or minimum of five each day. 3 TO 4 SAMPLES OBTAINED ON EACH SECTION	✓	

(continued on sheet 2)

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check air inside tank enclosure for poisonous gases.
3. Wear air filter when near batch mixing operation.
4. Exercise care entering and exiting tank.

A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

PROJECT IAP-614 - Contract AT(45-1)-2124

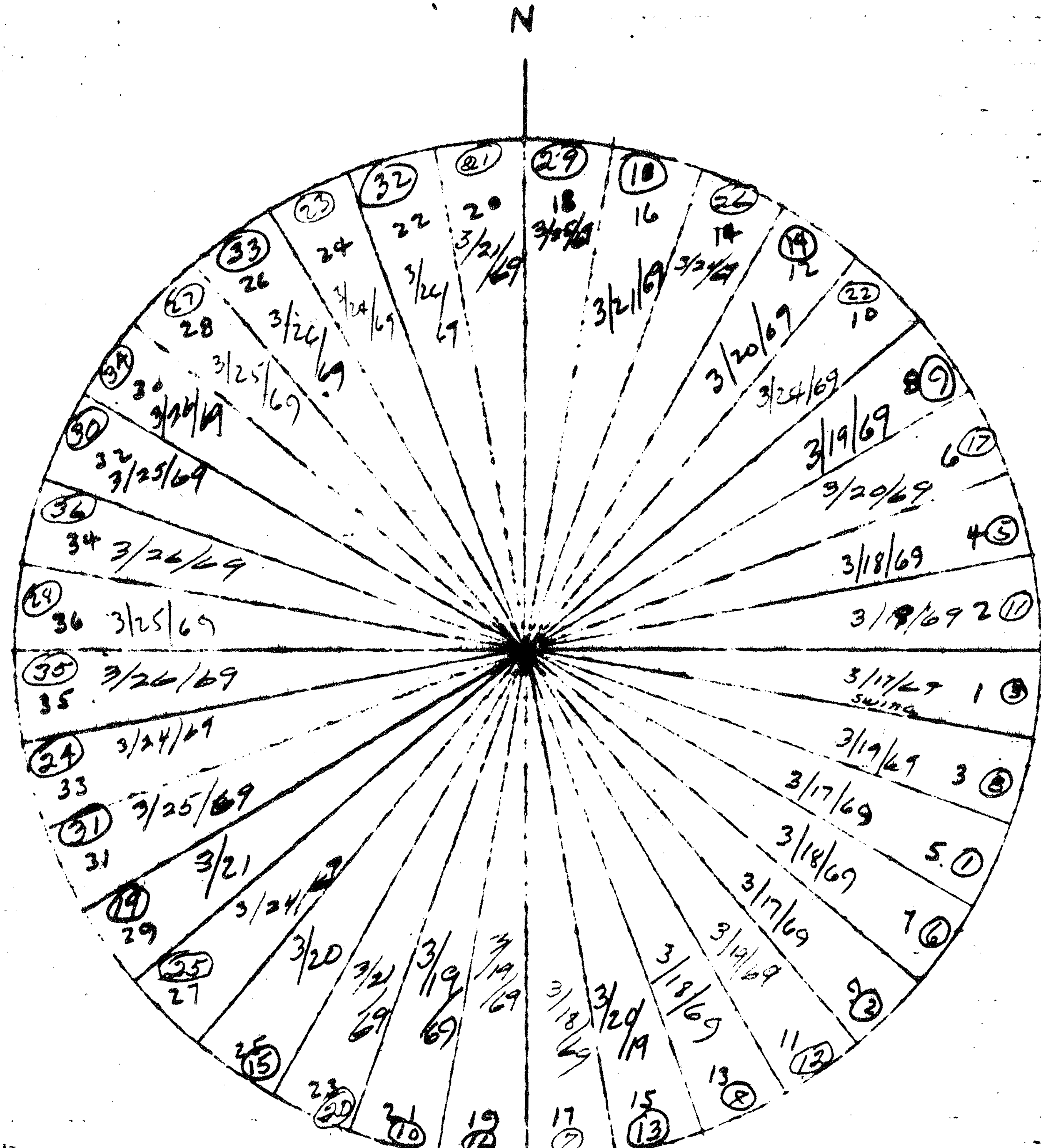
FEATURE -8- Insulation in bottom of tanks. Tank ______.

Requirements	Acceptance Yes	Acceptance No
(continued from sheet 1)		
5. Curing:	✓	
a. Covered with moist burlap for twenty-four hours - then air dried for ninety-six hours. AIR DRIED UNTIL TEST SHOW 200 PSI - USUALLY 72 HOURS		
b. Tests - shall not be less than 200 psi (wet or dry).		
3 day / 4 day / 5 day / 6 day / 7 day		
Batch #1		
Batch #2 TESTS RESULTS ON FILE		
Batch #3		
Batch #4 SAMPLE ATTACHED		
Batch #5		
Batch #6		
Batch #7		
Batch #8		
Batch #9		
6. Repairs - give nature and description of repair.	✓	

ONLY REPAIRS NECESSARY WERE SHAPING UP TRENCHES WHERE EDGES HAD BEEN KNOCKED OFF
ELEVATION OF KAOLITE ON FILE

NOTE: ONE CRACK APPEARED IN KAOLITE JUST AS PRIMARY SHELL BOTTOM WAS LOWERED AFTER COMPLETION OF WELDING THE CRACK WAS 1/16" WIDE OR SMALLER AND WAS REPAIRED BY SEALING WITH KAOLITE SEAL MIX

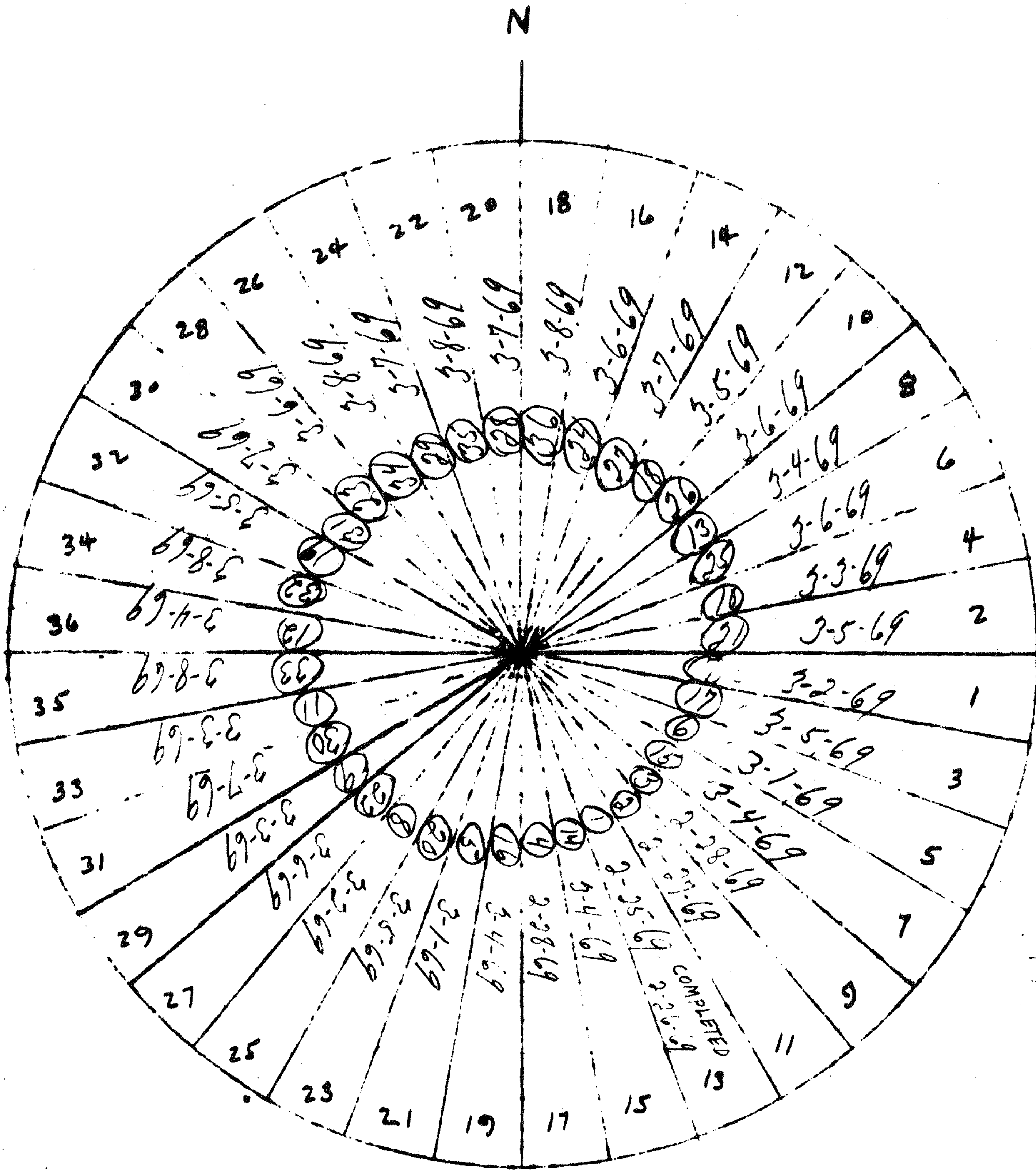
R CLOUD
C S Davis



TANK 101
KAOLITE INSULATION
PLACEMENT SCHEDULE

KAOLITE BREAKS - 3-24-69

DATE MADE	AGE	P.S.I.	SECTION	
3-17-69	7	990	#1	
"	7	840	9	
"	7	450	5	
" (CYLINDER)	7	283	9	(WT. PER C.F. 70-75)
3-19-69	5	590	2	
"	5	440	11	
"	5	635	8	
"	5	810	3	
"	5	635	2	
3-20-69	4	435	19	
"	4	200	15	
"	4	340	12	
"	4	735	6	
"	4	420	25	
3-21-69	3	450	20	
"	3	250	23	
"	3	475	29	
"	3	300	16	



TANK 102
KAOLITE INSULATION

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis
FEATURE	-8- Insulation in Bottom of Tanks. Tank 102.	Inspected by: SEE BELOW
REFERENCES:	PDM Drawing 38570-4 and 38570-9. PDM submittal, Willard Smith, dated 2-12-69. Drawing H-2-64307, Rev. 2. Specification HWS-7789, Paragraph 9.0.	Date: Distribution: WS Graves CN Zangar A. Short QC File
OTHER DATA:	Battelle - Evaluation of Kaolite-2200.	

Requirements	Acceptance Yes	Acceptance No
1. Review feature No. 7 as a check on embedded materials.	✓	
2. Conditions of environs pertaining to:	✓	
a. Protection of tank bottom and materials. ENTIRE WORK COVERED BY TARPAULIN		
b. Temperature (60-70°)(steel 50°+). TEMPERATURE RECORDED DAILY - RANGE 42° TO 78° INSIDE TARPAULIN		
3. Formwork:		
a. Maintain minimum 1" under pipe and 2½" over pipe thickness of insulation at the four 4-inch vent pipes. All other places - minimum of 5" thick insulation. AVE THICKNESS ESTIMATED MINIMUM 7".	✓	
b. Joints - configuration and treatment to maintain strength and thermal characteristics.	✓	
c. Screeds and blockouts - air trenches and straingages.	✓	
4. Placement:		
a. Mixing - 78 qts./water/6-40# bags (3 to 5 minutes). 15¼ TO 16 GAL/BATCH AVERAGE 15½ GAL	✓	
b. Each batch placed within 20 minutes - vibrator. AVERAGE 7 MINUTES		
c. Obtain samples - one each 10 batches or minimum of five each day. 4 SAMPLES PER SECTION WERE OBTAINED	✓	

(continued on sheet 2)

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check air inside tank enclosure for poisonous gases.
3. Wear air filter when near batch mixing operation.
4. Exercise care entering and exiting tank.

R CLOUD
E S Davis

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VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 - Contract AT(45-1)-2124

FEATURE -8- Insulation in bottom of tanks. Tank 102.

Requirements	Acceptance Yes	Acceptance No
(continued from sheet 1)		
5. Curing:	✓	
a. Covered with moist burlap for twenty-four hours - then air dried for ninety-six hours. AIR DRIED TILL TEST INDICATE 200 PSI - USUALLY WITHIN 72 HOURS		
b. Tests - shall not be less than 200 psi (wet or dry).	✓	

	3 day	4 day	5 day	6 day	7 day
Batch #1					
Batch #2					
Batch #3					
Batch #4					
Batch #5					
Batch #6					
Batch #7					
Batch #8					
Batch #9					

SERIES OF TEST RESULTS ON FILE
SAMPLE RESULT ATTACHED.

6. Repairs - give nature and description of repair. ✓

(a) - SURFACE CRACKS — 1 TO 2 INCHES DEEP ACROSS TWO SECTIONS - TOTAL APPROX 7' LONG. CRACKS WERE DUG OUT & NEW MATERIAL INSTALLED.
CRACKS OCCURRED AS RESULT OF FLEXING OF PLATE BENEATH.

(b) SURFACE UNEVEN AND TOO HIGH - A 25' SEGMENT IN S.E CORNER WAS 1/4" TO 3/8" TOO HIGH. FINAL ELEVATIONS
• NOTED ON PDM DWG #10

R. CLOUD
Ed Dai

KAOLITE BREAKS - 3-11-69

DATE MADE	AGE	P.S.I.	SECTION	
3-4-69	7	715	#7	
"	7	715	19	
"	7	880	15	
"	7	655	8	
"	7	350	36	
" (CYLINDER)	7	442	36	WT. CU. FT = 68.56#
3-8-69	3	470	26	
"	3	465	34	
"	3	520	22	
"	3	415	18	

VITRO-HFS QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124

FEATURE 16 - Erection of primary dome and penetrations *TANK 101*

Prepared by: E.S. Davis 6-10-69

Inspected by: *[signature]*

Date: *OCT. 16, 1969*

REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs. HWS-7789, Rev. 2, Par. 6.0, 11.0, 12.6, 14.4.
Design Change 2124-16

Distribution:

WS Graves
CM Zangar
A. Short
QC File (2)

OTHER DATA: PDM Welding Procedures 45-3, 65-19B, 46-172, 46-162, 56-16, 52-28, 55-49, 60-112.
Welding Procedure Specification DB119-197.
Dwg. 38570, Sheets 15, 23, 24, 25, E2 through E-15.

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings.		
a. Plate material	*OK*	
b. Weld rod		
c. Heat numbers on exterior of shell		
2. Check fabrication for		
a. Joint spacing		
b. Welding procedures	*OK*	
c. Weldor qualifications		
d. Handling		
e. Excessive distortion		
f. Good workmanship practices		
g. Visual weld defects.		
3. Dome penetrations		
a. Orientation, size and elevation		
b. Total number		*LATER*
c. Penetration anchor installed		
d. Concrete anchors installed		

HAZARDS AND/OR SAFETY FEATURES

Caution: Ascertain that dome supports are installed and braced adequately to support dome and personnel.

Danger: Check access ladders and platforms for safe use.
Wear hard hats, gloves, eye protection.
Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

ROJECT IAP-614 Contract AT(45-1)-2124

Prepared by: E.S. Davis 6-10-69

Inspected by: Al Short

Date: Sept. 24, 1969

Distribution:

WS Graves
CN Zangar
A. Short
QC File (2)

RE 16 - Erection of primary dome and penetrations Tank 102

EFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs. HWS-7789, Rev. 2, Par. 6.0, 11.0, 12.6, 14.4.
Design Change 2124-16

THER DATA: PDM Welding Procedures 45-3, 65-19B, 46-172, 46-162, 56-16, 52-28, 55-49, 60-112.
Welding Procedure Specification DB119-197.
Dwg. 38570, Sheets 15, 23, 24, 25, E2 through E-15.

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings.		
a. Plate material b. Weld rod c. Heat numbers on exterior of shell	OK	
2. Check fabrication for		
a. Joint spacing b. Welding procedures c. Weldor qualifications d. Handling e. Excessive distortion f. Good workmanship practices g. Visual weld defects.	OK	
3. Dome penetrations		
a. Orientation, size and elevation * b. Total number c. Penetration anchor installed d. Concrete anchors installed		
PENETRATIONS #6 (42") & #9 (4") WERE INSTALLED OUT OF TOLERANCE BUT NO INTERFERANCE WAS ANTICIPATED, SO THEY WILL REMAIN THERE		

REMARKS AND/OR SAFETY FEATURES

Caution: Ascertain that dome supports are installed and braced adequately to support dome and personnel.

Danger: Check access ladders and platforms for safe use.
Wear hard hats, gloves, eye protection.
Check for tank grounding.

VITRO-HWS QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: MS Davis 6-10-69
FEATURE 13 Erection of primary tank wall and wall penetrations. Tank 101	Inspected by: [signature]
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs., HWS-7789, Rev. 2, Par. 6.0, 11.0.	Date: Oct. 17, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA: PDM Welding Procedures 61-7A, 61-7B, 61-7C, 61-7D. Welding Procedure Specification DB-119-197. Dwg. 38570, Sheet 1 and QC - 3 .	

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings. a. Plate material b. Weld rod. c. Heat numbers on exterior of shell.	OK	
2. Check fabrication for: a. Joint spacing b. Welding procedures c. Weldor qualifications d. Handling e. Excessive distortion f. Good workmanship practices g. Shell penetrations h. Visual weld defects.	OK	
2 b ACCEPTABLE MODIFICATIONS WERE MADE IN WELD PROCEDURES.		

REMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use.

Wear hard hats, gloves, and eye protection.

Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: HS Davis 6-10-69
FEATURE	13 Erection of primary tank wall and wall penetrations. Tank 102	Inspected by: Al Short
REFERENCES:	Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs., HWS-7789, Rev. 2, Par. 6.0, 11.0.	Date: Aug. 15, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA:	PDM Welding Procedures 61-7A, 61-7B, 61-7C, 61-7D. Welding Procedure Specification DB-119-197. Dwg. 38570, Sheet 1 and QC - 7 .	

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings.		
a. Plate material	OK	
b. Weld rod.		
c. Heat numbers on exterior of shell.		
2. Check fabrication for:		
a. Joint spacing OK		
b. Welding procedures (SOME ACCEPTABLE MODIFICATIONS MADE)		
c. Weldor qualifications OK		
d. Handling OK		
e. Excessive distortion OK	OK	
f. Good workmanship practices ACCEPTABLE		
g. Shell penetrations LATER	— — —	✓
h. Visual weld defects. MALFUNCTIONING OF "3 O'CLOCK" WELDOR WAS CAUSE FOR CONCERN OVER THE EXCESSIVE NUMBER OF WELD DEFECTS IN THE BA-2 & BA-3 WELDS. VISUAL DEFECTS WERE EXCESSIVE AND WERE CONSIDERED A RESULT OF OPERATOR ERROR. WELD REPAIR WAS CONSIDERED AS EXCESSIVE.		

REMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use.

Wear hard hats, gloves, and eye protection.

Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124

Prepared by:
HS Davis 6-11-69

NATURE 14 Inspection of primary shell TANK 101

Inspected by:
Al Short

Date:
OCT. 17, 1969

REFERENCES: FDM Radiographic Procedure RP-1
FDM Magnetic Particle Inspection MP-4
Dwg. 38570, QC 3 , Dwg. 38570 MT

Distribution:

WS Graves
CN Zangar
A. Short
QC File (2)

OTHER DATA: Radiation signs -
HWS 7789, Rev. 2, Section 12.0 Weld Inspection

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all butt welds.		
2. Check for:		
a. Film and x-ray quality b. Proper interpretation and marking of film c. Recording of defects.	OK	
3. Repair all defective welds		
a. Visually check all welds prior to repair. b. Ascertain that repair procedure is acceptable. c. Check and record x-ray film of repairs.	OK	
4. Visually witness all mag-particle testing including tank penetrations.		
a. Continually check testing equipment. b. Record position and location of test. c. Ascertain that all areas are repaired satisfactorily.	OK	

REMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use.
Wear hard hats, gloves and eye protection.
Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

'ROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: ES Davis 6-11-69
T' 'RE 14 Inspection of primary shell TANK 102	Inspected by: Al Short
EFERENCES: PDM Radiographic Procedure RP-1 PDM Magnetic Particle Inspection MP-4 Dwg. 38570, QC - 7, Dwg. 38570 MT	Date: Sept. 16, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
'THER DATA: Radiation signs - HWS 7789, Rev. 2, Section 12.0 Weld Inspection	

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all butt welds.		
2. Check for:		
a. Film and x-ray quality b. Proper interpretation and marking of film c. Recording of defects.	OK	
3. Repair all defective welds		
a. Visually check all welds prior to repair. b. Ascertain that repair procedure is acceptable. c. Check and record x-ray film of repairs.	OK	
4. Visually witness all mag-particle testing including tank penetrations.		
a. Continually check testing equipment. b. Record position and location of test. c. Ascertain that all areas are repaired satisfactorily.	OK	

REMARKS AND/OR SAFETY FEATURES

<u>Danger</u> - Check access ladders and platforms for safe use.
Wear hard hats, gloves and eye protection.
Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124

FEATURE 15 Install shoring for tank dome erection TANK 101

REFERENCES: PDM Drawings E1B, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13.

OTHER DATA: HWS-7789, Rev. 2, Paragraph 17.0.

Prepared by: A. Short 7-7-69
Inspected by: [signature] Short
Date: OCT. 16, 1969

Distribution:
WS Graves
CN Zangar
A. Short
QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Witness that contractor exerts care in placing and assembling support system inside tank.	OK	
2. Check location of supports.	OK	
See that correct bases are used for dome erection and concrete placement.		LATER
4. See that scaffolding is installed on support system for safe personnel use.	OK	
5. See that cross-bracing is tightened for erection of dome, loosened for stress relief, and tightened for concrete placement.		LATER
6. Check tank bottom for needed repair where support columns are to be located.	OK	

REMARKS AND/OF SAFETY FEATURES

Caution: Ascertain that dome supports are installed and braced adequately to support dome and personnel.

Danger: Check access ladders and platforms for safe use.
Wear hard hats, gloves and eye protection.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: A. Short 7-7-69
FEATURE 15 Install shoring for tank dome erection TANK 102	Inspected by: A. Short
REFERENCES: FDM Drawings E1B, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13.	Date: Aug. 20, 1969
	Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA: HWS-7789, Rev. 2, Paragraph 17.0.	

Requirements	Acceptance Yes	Acceptance No
1. Witness that contractor exerts care in placing and assembling support system inside tank.	OK	
2. Check location of supports.	OK	
3. See that correct bases are used for dome erection and concrete placement.	OK	
4. See that scaffolding is installed on support system for safe personnel use.	OK	
5. See that cross-bracing is tightened for erection of dome, loosened for stress relief, and tightened for concrete placement.	OK	
6. Check tank bottom for needed repair where support columns are to be located.	OK	

REMARKS AND/OR SAFETY FEATURES

Caution: Ascertain that dome supports are installed and braced adequately to support dome and personnel.

Danger: Check access ladders and platforms for safe use.
Wear hard hats, gloves and eye protection.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: HS Davis 9-10-69
FEATURE 17 Inspection of primary dome and dome penetrations. Tank 101	Inspected by: A Short
REFERENCES: PDM Magnetic Particle Inspection MP-4. PDM Drawings 24, 25 and 26.	Date:
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
OTHER DATA: HWS-7789, Paragrahs 12.3, 12.6, and 14.5	

Requirements	Acceptance Yes	Acceptance No
1. Visually check all welds	OK	
2. Witness magnetic particle testing of welds on all penetrations.	OK	
3. Check for excessive distortions and flat spots.	OK	
4. Ascertain that quantity, size, location and elevation of penetrations are correct.		LATE
5. Ascertain that overall dome shape is within tolerances.		LATE

REMARKS AND/OR SAFETY FEATURES

Caution: Ascertain that dome supports are installed and braced adequately to support dome and personnel.

Danger: Check access ladders and platforms for safe use.
Be very cautious around openings in dome.
Wear hard hats, gloves and eye protection.
Check for tank grounding.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: ES Davis 9-10-69
FEATURE 17	Inspection of primary dome and dome penetrations. Tank 102	Inspected by: A Short
REFERENCES:	PDM Magnetic Particle Inspection MP-4. PDM Drawings 24, 25 and 26.	Date: SEPT. 22, 196
		Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
OTHER DATA:	HWS-7789, Paragrahs 12.3, 12.6, and 14.5	

Requirements	Acceptance Yes	Acceptance No
1. Visually check all welds	OK	
2. Witness magnetic particle testing of welds on all penetrations.	OK	
3. Check for excessive distortions and flat spots.	OK	
4. Ascertain that quantity, size, location and elevation of penetrations are correct.	OK	
5. Ascertain that overall dome shape is within tolerances.	OK	

REMARKS AND/OR SAFETY FEATURES

Caution: Ascertain that dome supports are installed and braced adequately to support dome and personnel.

Danger: Check access ladders and platforms for safe use.
Be very cautious around openings in dome.
Wear hard hats, gloves and eye protection.
Check for tank grounding.

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Rev. 0

VITRO-HES QUALITY ASSURANCE

ROJECT	IAP-614	Prepared by: E. S. Davis 9-22-69
TA[illegible]E	18 - Preparation of primary tank for stress relief - tank 101.	Inspected by: [illegible]
EFERENCES:	PDM erection drawings E-1 thru E-15 PDM stress relieving procedure. Correspondence regarding stress relief. Summary - AY Tank stress relief.	Date: 10-29-69 Distribution: WS Graves CN Zangar [redacted] A. Short QC File (2)
THER DATA:	Specification HWS 7789, Rev. 2, paragraph 14.5 and 15.0. Contract Drawing H-2-64372, Rev. 1.	

	Requirements	Acceptance Yes	No
1.	Install all penetrations 138 . Check location.	1. OK	
2.	Install all attachments, ground angles (4), 1/2" half couplings (2), concrete anchors. ← ARE NOT REQUIRED PER S GRAVES 9-23-69	2. OK (4	INSTALLED)
3.	Complete all radiography, vacuum testing and magnetic particle tests of welds.	3. OK	
4.	Check for tank measurement surveys including attachment of washers for reference points.	4. OK	
5.	Check dome for compliance with curvature guidance dimensions.	5. OK	
6.	Check for proper number, type and condition of thermocouples permanent 36, temporary (12) 96; connections to and proper operation of recording instruments.	6. OK	
7.	Check potential growth clearance (4½") all around tank.	7. OK	
8.	Check temporary dome support strut bolts and turnbuckles for looseness and de-activation.	8. OK	
9.	Check to see if tank annulus and leak detection wells are dry.	9. OK	
10.	Check application of temporary insulation, installation of tank firing devices and servicing facilities, temporary lighting, temporary covers, signs and barricades that may prevent safe and successful stress relief operation.	10. OK	

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection.
Check all scaffolds, ladders, walkways for proper installation prior to personnel use.
Keep safe distance during loading of gas tanks and tank firing devices testing.

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VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614	Prepared by: E. S. Davis 9-22-69
[illegible]URE	18 - Preparation of primary tank for stress relief - tank 102.	Inspected by: Al Short
REFERENCES:	PDM erection drawings E-1 thru E-15 PDM stress relieving procedure. Correspondence regarding stress relief. Summary - AY Tank stress relief.	Date: Oct. 13, 1969 Distribution: WS Graves CN Zangar ← A. Short QC File (2)
OTHER DATA:	Specification HWS 7789, Rev. 2, paragraph 14.5 and 15.0. Contract Drawing H-2-64372, Rev. 1.	

Requirements	Acceptance Yes	Acceptance No
1. Install all penetrations 138. Check location.	OK	
2. Install all attachments, (ground angles (4)), 1/2" half couplings (2), concrete anchors. ← ARE NOT REQUIRED PER S GRAVES 9-23-69	OK	
3. Complete all radiography, vacuum testing and magnetic particle tests of welds.	OK	
4. Check for tank measurement surveys including attachment of washers for reference points.	OK	
5. Check dome for compliance with curvature guidance dimensions.	OK	
6. Check for proper number, type and condition of thermocouples permanent 36, temporary 72; connections to and proper operation of recording instruments.	OK	
7. Check potential growth clearance ($4\frac{1}{2}$") all around tank.	OK	
8. Check temporary dome support strut bolts and turnbuckles for looseness and de-activation.	OK	
9. Check to see if tank annulus and leak detection wells are dry.	OK	
10. Check application of temporary insulation, installation of tank firing devices and servicing facilities, temporary lighting, temporary covers, signs and barricades that may prevent safe and successful stress relief operation.	OK	

REMARKS AND [illegible] SAFETY FEATURES

Wear hard hats, gloves and eye protection.
Check all scaffolds, ladders, walkways for proper installation prior to personnel use.
Keep safe distance during loading of gas tanks and tank firing devices testing.

February 17, 1969

W.S. Graves/E.E. Smith

Max Schulze

AY Tanks IAP-614 -18

On 2/13/69 Jerry Sermersheim called and asked whether he could use A285, Grade C material for the Packing Compression Ring, Drawing H-2-64448, Revision 2, Detail 18, Zone C-10. I told him this would be OK.

On 2/14/69 Sermersheim called to ask if he could use API 5L pipe for the 30" Sch. 10 pipe shown on Drawing H-2-64419, Revision 3, Risers No. 2 and 3, Zone E-2. I told him this would be OK.

Max Schulze

MS:ds

cc: CW Cardwell
G. Kligfield
M. Schulze/File

Zangar/QA File

VITRO-HES QUALITY ASSURANCE

OJECT IAP-614	Prepared by: E. S. Davis 9-23-69
AT 19 -Stress relief of primary steel tank. Tank 101 .	Inspected by: [signature] Short
FERENCES: PDM stress relieving procedure	Date: Nov. 5, 1969
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
HER DATA: Specification HWS 7789, paragraph 15.0	

Requirements	Acceptance Yes	No
1. Verify that ~~108~~ 132 thermocouples are operating and that the temperature of each is read and recorded every 15 minutes.	1. OK	
2. During heating-up period, the maximum temperature differential may not vary more than 200°F between any two areas. Verify.	2. OK	
3. Above 600°F the rate of heating or rate of cooling may not exceed 100°F per hour. Verify.	3. OK	
4. Holding temperature must remain at 1150°F ± 50°F for a period of one hour. Verify. ALL THERMOCOUPLES EXCEEDED 1000°F, AND THAT TEMPERATURE WAS HELD FOR 4 HOURS.	4. SEE NOTE	
5. Observe and/or note comments pertaining to the following:	5.	
a. Signs and barricades	a - OK	
b. Number and apparent purpose of personnel at the immediate site.	b - OK	
c. Any noticeable difficulty with firing mechanism.	c - *	
d. Any noticeable fumes, smoke, fire, or other heat-generated phenomena.	d - OK	
e. Any noticeable movement of insulation.	e - *	
f. Any thermocouple or instrument failure.	f - *	
g. Unusual growth or movement of tank.	g - OK	
* C. SOME DIFFICULTY WAS EXPERIENCED KEEPING #2 BURNER IGNITED PRIOR TO ACTUAL STARTUP. LATER THE PROPANE TANKS FROZE AND REDUCED LINE PRESSURE SO THAT DIFFICULTY WAS EXPERIENCED IN MAINTAINING THE ATTAINED TEMPERATURE.		

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection.
When in the immediate vicinity of the tank, have a standby person observing your actions.
Do not loiter in the immediate area of the tank.

* e. DURING THE STRESS RELIEF CYCLE, TWO INSULATION HOLDING BANDS BROKE AS A RESULT OF THERMAL GROWTH OF THE TANK.

f. SOMEWHAT ERRATIC READINGS WERE OBTAINED FROM A FEW THERMOCOUPLES IN THE KAOLITE. A WIDE RANGE OF TEMPERATURES WAS ALSO EXHIBITED BY THE SAME THERMOCOUPLES.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614	Prepared by: E. S. Davis 9-23-69
TURE 19 -Stress relief of primary steel tank. Tank # 102	Inspected by: [illegible signature]
REFERENCES: PDM stress relieving procedure	Date: 10-2-69
OTHER DATA: Specification HWS 7789, paragraph 15.0	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Verify that 108 thermocouples are operating and that the temperature of each is read and recorded every 15 minutes.	yes. ✱	
2. During heating-up period, the maximum temperature differential may not vary more than 200°F between any two areas. Verify.	yes. ✱	
3. Above 600°F the rate of heating or rate of cooling may not exceed 100°F per hour. Verify.	yes ✱	
Holding temperature must remain at 1150°F ± 50°F for a period of one hour. Verify.	yes ✱	
5. Observe and/or note comments pertaining to the following: a. Signs and barricades b. Number and apparent purpose of personnel at the immediate site. c. Any noticeable difficulty with firing mechanism. d. Any noticeable fumes, smoke, fire, or other heat-generated phenomena. e. Any noticeable movement of insulation. f. Any thermocouple or instrument failure. g. Unusual growth or movement of tank.	✱	

EMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection.
When in the immediate vicinity of the tank, have a standby person observing your actions.
Do not loiter in the immediate area of the tank.

PROJECT

F[illegible]TURE

Requirements	Acceptance Yes	Acceptance No
* 1. The 108th Point (T.E. #27) was not put in service until the 8-4 shift 9-30-69		
* 2. Clearance had been obtained to allow greater tolerance than was originally called out by this Procedure.		
* 3. Same as for #2 above		
* 4. This requirement was modified to accept a wider spread & hold the temperature on the vessel for a longer time. Three hours for this instance.		
* 5. (a) Signs and barricades were minimal		
(b) Number and purpose of personnel at the immediate site was unbelievable at times. On behalf of the extra Vitro-ARHCO & AEC people present from time to time, it could be said that they all were in some way connected or interested to help get the work done.		
(c) Firing equipt. controls were not put through dry runs, in a manner to allow trouble free operation		
(d) OK		
(e) OK		
(f) — Assuring that the hot junction's of the M.G.O. type bottom couples were hard against the tank, was a major cause of concern & probable temperature recording errors. A small air gap, over the short temp rise time caused questionable results. T.C.'s #26 & 27 were held against the skin firmly, at a little higher elevation, but gave steady & predictable answers.		

PROJECT

FI__URE

Requirements	Acceptance Yes	Acceptance No
f. Continued.		

All Recorders Performed very well. Chart Roll alignment Caused a few Spots of malprinting as did bits of foreign material on the Selector Switches.

RPM. Should Keep Ropes &/or other items clear, So Recorder doors Can be opened Properly for Chart or Recorder maintenance.

The Entire Recorder Case assembly would be & Should be out Several feet from the tank wall, to Permit easy access to the back Connections, when checking is required.

(G) OK.

AT 500° ABOVE AMBIENT AT ELEVATION 654.83
TANK EXPANDED N-S 2 5/16", EW 2 7/16"

AT 1150° ABOVE AMBIENT AT ELEVATION 654.83
TANK EXPANDED N-S 7/16", EW 7/8"

CHARTS FROM RECORDER WERE SENT TO PITTSBURG BY CONTRACTOR

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614	Prepared by: E.S. Davis 10-3-69
ITEM 20 Removal of stress relief equipment and temporary insulation. (Tank 101)	Inspected by: [signature]
REFERENCES: PEM Stress Relieving Procedure	Date: Nov. 4-69
OTHER DATA: Specification HWS 7789, paragraph 14.0	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Exercise care to prevent damage to permanent thermocouples and wiring. All wiring is to be returned to the original protective boxes. *	OK	
2. Require that all temporary insulation be removed from the annulus.	OK	
3. See that annulus space is thoroughly cleaned.	OK	
4. Conduct critical examination of the interior of the tank.	OK	
a. Excessive oxidation NONE		
b. Impingement of flame on metal surfaces NONE		
c. Irregularities in tank configuration NONE		
d. Cracks NONE		
5. Witness survey of interior tank dimensions.	OK	
6. Check propane tanks and lines for pressure and/or leakage.	OK	

* THREE THERMOCOUPLES WERE DAMAGED AS A RESULT OF CARELESSNESS. THEY HAVE SINCE BEEN REPAIRED.

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves, and eye protection.
2. Have assurance that air in tank is clean and safe to breath.
3. Check ladders and scaffolding for safe use.
4. Enter tank with care and always in the presence of another person.

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VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614	Prepared by: E.S. Davis 10-3-69
FIGURE 20 Removal of stress relief equipment and temporary insulation. (Tank 103)	Inspected by: [signature] Short
REFERENCES: PEM Stress Relieving Procedure	Date: OCT. 15, 1969
OTHER DATA: Specification HWS 7789, paragraph 14.0	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

Requirements	Acceptance Yes	Acceptance No
1. Exercise care to prevent damage to permanent thermocouples and wiring. All wiring is to be returned to the original protective boxes. *	O/C	
2. Require that all temporary insulation be removed from the annulus.	O/C	
3. See that annulus space is thoroughly cleaned.		✓
4 Conduct critical examination of the interior of the tank.		
a. Excessive oxidation		
b. Impingement of flame on metal surfaces	OK	
c. Irregularities in tank configuration		
d. Cracks		
5. Witness survey of interior tank dimensions. (NOT WITNESSED)	OK	
6. Check propane tanks and lines for pressure and/or leakage.	OK	

* NUMBER 4 THERMOCOUPLE (IN THE TANK FOUNDATION) WAS DESTROYED DURING STRESS RELIEF BY A 110 V WIRE FROM PDM STRESS RELIEF EQUIP. BEING ALLOWED TO SHORT OUT ON THE THERMOCOUPLE SHEATH AND BURNING THROUGH IT.

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hat, gloves, and eye protection.
2. Have assurance that air in tank is clean and safe to breath.
   Check ladders and scaffolding for safe use.
4. Enter tank with care and always in the presence of another person.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614	Prepared by: E. S. Davis 10-
FEATURE 21 Hydrostatic test of primary tank. Tank *101*.	Inspected by: *[signature]*
REFERENCES: PDM Drawing - E2	Date: *Nov. 11-69*
	Distribution: WS Graves; CN Zangar; A. Short; QC File (2)
OTHER DATA: HWS 7789, paragraph 16.0	

Requirements	Acceptance Yes	N
1. See that four vessel penetrations are blanked closed.	*OK*	
2. Fill tank to a depth of 39' ± 1".	*OK*	
3. Coat all accessible welds with blue chalk.	*OK*	
4. Inspect all coated welds for leakage after a holding period of 24 hours.	*OK*	
5. Note any new irregularities in tank configuration.	*OK*	

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, floves, and eye protection.
2. Check scaffolding in annulus before using.
3. Enter annulus only when other personnel are present.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614	Prepared by: E. S. Davis 10-3-69
FEATURE 21 Hydrostatic test of primary tank. Tank 102.	Inspected by: A. Short
REFERENCES: PDM Drawing - E2	Date: Oct. 15, 1969
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
OTHER DATA: HWS 7789, paragraph 16.0	

Requirements	Acceptance Yes	Acceptance No
1. See that four vessel penetrations are blanked closed.	OK	
2. Fill tank to a depth of 39' ± 1". (39' - 10")	OK	
3. Coat all accessible welds with blue chalk.	OK	
4. Inspect all coated welds for leakage after a holding period of 24 hours.	OK	
5. Note any new irregularities in tank configuration. (NONE)	OK	

KAOLITE INSULATING CONCRETE IS SOMEWHAT FRACTURED, PRESUMABLY FROM WEIGHT OF WATER USED IN HYDRO.

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, and eye protection.
2. Check scaffolding in annulus before using.
3. Enter annulus only when other personnel are present.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 Contract AT(45-1)-2124	Prepared by: EB Davis 10-13-69
ATURE 22 Complete erection of secondary shell. Tank 102	Inspected by: [signature] Short
REFERENCES: Procedure for material control; weldor performance qualifications, vendor drawings, mill and material certifications, erection dwgs. HWS-7789, Rev. 2, Par. 6.0, 11.0.	Date: Nov. 10, 1969 Distribution: WS Graves CN Zangar A. Short QC File (2)
OTHER DATA: PDM Welding Procedures 45-3, 46-162. Welding Procedure Specification DB119-197. Dwg 38570, sheets E14, E15, 5D, 15C, 24 Rev. C.	

Requirements	Acceptance Yes	Acceptance No
1. Check mill and material certification and markings	1.	
a. Plate material	a. – OK	
b. Weld rod	b. – OK	
c. Heat numbers on exterior of shell.	c. – OK	
2. Check fabrication for	2.	
a. Joint geometry and spacing	a - OK	
b. Welding procedures	b - OK	
c. Weldor qualifications	c - OK	
d. Handling	d - OK	
e. Excessive distortion	e - OK	
f. Good workmanship practices	f - OK	
g. ~~A039~~ Shell penetrations	g - OK	
h. Location and orientation of anchor clips	h - *	
i. Installation of roof stiffeners	i - *	
j. Installation of flashing strip.	j - *	

* INTERFERENCES BETWEEN ROOF STIFFENER, FLASHING STRIP, AND ANCHOR CLIPS WERE RESOLVED BY NARROWING FLASHING STRIP, AND MODIFYING ANCHOR CLIPS.

REMARKS AND/OR SAFETY FEATURES

Danger - Check access ladders and platforms for safe use.
Wear hard hats, gloves and eye protection.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 AEC-9075

Prepared by: ES Davis 11-5-69

F[illegible]URE (23) Placement of concrete over dome - tank 101 2ND POUR

Inspected by: SEE BELOW

Date: 12-29-69

REFERENCES: Dwgs. H-2-64310, Rev. 0; H-2-64311, Rev. 0; H-2-64312, Rev. 0;
Revised sketch, dated 10-30-69, supplementing Dwg. H-2-64312, Rev. 0.
Specification HWS 7791, Rev. 1
Soule Steel Company drawings E-2, E-3, and E-4; cut sheets 2 thru 6.

Distribution:
WS Graves
CN Zangar
A. Short
QC File (2)

OTHER DATA: ACl 318-66, AWS D12.1

Requirements	Acceptance Yes	Acceptance No
1. Check dome support pads; see that support X-bracing is tightened.	✓	
2. Check dome, existing concrete and reinforcing steel for cleanliness.	SEE NOTE	
3. Check placement of reinforcing steel. 12-16-69	ESD	
a. Size and number of bars	✓	
b. Clearance from ~~formwork and shell and~~ dome steel	✓	
c. Additional reinforcement around penetrations	✓	
d. ~~Min. 40-inch lap in haunch area~~		
e. ~~Continuous butt welding where noted.~~		
4. Check formwork.		
a. Alignment / b. Tie rods and bracing / c. Construction joint. } ONLY SCREEDS REQUIRED	ESD	
5. Check placing of concrete. 12-17-69		
a. High early strength 3000# concrete with type III cement (3/4" - AGGREGATE)	ES Davis	
b. Slump of concrete - 2 to 4 inches	✓	
c. Temperature conditions for cold weather WATER HEATED	✓	
d. Free drop - not more than five feet	✓	
e. ~~Rate of placement - 2'/hr for first 5'-6"; 1'/hr to constr. joint~~		
f. Vibration	✓	
g. Finish - ~~straight or~~ curved edge to screed	✓	

(continued on page 2)

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection. ✓

Stay clear of concrete handling equipment. ✓

CONCRETE MIX TRUCKS - ONE CRANE HANDLING 1½ YD BUCKET

MANOMETER USED TO MEASURE TANK PRESSURE WAS FILLED WITH 50% ZEREX & 50% WATER - SP. GR. 1.07

PROJECT IAP-614 AEC-9075

FEATURE (23) Placement of concrete over dome Tank 101 2ND POUR 12-17-69

Requirements	Acceptance Yes	Acceptance No
5. h. Curing and protection	SEE NOTE	
i. Sampling concrete for 7, 14, and 28 day tests.	✓	
6. Removal of dome supports after seven days / Removal of center support after 14 days } NOT STARTED		
7. Results of concrete sample test		
a. Seven days — BREAK MADE 12-24-69 — 3710 (40) - 3930 (41) - 4 CYLINDERS		
b. Fourteen days / c. Twenty-eight days } NOT YET		
8. PRESSURE OF 3/4 PSIG WAS MAINTAINED DURING THE CONCRETE PLACEMENT AND FOR THREE DAYS. THEREAFTER	ESD.	

NOTES-

2. REMOVAL OF BULKHEAD FROM PREVIOUS POUR WAS VERY DIFFICULT AND ACTUALLY DELAYED PLACING OF CONCRETE ONE FULL DAY. CLEANUP OF THE CONSTRUCTION JOINT WAS NOT COMPLETED UNTIL ONE HOUR PREVIOUS TO THE FINISH OF CONCRETE PLACEMENT OF THIS POUR.

5.(h) CURING WAS PERFORMED WITH BLANKETS. IN AN ATTEMPT TO AVOID OVERTIME WORKMEN STARTED PROTECTION OF CONCRETE TOO SOON AFTER PLACEMENT LEAVING AN UNUSUAL NUMBER OF FOOTPRINTS IN THE FINISHED SURFACE. THESE FOOTPRINTS WERE FILLED ON 7-23-69. STRUCTURAL DAMAGE TO THE CONCRETE IS NIL. ESD.

RECORD OF POUR-

		Slump	TEMP. OF CONC.	AMBIENT TEMP	TANK PRESSURE (IN.
POUR STARTED @	8:45 AM	2" SLUMP	64°	36°	18 3/4
	10 AM	3"	63°	34°	18 1/2
	11 AM	3"	63°	34°	18 1/4
	12 NOON	3"	64	34°	18
	1 00 PM	3"	64	34°	17 (SHORT PERIOD)
	2 00	3 1/4"	64	34°	17 3/4
	3 00	3"	64	34°	18
	4 00			36°	18 1/2

POUR COMPLETED 3:40 PM TOTAL CU. YDS - 162

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 AEC-9075

Prepared by: ES Davis 11-5-69

FEATURE (23) Placement of concrete over dome - tank 101

Inspected by: SEE BELOW

Date: 12-12-69

REFERENCES: Dwgs. H-2-64310, Rev. 0; H-2-64311, Rev. 0; H-2-64312, Rev. 0;
Revised sketch, dated 10-30-69, supplementing Dwg. H-2-64312, Rev. 0.
Specification HWS 7791, Rev. 1
Soule Steel Company drawings E-2, E-3, and E-4; cut sheets 2 thru 6.

Distribution:
WS Graves
CN Zangar
A. Short
QC File (2)

OTHER DATA: ACI 318-66, AWS D12.1

Requirements	Acceptance Yes	Acceptance No
1. Check dome support pads; see that support X-bracing is tightened. 12-9-69	✓	
2. Check dome, existing concrete and reinforcing steel for cleanliness. 12-1-69	ESD	
3. Check placement of reinforcing steel.	ESD	
a. Size and number of bars b. Clearance from formwork and shell and dome steel c. Additional reinforcement around penetrations d. Min. 40-inch lap in haunch area e. Continuous butt welding where noted. } 12-1-69 THRU 12-11-69		
4. Check formwork.	ESD	
a. Alignment b. Tie rods and bracing c. Construction joint. } 12-8-69 THRU 12-11-69		
5. Check placing of concrete.		
a. High early strength 3000# 3/4" AGGREGATE concrete with type III cement 11-24-69	✓	
b. Slump of concrete - 2 to 4 inches 12-11-69	✓	
c. Temperature conditions for cold weather 12-11-69	✓	
d. Free drop - not more than five feet 12-11-69	✓	
e. Rate of placement - 2'/hr for first 5'-6"; 1'/hr to constr. joint	✓	
f. Vibration ESDavis 12-11-69	✓	
g. Finish - [redacted] curved edge to screed 12-11-69 ESD	✓	

(continued on page 2)

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection.

Stay clear of concrete handling equipment.

PROJECT IAP-614 AEC-9075

FI_URE (23) Placement of concrete over dome Tank 101

Requirements	Acceptance Yes	Acceptance No
5. h. Curing and protection 12-11-69 ESD	✓	
i. Sampling concrete for 7, 14, and 28 day tests. ESD	✓	
6. Removal of dome supports after seven days		
Removal of center support after 14 days		
7. Results of concrete sample test		
a. Seven days		
b. Fourteen days		
c. Twenty-eight days		

NOTE: VESSEL PRESSURISED TO 0.71#/SQ.IN± BY TANK FABRICATOR PRESSURE TO BE MAINTAINED FOR 3 DAYS

PRESSURES RECORDED 12-11-69

9:00 AM	17 3/4"	4:00 PM	19.5"
10:30 AM	20"	5:00 PM	19"
12:00 NOON	18"	6:00 PM	19.5"
2:00 PM	17.5"	7:00 PM	21 1/2"
3:00 PM	18.5"		

CONCRETE PLACED IN 10 LIFTS - TOTAL YARDS 306

8:30 AM - GROUT (SNOW & ICE COVERED UPPER PORTIONS OF STEEL. ALL MELTED PRIOR TO PLACEMENT OF CONCRETE)

9:10 AM	1ST LIFT	2' DEEP	SLUMP 4 1/2"	TEMP AMB 33°	CONCRETE TEMP 56°
10:10 AM	2ND LIFT	2' DEEP	2 1/2"	34°	63°
11:10 AM	3RD LIFT	2'	3"	35°	64°
12:30 PM	4TH LIFT	1'	3"	37°	64°
1:30 PM	5TH LIFT	1'	3"	38°	64°
2:30 PM	6TH LIFT	1'	3"	38°	64°
3:30 PM	7TH LIFT	1'	3"	37°	62°
4:30 PM	8TH LIFT	1'	3"	38°	64°
6:00 PM	9TH LIFT	1'	2 1/2"	38°	64°
7:15 PM	10TH LIFT	1'-6"	2 1/2"	39°	64°

CONCRETE PLACEMENT COMPLETED @ 8:40 PM
PROTECTION OF CONCRETE COMPLETED @ 9:40 PM USING BLANKETS & VISQUEEN PLASTIC OVER THE DOME & VISQUEEN PLASTIC OVER THE FORMED PORTION OF THE POUR.
RAIN SHOWERS DURING PLACEMENT OF LAST TWO LIFTS. E S Davis

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614 AEC-9075	Prepared by: ES Davis 11-5-69
FE..JRE (23) Placement of concrete over dome - tank 102	Inspected by: SEE BELOW
REFERENCES: Dwgs. H-2-64310, Rev. 0; H-2-64311, Rev. 0; H-2-64312, Rev. 0; Revised sketch, dated 10-30-69, supplementing Dwg. H-2-64312, Rev. 0. Specification HWS 7791, Rev. 1 Soule Steel Company drawings E-2, E-3, and E-4; cut sheets 2 thru 6.	Date: 12-2-69 Distribution: WS Graves CN Zangar ✓ A. Short QC File (2)
OTHER DATA: AC1 318-66, AWS D12.1	

Requirements	Acceptance Yes	Acceptance No
1. Check dome support pads; see that support X-bracing is tightened. 11-24-69 A. Short		
2. Check dome, existing concrete and reinforcing steel for cleanliness. 11-14-69 ESD	✓	
3. Check placement of reinforcing steel.		
a. Size and number of bars		
b. Clearance from formwork and shell and dome steel 11-25-69 ESD		
c. Additional reinforcement around penetrations 11-22-69 A. Short	✓	
d. Min. 40-inch lap in haunch area 11-20-69 ESD		
e. Continuous butt welding where noted. 11-25-69 A. Short		
4. Check formwork.		
a. Alignment 11-25-69 ESD		
b. Tie rods and bracing 11-24-69 ESD	✓	
c. Construction joint. 11-24-69 ESD		
5. Check placing of concrete.		
a. High early strength 3000# concrete (3/4" AGGREGATE) with type III cement 11-24-69	✓	
b. Slump of concrete - 2 to 4 inches 11-25-69 ESD	✓	
c. Temperature conditions for cold weather 11-25-69	✓	
d. Free drop - not more than five feet - 5½ FEET - 11-25-69	✓	
e. Rate of placement - 2'/hr for first 5'-6"; 1'/hr to constr. joint	✓	
f. Vibration ESD	✓	
g. Finish - ~~straight~~ or curved edge to screed ESD 11-25-69	✓	

(continued on page 2)

REMARKS AND/OR SAFETY FEATURES

Wear hard hats, gloves and eye protection.

Stay clear of concrete handling equipment.

PROJECT IAP-614 AEC-9075

FEATURE (23) Placement of concrete over dome Tank

Requirements	Acceptance Yes	Acceptance No
5. h. Curing and protection *11-25-69 ESD*	✓	
i. Sampling concrete for 7, 14, and 28 day tests. *ESD*	✓	
6. Removal of dome supports after seven days		
Removal of center support after 14 days		
7. Results of concrete sample test		
a. Seven days *3 1/4 DAY BREAK 3800#*		
b. Fourteen days		
c. Twenty-eight days		

NOTES- VESSEL PRESSURIZED TO 0.71#/SQ.IN.± BY TANK FABRICATOR - RESULTS AS READ ON MANOMETER USING 50% WATER - 50% ZEREX

11-25-69

5:00 PM - 17"	9:30 PM - 19¼"
5:30 PM - 19"	10:00 AM - 18¾"
6:55 PM - 19½"	11:00 AM - 19"
7:00 PM - 18½"	12:00 M - 19½"
8:30 PM - 18¼"	

PRESSURE MAINTAINED FOR 3 DAYS TILL 7:30 PM 11-28-69

CONCRETE WAS PLACED IN 10 LIFTS AS FOLLOWS:

BEGINNING @ ELEV. 651.36 —

8:30 AM - GROUT

Time	Lift	Depth	Slump	Temp ambient	Concrete temp
9:00 AM -	1ST LIFT -	2' DEEP -	SLUMP 2" -	TEMP AMBIENT 30° -	CONCRETE TEMP 62°
10:45 AM -	2ND "	2' -	4½"	32° -	62°
11:35 AM -	3RD " (NOTE - 3RD LIFT POURED 1'-0 TOO HIGH)	2' -	3½"	34°	
12:35 PM -	4th "	1' (MAX)	3¼"	36°	COMPLETE LIFT @ 1:00 PM
1:25 PM -	5th "	1' (MAX)	3¼"	38°	
2:15 PM -	6th LIFT	1' (MAX)	3½"		
3:10 PM -	7th LIFT	1' (MAX)	3¼"	38°	
4:10 PM -	8th LIFT		3¼"	36°	(1ST COURSE ABOVE GRADE STEP)
5:35 PM -	9th LIFT		3¼"	32°	
6:45 PM -	10th LIFT		3¼"	30°	62°

PROJECT

FI[illegible]URE

Requirements	Acceptance Yes	Acceptance No
CONTINUED CONCRETE PLACEMENT WAS COMPLETED @ 7:40 PM (TOTAL 318 YARDS) PROTECTION OF CONCRETE WAS COMPLETED @ 8:15 PM USING BLANKETS OVER THE DOME AND VISQUEEN PLASTIC OVER THE FORMED PORTION OF CONCRETE POUR. AMBIENT TEMP. 12 MIDNIGHT 30° - TEMP. OF AIR SPACE BETWEEN CONCRETE & BLANKET PROTECTION - 58° F. 12-1-69 COMPLETION OF CONCRETE POUR OVER DOME POUR STARTED @ 9:25 AM - AMBIENT TEMP 31° - TEMP. CONCRETE 65°. PRESSURE IN TANK 0#. SLUMP 3". JOINT DAMPENED WITH WATER. 10:00 AM PRESSURE IN TANK 9 3/4" 10:30 AM 19 3/4" 12:00 NOON 20 1/4" 1:00 PM 19" 2:00 PM 17 1/2" 3:00 PM 20 3/4" CONCRETE SAMPLES TAKEN @ 9:45 AM 11:00 AM 12:00 NOON 3" SLUMP AMBIENT TEMP 32° 2:40 PM POUR COMPLETED 2:50 PM PROTECTION STARTED @ 3:00 PM COVERED WITH BLANKETS TEMP. OF AIR SPACE BETWEEN CONCRETE & BLANKET @ 12:00 MIDNIGHT -		

VITRO-HES QUALITY ASSURANCE

ROJECT	IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 3/27/69
EATURE	6 - Correction of secondary tank bottom to flatness tolerance TANK 101	Inspected by: E. S. DAVIS
EFERENCES:	Specification HWS 7789, Paragraph 14.3, Bottoms	Date: SEE BELOW
		Distribution: WS Graves, CN Zangar, A. Short, QC File (2)

THER DATA: ELEVATIONS ARE CHARTED ON DRAWING PREPARED BY VITRO/HES SURVEY CREW. DWG IS ADAPTED FROM PDM DWG QC 4

Requirements	Acceptance Yes	No
1. **Flatness:**		
a. Peak-to-valley not to exceed 2".		
b. One peak-to-valley tolerance of 3" in 30 sq. ft.		
2. **Distortions:**		
a. Slopes shall not exceed 3/8" per foot.		
SURVEY MADE ON 3-10-69		
1a. SIX PLACES EXCEED 2" TOLERANCE		
b. ONE PLACE HAS PEAK TO VALLEY TOLERANCE OF 3"		
2. SLOPE EXCEEDS 3/8"/FOOT AS NOTED ON SURVEY.		
ABOVE CONDITIONS ACCEPTED ON 3/11/69	✓	

MARKS AND/OR SAFETY FEATURES

OK - Al Short

1. Wear hard hats, gloves and eye protection.
2. Check access ladders to platforms for safe use.

VITRO-HES QUALITY ASSURANCE

OJECT IAP-614 Contract AT(45-1)-2124	Prepared by: E. S. Davis 3/27/69
AT... 6 - Correction of secondary tank bottom to flatness tolerance TANK 102	Inspected by: E. S. DAVIS
FERENCES: Specification HWS 7789, Paragraph 14.3, Bottoms	Date: SEE BELOW
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
HER DATA: PEAK TO VALLEY ELEVATIONS CHARTED ON PDM DWG QC 6 BY VITRO FIELD SURVEY CREW ON 2-19-69	

Requirements	Acceptance Yes	Acceptance No
1. **Flatness:** a. Peak-to-valley not to exceed 2". b. One peak-to-valley tolerance of 3" in 30 sq. ft. 2. **Distortions:** a. Slopes shall not exceed 3/8" per foot.		
1a. 22 PLACES EXCEEDED 2" PEAK-TO-VALLEY TOLERANCE. 1b. NONE EXCEEDED 3" TOLERANCE. 2a. SLOPE APPROACHED 1" IN SEVERAL LOCATIONS. THESE CONDITIONS ACCEPTED BY VITRO DESIGN REPRESENTATIVES AND ARCHO REPRESENTATIVE		

ARKS AND/OR SAFETY FEATURES

OK - A. Short

1. Wear hard hats, gloves and eye protection.
2. Check access ladders to platforms for safe use.

VITRO-HES QUALITY ASSURANCE

OJECT IAP-614 Contract AT(45-1)-2124

ATU 10 (4) Inspection (Radiography-Magnetic Particle) and Repair Bottom Primary Tank

Prepared by: E. S. Davis 4/14/69

Inspected by: [signature] Short

Date: MAY 9, 1969

FERENCES: FDM radiographic inspection procedure RP-1. TK 102
Magnetic particle inspection MP-4.
Drawing 38570 QC- 228, Drawing 38570 MT- 9 & 10
HWS 7789, Rev. 2, Section 12.0 weld inspection.

Distribution:
WB Graves
CN Zangar
A. Short
QC File (2)

THER DATA:

Radiation signs.

Requirements	Acceptance Yes	Acceptance No
1. Radiograph all weld seams in bottom, knuckle plates and those adjoining first shell course.	OK	
2. Check for -		
a. Film and x-ray quality.	OK	
b. Proper interpretation and marking of film. SEE NOTE 1	OK	
c. Recording of defects.	OK	
3. Repair all defective welds.		
a. Visually check all welds prior to repair. b. Ascertain that repair procedure is acceptable. c. Check and record x-ray film of repairs.	OK	
4. Visually witness all mag-particle testing.		
a. Continually check testing equipment. b. Record position and location of tests. (PDM RECORDS) c. Ascertain that all areas are repaired satisfactorily.	OK	
5. Visually check all areas top and bottom for objectionable defects.	OK	

NOTE 1- OF 343 REJECTABLE DEFECTS FOUND IN THIS BOTTOM, THE CONAM RADIOGRAPHER FOUND ON 294, THE REASON APPEARS TO BE THE FLUORESCENT BULB TYPE VIEWER HE USES DOES NOT SEEM TO PROVIDE SUFFICIENT ILLUMINATION.

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check cribbing, tank grounding.
3. Maintain safe distance to prevent x-ray exposure.
4. Check scaffolding, brackets, ladders for safe access.

VITRO-HES QUALITY ASSURANCE

PROJECT IAP-614	Prepared by: E. S. Davis 10-3-69
FEATURE 21 Hydrostatic test of primary tank. Tank 102.	Inspected by: A. Short
REFERENCES: PDM Drawing - E2	Date: Oct. 15, 1969
	Distribution: WS Graves, CN Zangar, A. Short, QC File (2)
OTHER DATA: HWS 7789, paragraph 16.0	

Requirements	Acceptance Yes	Acceptance No
1. See that four vessel penetrations are blanked closed.	OK	
2. Fill tank to a depth of 39' ± 1". (39'-10")	OK	
3. Coat all accessible welds with blue chalk.	OK	
4. Inspect all coated welds for leakage after a holding period of 24 hours.	OK	
5. Note any new irregularities in tank configuration. (NONE)	OK	

KAOLITE INSULATING CONCRETE IS SOMEWHAT FRACTURED, PRESUMABLY FROM WEIGHT OF WATER USED IN HYDRO.

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves, and eye protection.
2. Check scaffolding in annulus before using.
3. Enter annulus only when other personnel are present.

VITRO-HES QUALITY ASSURANCE

PROJECT	IAP-614 - Contract AT(45-1)-2124	Prepared by: E. S. Davis
FEATURE	-8- Insulation in Bottom of Tanks. Tank 102.	Inspected by: SEE BELOW
REFERENCES:	PDM Drawing 38570-4 and 38570-9. PDM submittal, Willard Smith, dated 2-12-69. Drawing H-2-64307, Rev. 2. Specification HWS-7789, Paragraph 9.0.	Date:
OTHER DATA:	Battelle - Evaluation of Kaolite-2200.	Distribution: WS Graves CN Zangar A. Short QC File

Requirements	Acceptance Yes	Acceptance No
1. Review feature No. 7 as a check on embedded materials.	✓	
2. Conditions of environs pertaining to:	✓	
a. Protection of tank bottom and materials. ENTIRE WORK COVERED BY TARPAULIN		
b. Temperature (60-70°)(steel 50°+). TEMPERATURE RECORDED DAILY - RANGE 42° TO 78° INSIDE TARPAULIN		
3. Formwork:		
a. Maintain minimum 1" under pipe and 2½" over pipe thickness of insulation at the four 4-inch vent pipes. All other places - minimum of 5" thick insulation. AVE THICKNESS ESTIMATED MINIMUM 7".	✓	
b. Joints - configuration and treatment to maintain strength and thermal characteristics.	✓	
c. Screeds and blockouts - air trenches and straingages.	✓	
4. Placement:		
a. Mixing - 78 qts./water/6-40# bags (3 to 5 minutes). 15¼ TO 16 GAL/BATCH AVERAGE 15½ GAL	✓	
b. Each batch placed within 20 minutes - vibrator. AVERAGE 7 MINUTES		
c. Obtain samples - one each 10 batches or minimum of five each day. 4 SAMPLES PER SECTION WERE OBTAINED	✓	

(continued on sheet 2)

REMARKS AND/OR SAFETY FEATURES

1. Wear hard hats, gloves and eye protection.
2. Check air inside tank enclosure for poisonous gases.
3. Wear air filter when near batch mixing operation.
4. Exercise care entering and exiting tank.

R CLOUD
E S Davis

VITRO-HES QUALITY ASSURANCE

sheet 2

PROJECT IAP-614 - Contract AT(45-1)-2124

FE. JRE -8- Insulation in bottom of tanks. Tank 102.

Requirements	Acceptance Yes	Acceptance No
(continued from sheet 1)		
5. Curing:	✓	
a. Covered with moist burlap for twenty-four hours - then air dried for ninety-six hours. AIR DRIED TILL TEST INDICATE 200 PSI - USUALLY WITHIN 72 HOURS		
b. Tests - shall not be less than 200 psi (wet or dry).	✓	
3 day · 4 day · 5 day · 6 day · 7 day		
Batch #1		
Batch #2		
Batch #3		
Batch #4		
Batch #5		
Batch #6		
Batch #7		
Batch #8		
Batch #9		
SERIES OF TEST RESULTS ON FILE. SAMPLE RESULT ATTACHED.		
6. Repairs - give nature and description of repair.	✓	

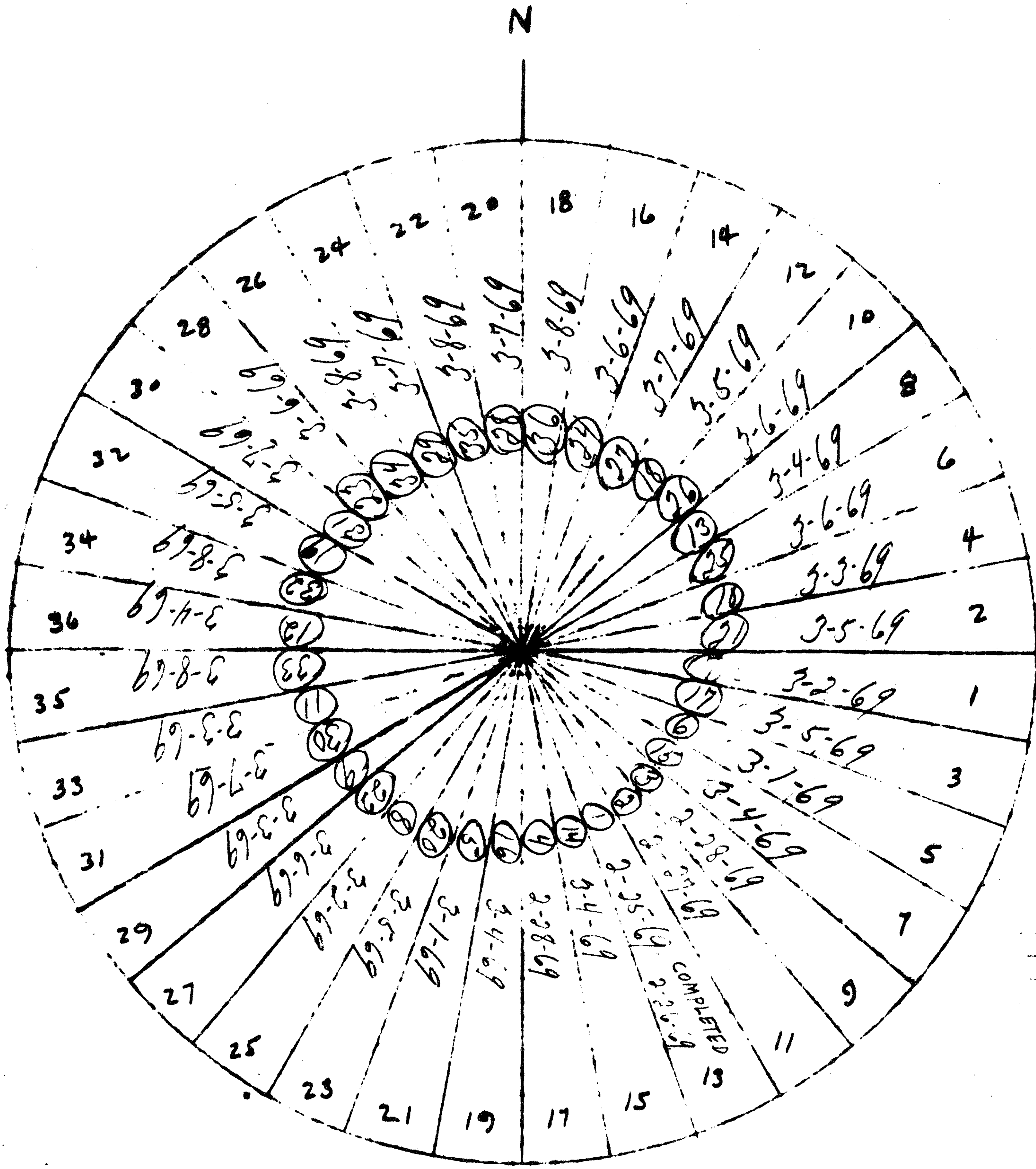
(a) - SURFACE CRACKS - 1 TO 2 INCHES DEEP ACROSS TWO SECTIONS - TOTAL APPROX 7' LONG. CRACKS WERE DUG OUT & NEW MATERIAL INSTALLED.
CRACKS OCCURRED AS RESULT OF FLEXING OF PLATE BENEATH.

(b) SURFACE UNEVEN AND TOO HIGH - A 25' SEGMENT IN S.E CORNER WAS 1/4" TO 3/8" TOO HIGH. FINAL ELEVATIONS • NOTED ON PDM DWG #10

R. CLOUD
Ed Dai

KAOLITE BREAKS - 3-11-69

DATE MADE	AGE	P.S.I.	SECTION	
3-4-69	7	715	#7	
"	7	715	19	
"	7	880	15	
"	7	655	8	
"	7	350	36	
" (CYLINDER)	7	442	36	WT. CU. FT = 68.56#
3-8-69	3	470	26	
"	3	465	34	
"	3	520	22	
"	3	415	18	



TANK 102
KAOLITE INSULATION

1.14 Kligfield, G., 1969, "AY Tank Farm Welding," (Letter to B. Kirz, June 10), Vitro Hanford Engineering Services, Richland, Washington.

HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

TO Ben Kirz

FROM G. Kligfield

DATE June 10, 1969

SUBJECT AY Tank Farm Welding

JOB NO. TAP-614 (2-1)

In the past few weeks I have met with our Title III people and the contractor (Hugo Stein) to discuss the incidents of repair on the Welding of the primary tanks. We were led to believe that once we got into the heavier walls (the primary tank) we would not be experiencing as many rejectable welds as we had previously. The net results of the welding on the bottoms for tanks 101 and 102 are generally good in terms of flatness but in tank 102 there was a fit-up problem and one of the seams had to be repaired several times to meet our rigid specifications. The remaining part of the tank bottom was in pretty good condition. There were more weld repairs than I would have liked. In tank 101 we feel that the welding has been decidedly improved; whether this is a case of more inspection or better welders is a matter of contention. There has been a continuous pro and con on the merits of the automatic welding, and really today I can't say which is giving us the better results. We know that the automatic welding on the secondary tank horizontal welds went along beautifully. There is a feeling that the machine with proper adjustment and operation should do the same thing on the primary tank. Hugo Stein wants to get the machine into an operating condition and prove to us that good welds--looks and integrity--can be made and will be made with this machine. We think that the machine needs close supervision and care when out of use as well as while welding.

In the past week I have had lengthy meetings with our people and PDM people, and find each trying to do a good job. A better understanding between our inspector and Hugo Stein is what is needed. In my meetings Friday we sat across the table and reviewed each item of controversy and hope we have reached agreements whereby our inspector Al Short is the Commission representative and, in a dispute, his decisions are final. Hugo Stein understands this and will work on this basis; he still believes that in

HES 8 (8-67) AEC-RL RICHLAND, WASH.

several areas where we indicated a possible rejection when the weld would be completed that he would be able to prove to us that the welds would be in good order. We have left this up to him; we have stressed that repair incidents should be reduced and we all agreed that had the automatic welder been in better working condition the present disputes might not exist. The PDM specialist on the automatic welder will be in next week and make adjustments so the automatic welder can be put back in operation with confidence; in the mean time we have authorized the use of manual welding so that the job will not be held up.

After our across-table meeting we went down into the tank to examine several of the weld areas that were under discussion and asked Mr. Wormley, ARHCO, Metallurgist, to join us for his opinion. I would say that he backed up our concern; that is, indications that we may have a problem in reading x-rays with several of the welds with too great a notch between passes (code allows rejection if x-ray shows possible masking of defects). Again Hugo Stein stressed the fact that these were good welds, and he is sure that there would be a definition such that the x-rays could be read and he felt that the final welds would be acceptable, but he said that he would have to concede to our final decision.

I feel strongly that we have taken the right action, on-site, with the people involved and see no need calling in Mr. Kinghorn at this time, although I did feel that Mr. Bach, who has been working closely with Hugo Stein and has been a good catalyst in this controversial period, should stay on the job until we get the welding with the machine on a good solid basis. I have called Bob Wendlandt at Seattle and have expalined that it would be most inopportune to pull Bach off the job at this time, and to see if he could arrange to have him stay on for another few weeks. I will keep close touch with the job and keep you advised on progress.

Original Signed By
GEORGE KLIGFIELD

G. Kligfield

GK/js

cc: G Knoeber
H Eager (2)
CW Cardwell (2)
H. Stein (2)
B Armstrong/J Wormley
WS Graves
M Schulze

1.15 Lien, D. G., 1967, "Computer Study of AY Tank," (Trip Report to Chicago, Illinois, November 27), Vitro Hanford Engineering Services, Richland, Washington.

November 27, 1967

W. S. Graves
M. H. Piskadlo

D. G. Lien

TRIP REPORT - COMPUTER STUDY OF AY TANK

On November 15, a meeting was held with Professor K. Milbradt, Illinois Institute of Technology; P. Hatch and W. Armstrong, Atlantic Richfield; C. Compton, AEC-RL; and the author at the Illinois Institute of Technology, Chicago, Illinois. The following are the main points of the meeting:

1. The primary steel tank will be analyzed by the computer to determine minimum plate thickness, bottom knuckle radius, and top expansion joint shape. This information will be available to us December 4, 1967.

2. The elliptical dome geometry will be set by Illinois Institute of Technology using a 15'0" minor axis.

3. The steel dome of the primary tank will be supported by the concrete dome through Nelson type weld anchors, expansion anchors are not required.

4. Stiffen primary tank bottom at center air plenum. Allow 1/8" clearance at air plenum between tank bottom stiffner and embedded steel ring.

5. Compacted backfill is not required around tanks. It is too expensive for the benefit it provides.

6. Computerized earthquake analysis of buried tank problem is approximately one year away.

7. A circumferential expansion joint in the base slab separating wall footing from slab may be more advantageous and less costly than sliding joint between wall and base slab. Both will be investigated by computer.

8. A crushable load bearing material should be provided between outer liner and concrete wall at bottom knuckle to provide for expansion. No reduction is to be made in 15" concrete wall at this point. This material should extend approximately 3' up wall.

TO: W. S. Graves
M. H. Piskadlo

November 27, 1967
Page 2

9. Mr. Hatch informed us that hydrogen build-up in annular space would be negligible and should not be considered in design.

10. If the secondary liner is used as a concrete form at base of dome in annulus area, it should not be fastened to primary tank. There should be a free joint at this junction.

11. Kaolite 20 and insulating concrete in general was discussed. Professor Milbradt contacted Mel Averies of Portland Cement Association, Chicago. It was Mr. Averies' opinion that any insulating concrete that was to be exposed to high temperatures such as stress relieving would produce should receive special handling. Care should be taken to ensure that one surface was free and that all moisture was driven off before stress relieving.

D. G. LIEN

DGL:hw

cc: G. Kligfield/C. A. Sursaw
DGL/File

1.16 Lien, D. G., 1969, "241-AY Tank 102- Insulating Concrete IAP-614," (Interoffice memorandum to W. S. Graves, November 3), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
DIVISION OF VITRO CORPORATION OF AMERICA

INTER-OFFICE MEMORANDUM

DATE November 3, 1969

TO W. S. Graves (LOCATION OR DEPARTMENT)

FROM D. G. Lien (LOCATION OR DEPARTMENT)

SUBJECT 241-AY TANK 102 - INSULATING CONCRETE
IAP-614

On October 17, 1969, Al Short and I visited the AY Tank Farm site and investigated the insulating concrete in Tank 102. At this time Tank 102 had been stress relieved and filled with water for the hydro test.

Visual examination of the insulating concrete at the base of the primary tank disclosed considerable cracking and spalling of the surface layer around the tank periphery. A couple of cracks were approximately 1/4" wide, several feet deep, and extended the full height of the insulating concrete. The concrete top surface felt spongy to the touch. Many of the air passage slots were partially blocked by spalled concrete.

There was no visual evidence of tank settlement or indication of large unsupported areas around the periphery of the primary tank. The bent plate ring around the insulating concrete was in place except for one break of approximately one inch at a plate splice. There was no indication of concrete spalling beyond the retainer plate.

It is my opinion that the surface cracking and spalling of insulating concrete was a direct result of stresses incurred during thermal stress relief of the primary tank. More specifically, tensile stresses in the periphery of the insulating concrete and stresses produced by skin friction from expansion and contraction of primary tank.

At this time I feel the insulating concrete is adequately supporting the primary tank but feel it would be wise to examine the concrete again after the primary tank hydro test water has been removed.

D G Lien
D. G. LIEN

DGL:hl

cc: M. H. Piskadlo
DGL/File

HES-60 (8-67)

JAN 16 1970

G. B. Pleat, Assistant Director
Reactor Products, Division of Production, HQ

STRESS RELIEVING OF AY TANKS

This responds to your teletype of January 15, 1970, PRC:JWP, and confirms information furnished to J. W. Pollock by phone regarding deviations from specifications which were allowed during stress relieving of AY tanks. The following table describes all such deviations and shows the actual conditions obtained:

	Specification	Modified Specification	Actual Performance	ASME Boiler and Pressure Code Sec. VIII, 1965 ed.
Holding temperature for stress relieving	1150 F. ± 50 F. for 1 hour per inch of thickness	1000 F. min. for 3 hours per inch of thickness	Tank 101* 1080 F. min. for 3.3 hours Tank 102* 1020 F. for 4.2 hours	1100 F. min. for 1 hour per inch of thickness or 1050 F. min. for 2 hours per inch of thickness or 1000 F. min. for 3 hours per inch of thickness
Maximum temperature differential in tank	200 F. between highest and lowest temperature points	Tank 102 220 F. between bottom knuckle and bottom plate	**70 F. between bottom knuckle and bottom plate	250 F. within any 15 foot interval of length

*Maximum plate thickness is 1".
**Distance between high and low temperature thermocouples was 31 feet. (Tank 102).
Maximum temperature differential on Tank 101 - 180°F

Original signed by
H. E. Parker

H. E. Parker
Assistant Manager
for Technical Operations

bcc: E&C Official File
E&C Reading File
Proj. Engr. O. J. Elgert
GWK/File H. E. Parker

CHEM.PROC. ELGERT

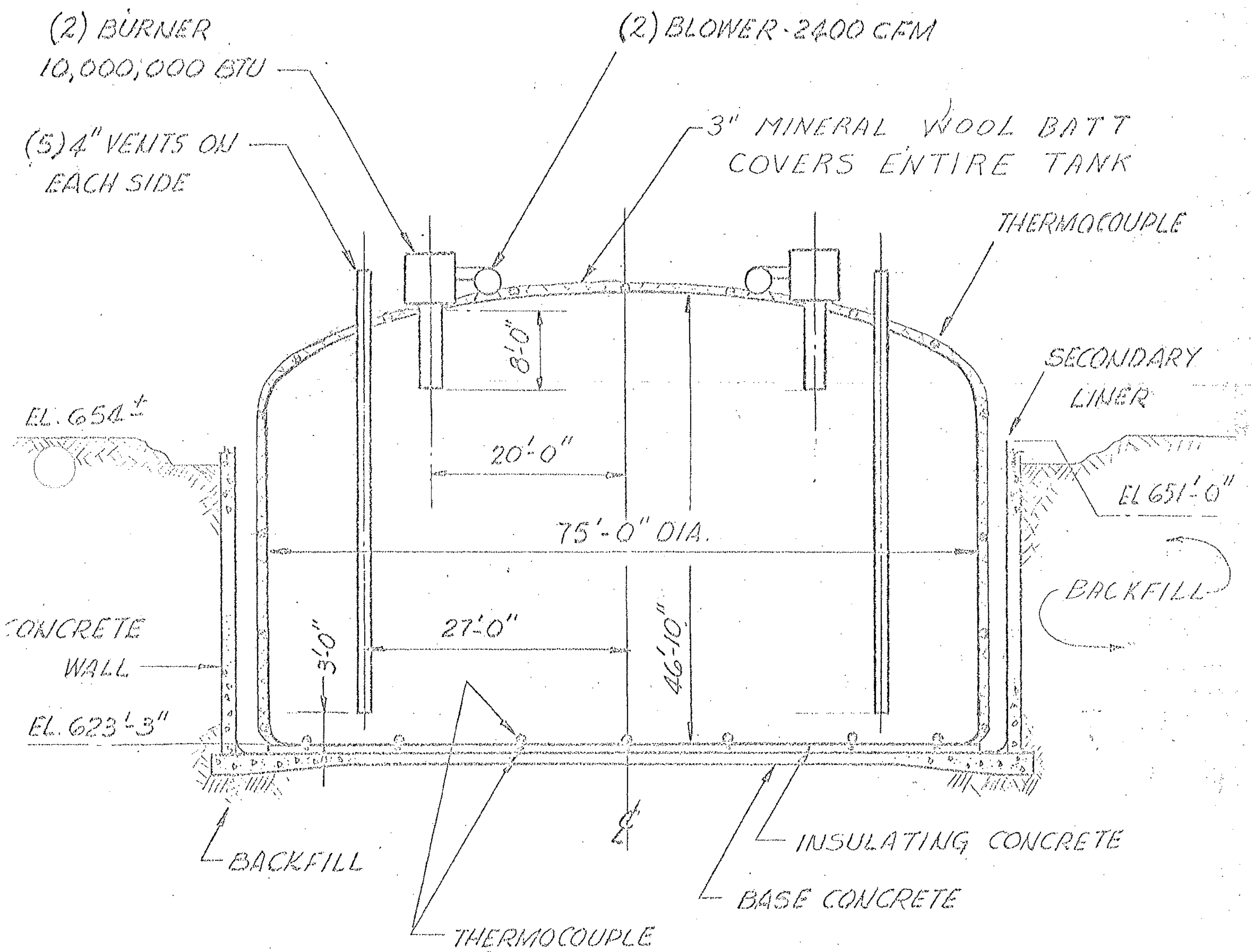
E&C DIV	E&C DIV	C&S DIV	LEGAL	ASST.MGR.TO
SQUIRES:jf	KIRZ			
KNOEBER	KREMA	TUMLINSON	DEGAN	PARKER

1/16/70

ATTACHMENT IV

	SPECIFICATIONS	ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, 1965 EDITION	MODIFIED SPECIFICATION	PERFORMED BY THE CONTRACTOR TK-101	PERFORMED BY THE CONTRACTOR TK-102
SOAKING TEMPERATURE	1150°F ± 50°F PER INCH OF THICKNESS.	1100°F PER HR. PER INCH OF THICKNESS. 1050°F FOR 2 HRS. PER INCH OF THICKNESS. 1000°F FOR 3 HRS. PER INCH OF THICKNESS. 950°F FOR 5 HRS. PER INCH OF THICKNESS.	1000°F MIN. PER HR. PER INCH OF THICKNESS.	1080°F FOR 3.3 HOURS.	1020°F FOR 4.2 HOURS.
MAX. RATE OF TEMPERATURE RISE & REDUCTION BETWEEN 600°F AND 1100°F	100°F PER HR.	400°F PER HOUR.		50°F PER HR.	50°F PER HR.
MAXIMUM TEMP. DIFFERENTIAL IN TANK.	200°F BETWEEN HIGH & LOW FOR ALL PARTS OF THE TANK ABOVE 600°F.	250° WITHIN ANY 15 FT. INTERVAL OF LENGTH.	220°F BETWEEN TOP OF BOTTOM KNUCKLE AND BOTTOM PLATE FOR TK-102.	180°F	70°F

6014



TANK 101

SET UP FOR STRESS RELIEVE

1.17 Lien, D. G., 1970, "Field Trip to AY Tank Farm," (Letter to G. Kligfield, July 10), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
DIVISION OF VITRO CORPORATION OF AMERICA

INTER-OFFICE MEMORANDUM

DATE July 10, 1970

TO George Kligfield (LOCATION OR DEPARTMENT)

FROM D. G. Lien (LOCATION OR DEPARTMENT)

SUBJECT FIELD TRIP TO AY TANK FARM — file

On June 30, 1970 I visited the AY Tank Farm with John Slaughter (AEC), Ray Vollert (ARHCO), and Bob Caldwell (Vitro Field Engineer).

The Phase I repair work was in progress in Tank 102. Approximately two-thirds of the Group 1 perimeter refractory concrete had been removed (reference Drawing H-2-35299, Structure Modifications to Insulating Concrete). From observation during the removal and inspection of the removed refractory concrete I noted the following:

1) In all sections inspected there was solid concrete at the point of primary tank bottom contact with the refractory concrete (tangent point of primary tank knuckle) except for an occasional friable layer, approximately 1/4-inch thick, at surface.

2) Most of the refractory concrete was solid or in large pieces from metal retaining band inward except for surface friable layer.

3) The surface pictures previously taken prior to repair are not representative of the refractory concrete under the tank knuckle.

During the early discussions reference to possible refractory concrete repair work, it was the general opinion that the refractory concrete in Tank 101 was in better condition than that in Tank 102. Similar repair work to Tank 101 was subject to re-evaluation, based on what was encountered in the refractory concrete during the repair work in Tank 102.

In my opinion, based on my observations and inspection of the refractory concrete removed from Tank 102, a re-evaluation of extent of repair work to the refractory concrete is warranted.

One method of re-evaluating Tank 101's refractory concrete would be to select four or five of the worst surface appearing sections and remove a 4 to 6-foot section of refractory concrete back to tank knuckle (tangent point), noting the condition of refractory material. From this information and sample compression tests of the refractory concrete removed, a more educated approach can be made to the repair action required.

HES-60 (8-67)
AEC-RL RICHLAND, WASH.

HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

INTER-OFFICE MEMORANDUM

TO: George Kligfield July 10, 1970

It should also be noted that removing the refractory concrete from under the tank knuckle and replacing it with concrete will have an unknown affect on tank knuckle stresses.

D. G. Lien
D. G. Lien

DGL:vs

cc: W. S. Graves
M. H. Piskadlo
C. A. Sursaw
D. G. Lien/File

HES-59 (12-66)
AEC-RL RICHLAND, WASH

1.18 Schulze, M., 1969a, "AY Tanks IAP-614," (Letter to C. W. Cardwell, February 17), Vitro Hanford Engineering Service, Richland, Washington.

February 17, 1969

C. W. Cardwell

M. Schulze

AY Tanks IAP-614

The following verbal agreements were made on 2-13-69 at 241-AY-Tank site:

1. It will be satisfactory to install insulating Firebrick under the Air Pipes, Drawing H-2-64307, Rev. 2, to attain proper elevation of Air Pipe from Tank Bottom.

2. The Kaolite thickness will be governed by the cross-section as shown on Drawing H-2-64307, Rev. 2. Thus, minimum thickness of Kaolite over any area in Tank Bottom will be 5".

3. Slope of "bubbles" or ripples in Tank Bottom may be 1" per foot rather than 3/8" per foot per Spec. HWS H57789, Sect. 14.3.

4. It will be acceptable to install flat bar stiffeners on top of secondary Tank Bottom as necessary to constrain "bubbles" and prevent cracking or depressions in Kaolite as may be caused by deflection of "bubbles" or ripples. The height of Kaolite over flat bar shall be 5" minimum.

People at the site at the time of discussions:

AEC	PDM	Vitro
HE Eager	Dean Bach	WS Graves
DJ Squires	Hugo Stein	A Short
JO Rodgers	RE Wendlandt	M Schulze
	WF Smith (subcont.)	

M. Schulze

MS:fwk

cc: HE Eager
WS Armstrong
GW Knoeber
WS Graves
EE Smith
G Kligfield
ML Elkins
MS/files

1.19 Schulze, M., 1969b, "Subject IAP-614 PUREX Tank Farm Expansion – Insulating Concrete," (Letter to C. W. Cardwell, February 19), Vitro Hanford Engineering Services, Richland, Washington.

February 19, 1969

C. W. Cardwell

W. S. Graves

IAP-614 Purex Tank Farm Expansion - Insulating Concrete

The data forwarded by Willard Smith, Inc. with letter of 2-10-69 to Pittsburgh-Des Moines Steel Company has been reviewed. The following comments apply:

1. The drawings do not show the angle of the concrete retaining form. We would like to see a slope between 45 and 10 degrees from the vertical to lessen the possibility of a through crack opening up.

2. As long as the secondary tank bottom is not flat, we would prefer a pouring sequence of Pours 1 & 2; 35, 36; 17, 19; 18, 20 (See Willard Smith Drawing CS-266-1) and then followed at contractors option working from any of the above listed pours. We would expect this sequence to minimize the possibility of raised portions of the steel bottoms being moved into unpoured sectors thus compounding the amount of distortion which might be present.

Note that in accordance with drawing H-2-64307 it is P-DM's responsibility to produce an insulating surface level within plus or minus 1/4 inch. We also understand that the Kaolite 2200 LI cannot be used in thin layers for patching depressions which might result as the secondary shell depresses under the concrete loading.

Original Signed By
W. S. Graves

W. S. Graves

WSG:fwk

cc: M Schulze
EE Smith
MH Piskadlo
GK/CAS
WSG/files

1.20 Schulze, M., 1969c, “Stress Relieving of TK 102 Tank on 9-30-69,” (Letter to File, October 6), Vitro Hanford Engineering Services, Richland, Washington.

October 6, 1969

FILE

Max Schulze

IAP-614 - AY Tanks
Stress Relieving of TK 102 Tank on 9-30-69

On Tuesday, 9-30-69, I was called at home by Dave Squires several times between 7:00 and 11:30 p.m. regarding progress and problems during stress relief of Tank 102. After the second call, about 8:30 or 9:00, I tried to call Sarge Graves to see if he wanted to go out to the tanks but could not raise him.

Squires called about 11:30 p.m. to tell me that he and the ARHCO people, Bill Armstrong, Paul Hatch, and Ernie Moore, had had a conference regarding rate-of-rise and time-at-temperature. Hatch was concerned with possible bad effects on Kaolite subjected to a high temperature for any length of time. They had decided to "opt for three hours at 1000 F rather than go for the full 1100 F minimum for one hour. Squires was concerned about possible contractual effects and "making of the precedent, 1969". I examined the alternates. Suppose the rate-of-rise was too slow; should we tell them to shut the whole job down and start from scratch with a different system? This was unacceptable to Hatch as being even worse. [I pointed out that if, indeed, they couldn't reach 1100 F minimum they would be proposing a lower temperature and longer time in accordance with ASME Code. We would be hard put to deny their request only on the basis of "our spec says" in that the spec is written around ASME Code. Also, when the spec was written, discussion about this very problem had taken place and it was decided to keep this option in the hip pocket rather than allow it out in the spec. It may be of interest to note that Savannah River had this option in their spec.] In view of the fact that Squires had tried to call both Kligfield and Graves and could get no response, I told Squires I would get out there right away.

I arrived at the tank farm at about 12:30 a.m. and talked at some length with Squires about the progress and we read the charts. Squires left at about 3:30 a.m. after having recorded the readings every hour.

The rate-of-rise through the midnight to 4:00 a.m. area was 40 F per hour and was the same for thermocouples at all points in the tank. The thermocouples in the tank bottom were performing erratically with the exception of numbers 15, 16, 21, and 23 which were fairly constant and agreed with the two thermocouples fastened to the knuckles. Temperature in the base concrete was 180 F consistently.

I talked with Stein and he was not in favor of the 1000 F for three hours but wanted to stay with the original spec to stay with the 1100 F for one hour. I told him this would be fine if he would hold the 40 F per hour rise and that this would be only 1/2 hour over the new agreement and I could see no problem there.

ATTACHMENT II

During this time the ARHCO people checked at intervals until about 4:00 A.M. when Bill Armstrong came down to stay. At that time we were getting very close to the 1000 F in the bottom with readings of 915, 935, 960 and 1030 F, the knuckle reading being 970 and 980. Dome temperature at that time was in the 1080-1170 range. At 4:30 a.m. we decided that we would accept the bottom as being at 1000 F and started the three hour count at that time although Stein still had the option of going up per the original spec if he could. In the event temperature rise from 4:00 a.m. on was extremely slow and it was obvious that we had peaked out. Thus, while the decision to go for the option of three hours at 1000 F was made for a different reason, it would have had to be made on the basis of the actual performance.

Stein called Tom Gordon at about 6:30 AM to advise him of events and ~~get~~ to get him out by 7:30 AM to start the reduction part of the cycle. He showed up at about 8:00. Herb Eager arrived in the morning and wanted to document all happenings. While I was giving him my account of the peaking-out Tom Gordon interrupted and strenuously objected to any idea that his equipment could not have continued beyond the points reached. He also blamed the original long delay at heat-up of the tank bottom to our thermocouples stating that it was his belief that these thermocouples were lying in water in the Kaolite and were not recording tank bottom temperature. It escapes me how tank bottom temperature could have been over 200° if there was any water in the Kaolite for the thermocouples to lay in.

Upon return to Richland, a meeting was held in Ben Kirz' office with Krema, Kirz, Elkins, Knoeber, Kligfield and Graves. I was asked how I was sure the tank was stress relieved and I stated that minimum temperatures were based on the correlation between the four bottom thermocouples and the ones in the knuckle. Graves stated that ASME Code allowed stress relieving at 100 F less (1000 F) for three hours. Elkins asked about any further reduction and consequent time. A check in the Code book showed that for 50 F more reduction (950 F) five hours at temperature would be required. A quick check of my notes showed that readings from 3:00 a.m. to 8:00 a.m. confirmed that this condition was met also.

Upon completion of the meeting, Kligfield and I talked to John Adams, PDM, Director of Research, and requested that he come out to Hanford as soon as possible to discuss new stress relief procedures for TK-101 and to see the internal support system so that he could better appreciate the problems we anticipate in the removal of the supports. Adams stated that he would be unavailable through the middle of the week of 10/6 and wanted to see the curves for stress relief of TK-102 and talk with Tom Gordon prior to coming out. We later talked to Bob Wendlant, PDM, Bellevue, Washington, to impress him with the urgency of a visit by Adams.

One small item of interest was the near failure of one of the springs on the insulation holding bands. The spring had been located so that it straddled a gap between batts in the insulation and was thus exposed to tank shell temperature. That area of the spring was annealed and quite relaxed. Insulation was stuffed into the crack behind the spring. I pointed this out to Al Short in the morning so that on TK-101 this could be prevented.

MS:ds

1.21 Schulze, M., 1970a, "IAP-614-AY Tanks Kaolite," (Interoffice memorandum to G. Kligfield, June 11), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
DIVISION OF VITRO CORPORATION OF AMERICA

→ S. Graves what did you learn today? MK

INTER-OFFICE MEMORANDUM

DATE June 11, 1970

TO G. Kligfield (LOCATION OR DEPARTMENT)

FROM Max Schulze (LOCATION OR DEPARTMENT)

SUBJECT IAP-614 - AY Tanks Kaolite

I made telephone contacts with Ed Dickson, B&W Refractories, Augusta, Ga., this week with the following of interest:

1. Dickson was the primary contact with duPont, visiting the SR facility and conferring with Ernie Westbrook et al about their insulating concrete problems.

2. Dickson advised that chemical analysis of the RL samples was satisfactory for the product and that chemistries between friable and solid (hard) samples was within hundredths of a percent. Reports will be forwarded to RL. Physical tests on solid samples met specs.

3. In Dickson's opinion, cracking failure at SR was due to the combination of lack of flatness in primary and secondary tank bottoms plus radial growth of primary tank bottoms during stress relief resulting in shear stresses for which the Kaolite is not designed. It can be rationalized that the friable material sheared and crumbled at RL lessening tendency to crack in large lumps.

4. Dickson recommended repair by pouring two foot wide full depth ring in place of present periphery. He strongly rebuffed any thought of less-than-full-depth repairs, whether Kaolite or structural concrete, because of shear stresses.

5. Dickson believes that a redesign of insulating concrete pad is necessary as follows:

   a. Stop pour at knuckle tangent.

   b. Bevel outward for about 2-3 inches.

   c. Pour outer ring beyond this to pick up support of primary bottom during stress relief, if necessary. Pour in 6'-8' segments. This will undoubtedly crack, etc., during stress relief and pieces can then be removed.

Note: This recommendation will be made to Nooter for the new SR tanks.

HES-60 (8-67)
AEC-RL RICHLAND, WASH.

HANFORD ENGINEERING SERVICES
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INTER-OFFICE MEMORANDUM

6. As to friable material, Dickson poses possibility of freezing after placement. I talked to Jim Trumbull, B&W, Seattle, and he suggested that the annuli collected a great deal of water which could have migrated into the concrete and subsequent low temperatures transmitted through the primary tank bottom may have caused freezing of moisture in the top of the Kaolite.

7. Trumbull strongly recommended using a paddle mixer and a different system of pouring.

8. Trumbull and possibly Dickson will be here Monday to look at Kaolite and to engage in discussions as to present and past problems and future design. Trumbull will contact Vollert or Armstrong at ARHCO to make arrangements and Graves or Kligfield to advise what arrangements were made.

Max Schulze /ds

Max Schulze

MS:ds

cc: WS Graves
EF Smith
EE Smith
DG Lien
DJ Squires, AEC
B. Kirz/Knoeber
JH Slaughter
MS/File

AY TANKS

Inspection of Kaolite in TK-101 and Discussions-7/21/70

I INSPECTION OF TANKS

E.J. Dickson and J.L. Trumbull, B&W, and Willard Smith arrived at AY tank site at about 11:15 a.m., put on coveralls and were lowered into TK-101 in company with E.F. Smith, Max Schulze, and Bob Caldwell, V/HES. Some work was going on in the vessel to remove #1 sections of outer ring. Dickson was shown as-is Kaolite with friable surface, cracked Kaolite, and method of removal. Several times during the inspection of the annulus Dickson satisfied himself that there was some bellying-up or oil canning of the secondary bottom. Inspection of TK-101 was continued until noon at which time all parties were taken out of tank to go to 2101M Bldg. for lunch, to be followed by discussions.

II DISCUSSION

Discussions were held in 2101M Bldg. Attendees:

Vitro	AEC	ARHCO	Vendor
W.S. Graves	J.H. Slaughter	W.C. Armstrong	E.J. Dickson - B&W, Augusta, Ga.
E.F. Smith		F.R. Vollert	J.L. Trumbull, B&W, Seattle
D.G. Lien		D.R. Gustavson	Willard Smith, Seattle
M. Schulze			R.J. Wendlandt, PDM, Seattle
A. Short			
E.S. Davis			
B.A. Caldwell			

A. Pads in both TK-101 and 102 have a friable surface at the top which is not homogeneous with the balance of the Kaolite. Friable material has little or no compressive strength and will break up immediately and crumble under impact or compression.

B. The friable layer in TK-102 varies from about 3/4" to 1-3/4" thick whereas in TK-101 it generally varied from 1/4" to 1/2" thick.

TK-102 had one area in particular which contained a soft punky material which had no strength whatever and evidence of one or two other small locations of like material.

C. Possible causes of problems were discussed.

(1) Addition of detergent. As Willard Smith poured the Kaolite with a Refractall Gun he found that it was necessary to add two cups of detergent per 200 lbs. of material per 16 gallons of water, all quantities nominal. The detergent acted as a lubricant for moving the Kaolite thru the hose; the Kaolite would not move without it. Maximum hose length was 100 ft. and 50 psi air pressure was required. Dickson doubted that the detergent could cause any problems unless by migration of alkalies (sodium and potassium). Chemical analyses by B&W on samples submitted covering full depth of material did not indicate any difference. When Dickson was asked whether he knew of any previous experience with the Refractall Gun, he replied that he did not know of any cast jobs being done this way but that dry and wet gunning processes were common. There was a question concerning tendency to segregate during pumping and Dickson agreed theoretically this could be but there was no evidence of this in TK-101 that he could see.

(2) Vibrating - A question was raised concerning vibrating the poured material at SR and Dickson said that it was lightly vibrated there. Heavy vibrating will cause segregation, but again, there is no evidence of this in Tank 101 as segregation would mean that the cement fines would want to float to the top and the result would be a local strengthening of the top at the expense of the bottom. This does not describe the condition in TK-101 or 102. Large air bubbles in samples in Vollert's possession confirms the fact that vibrating was not excessive.

(3) Screeding - Dickson questioned Willard Smith as to method of screeding and was told that a wooden screed was used and screeding was done right over the frame starting at the outside or wide section and moving toward the center. Shirley Davis stated that the average pour lasted 2 hours and 15 minutes and that set-up time was 4 to 5 hours, and that the material was still plastic when forms were pulled.

(4) Curing - Willard Smith described the tent and heaters furnished. He stated that the humidity was about 90%, but admitted that no measurements were taken or records kept on this point. After a pour was finished it would be covered with polyethylene. In some cases the polyethylene was pulled after 8 hours instead of 24 hours and would be off for up to 4 hours while stripping forms. Possibly some polyethylene was not reinstalled. Dickson asked whether the cast surface was wet at all times under the cover and stated that the material should be covered for 24 hours or until hydration is completed. This would require a material temperature of 65° for 24 hours. He stated that dropping material temperature to 50° would increase curing time to 7 days. He asked if there was a possible drying effect from the air flow.

There was some discussion about possible effects of the loss of part of the tent during a wind storm, but this occurred during pouring in TK-101, the tank with the better Kaolite. There was some discussion about temperatures and generally it was observed that the lowest temperatures were encountered during and immediately after pouring in TK-102.

(5) Stress Relief - The stress relief operation was described to Dickson. Particular stress was laid on the amount of steaming in the annulus. Dickson suggested that possibly the moisture was condensing against the secondary tank wall and that we had a recycling effect for some time. Dickson was questioned as to whether the presence of steam could in some way cause the friable surface. He replied that it could not. The question was rephrased with reference to steam possibly causing problems with the binder. Dickson said that it cannot cause problems with the type of binder we have, calcium aluminate. Problems could be caused with a calcium silicate binder.

(6) Binders - A discussion took place around the subject of binders. Kaolite 2000 uses a binder called alumnite which is calcium aluminate with 5% iron. Kaolite 2200LI (low iron) uses a calcium aluminate with a lower iron content. The K 2000 has about twice the strength of the K 2200LI.

SR used K 20 modified to control chlorides. The binder in K 20 Modified as used by SR was High Early Portland Cement (Type III), a calcium silicate. Dickson was questioned as to resistance of K 20, K 2000 and K 2200LI to sulfates. He stated that he would get his laboratory working on this and provide answers as soon as possible. Dickson advised that the coefficient of expansion of Kaolite 2200LI is 3.3×10^{-6}.

The question was raised as to density of the calcium aluminate with reference to the aggregate and the reply was that the calcium aluminate is heavier dry and lighter wet.

(7) Storage - Dickson was asked about sensitivity of material to rain in the dry state and he replied that there is about a 10% strength loss per year during warehousing. High humidity, however, will make the material lump. Willard Smith stated that the material was pumped thru a 1/2" grid. Trumbull stated that B&W now produces the material in shrink pack on pallets in the factory but that it would still be advisable to put a good polyethylene cover over it.

D. Dickson gave his and SR's view as to cause of failure, as follows:

The knuckle forming of the secondary causes a slight reverse curve or oil can in the bottom under the outside few feet of the Kaolite location.

The Kaolite is poured directly on the surface which will support the Kaolite with little or no deflection.

The primary bottom is assembled and it too will have the slight reverse curve, although to a lesser extent than the secondary.

During hydro test the weight causes the secondary bottom to flatten and the tendency toward point. Loading in the primary overstresses the Kaolite in shear thru the reduced section.

The meeting was terminated.

MS:ds

cc: Onsite Attendees
G.Kligfield

1.22 Schulze, M., 1970b, "Inspection of Kaolite in TK-101 and Discussion," (Meeting minutes, July 21), Vitro Hanford Engineering Company, Richland, Washington.

AY TANKS

Inspection of Kaolite in TK-101 and Discussions-7/21/70

I INSPECTION OF TANKS

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II DISCUSSION

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Vitro	AEC	ARHCO	Vendor
W.S. Graves	J.H. Slaughter	W.C. Armstrong	E.J. Dickson - B&W, Augusta, Ga.
E.F. Smith		F.R. Vollert	J.L. Trumbull, B&W, Seattle
D.G. Lien		D.R. Gustavson	Willard Smith, Seattle
M. Schulze			R.J. Wendlandt, PDM, Seattle
A. Short			
E.S. Davis			
B.A. Caldwell			

A. Pads in both TK-101 and 102 have a friable surface at the top which is not homogeneous with the balance of the Kaolite. Friable material has little or no compressive strength and will break up immediately and crumble under impact or compression.

B. The friable layer in TK-102 varies from about 3/4" to 1-3/4" thick whereas in TK-101 it generally varied from 1/4" to 1/2" thick.

TK-102 had one area in particular which contained a soft punky material which had no strength whatever and evidence of one or two other small locations of like material.

C. Possible causes of problems were discussed.

(1) Addition of detergent. As Willard Smith poured the Kaolite with a Refractall Gun he found that it was necessary to add two cups of detergent per 200 lbs. of material per 16 gallons of water, all quantities nominal. The detergent acted as a lubricant for moving the Kaolite thru the hose; the Kaolite would not move without it. Maximum hose length was 100 ft. and 50 psi air pressure was required. Dickson doubted that the detergent could cause any problems unless by migration of alkalies (sodium and potassium). Chemical analyses by B&W on samples submitted covering full depth of material did not indicate any difference. When Dickson was asked whether he knew of any previous experience with the Refractall Gun, he replied that he did not know of any cast jobs being done this way but that dry and wet gunning processes were common. There was a question concerning tendency to segregate during pumping and Dickson agreed theoretically this could be but there was no evidence of this in TK-101 that he could see.

(2) Vibrating - A question was raised concerning vibrating the poured material at SR and Dickson said that it was lightly vibrated there. Heavy vibrating will cause segregation, but again, there is no evidence of this in Tank 101 as segregation would mean that the cement fines would want to float to the top and the result would be a local strengthening of the top at the expense of the bottom. This does not describe the condition in TK-101 or 102. Large air bubbles in samples in Vollert's possession confirms the fact that vibrating was not excessive.

(3) Screeding - Dickson questioned Willard Smith as to method of screeding and was told that a wooden screed was used and screeding was done right over the frame starting at the outside or wide section and moving toward the center. Shirley Davis stated that the average pour lasted 2 hours and 15 minutes and that set-up time was 4 to 5 hours, and that the material was still plastic when forms were pulled.

(4) Curing - Willard Smith described the tent and heaters furnished. He stated that the humidity was about 90%, but admitted that no measurements were taken or records kept on this point. After a pour was finished it would be covered with polyethylene. In some cases the polyethylene was pulled after 8 hours instead of 24 hours and would be off for up to 4 hours while stripping forms. Possibly some polyethylene was not reinstalled. Dickson asked whether the cast surface was wet at all times under the cover and stated that the material should be covered for 24 hours or until hydration is completed. This would require a material temperature of 65° for 24 hours. He stated that dropping material temperature to 50° would increase curing time to 7 days. He asked if there was a possible drying effect from the air flow.

There was some discussion about possible effects of the loss of part of the tent during a wind storm, but this occurred during pouring in TK-101, the tank with the better Kaolite. There was some discussion about temperatures and generally it was observed that the lowest temperatures were encountered during and immediately after pouring in TK-102.

(5) Stress Relief - The stress relief operation was described to Dickson. Particular stress was laid on the amount of steaming in the annulus. Dickson suggested that possibly the moisture was condensing against the secondary tank wall and that we had a recycling effect for some time. Dickson was questioned as to whether the presence of steam could in some way cause the friable surface. He replied that it could not. The question was rephrased with reference to steam possibly causing problems with the binder. Dickson said that it cannot cause problems with the type of binder we have, calcium aluminate. Problems could be caused with a calcium silicate binder.

(6) Binders - A discussion took place around the subject of binders. Kaolite 2000 uses a binder called alumnite which is calcium aluminate with 5% iron. Kaolite 2200LI (low iron) uses a calcium aluminate with a lower iron content. The K 2000 has about twice the strength of the K 2200LI.

SR used K 20 modified to control chlorides. The binder in K 20 Modified as used by SR was High Early Portland Cement (Type III), a calcium silicate. Dickson was questioned as to resistance of K 20, K 2000 and K 2200LI to sulfates. He stated that he would get his laboratory working on this and provide answers as soon as possible. Dickson advised that the coefficient of expansion of Kaolite 2200LI is 3.3×10^{-6}.

The question was raised as to density of the calcium aluminate with reference to the aggregate and the reply was that the calcium aluminate is heavier dry and lighter wet.

(7) Storage - Dickson was asked about sensitivity of material to rain in the dry state and he replied that there is about a 10% strength loss per year during warehousing. High humidity, however, will make the material lump. Willard Smith stated that the material was pumped thru a 1/2" grid. Trumbull stated that B&W now produces the material in shrink pack on pallets in the factory but that it would still be advisable to put a good polyethylene cover over it.

D. Dickson gave his and SR's view as to cause of failure, as follows:

> The knuckle forming of the secondary causes a slight reverse curve or oil can in the bottom under the outside few feet of the Kaolite location.
>
> The Kaolite is poured directly on the surface which will support the Kaolite with little or no deflection.
>
> The primary bottom is assembled and it too will have the slight reverse curve, although to a lesser extent than the secondary.
>
> During hydro test the weight causes the secondary bottom to flatten and the tendency toward point. Loading in the primary overstresses the Kaolite in shear thru the reduced section.

The meeting was terminated.

MS:ds

cc: Onsite Attendees
G.Kligfield

1.23 Short, A., 1969, "Nick DeStefano Visit to 241-AY Tank Farm – Project IAP-614," (Letter to C. W. Cardwell, June 18), Vitro Hanford Engineering Services, Richland, Washington.

Vitro HANFORD ENGINEERING SERVICES
DIVISION OF VITRO CORPORATION OF AMERICA

INTER-OFFICE MEMORANDUM

DATE June 18, 1969

TO C. W. Cardwell (LOCATION OR DEPARTMENT)

FROM Al Short (LOCATION OR DEPARTMENT)

SUBJECT Nick DeStefano Visit to 241-AY Tank Farm - Project IAP-614

Mr. Nick DeStefano, PDM Quality Control Supervisor for the Western Division, was on site on Monday and Tuesday, June 16 and 17. On Tuesday morning he accompanied Bill Torrance, PDM Field Engineer on site, when Bill brought the previous night's radiographs to my office for my review. Mr. Sarge Graves was also in my office that morning. I wanted Sarge to see a radiograph that exhibited a classic example of the masking effect that irregular weld surface configuration causes so I asked Bill Torrance to bring XR-35 of the BA-2 joint in Tk-102 primary to my office for additional review. The film covers three feet of weld about which there has been a substantial amount of contention with Hugo Stein regarding repairs to bring the weld crown into conformance with the ASME Sec. VIII radiography code.

Stein had welded two weld beads around the inside of the Tk-102 primary BA-2 joint. The PDM submerged-arc "3-o'clock" welder was not functioning properly, and the surface configuration of the "Two-pass" weld was not in conformance to ASME. The lower weld pass in some places was below the plane surface of the adjoining plate. The upper weld had an excessive crown that drooped in some places, and in many places exhibited classic characteristics that are known to cause images on the radiograph that would mask internal weld defect images. In other places the fusion line between the upper and lower weld beads was below the surface of the plate. When at Stein's request, I started marking the weld surface for repair, Stein complained about my being too critical. I explained that many of the places that I had marked were unacceptable because of the above-mentioned reasons. His reply was that he and I both knew how the radiograph would appear as a result of the irregular surface configurations, but that it was a "good" weld and he should not have to make any repairs. (See my log - Tuesday, June 3, 1969.) Stein has remained adamant about the weld since then, even thoug it has since been repaired.

Therefore, the first film that was reviewed in my office yesterday (Tuesday, June 17) was the XR-35. Two feet of the film had been found unacceptable because the fusion line between the upper and lower weld passes was so much closer to the plane surface of the adjoining plates than the crowns of the two weld beads. The resulting image on the radiograph could very easily be mistaken for lack of penetration with slag inclusions, or it could completely mask other defects.

HES-60 (8-67)
AEC-RL RICHLAND, WASH.

HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

INTER-OFFICE MEMORANDUM

When Nick DeStefano looked at the radiograph on the viewer in my office, he agreed that that section of the radiograph was completely unacceptable. I explained briefly that the radiograph represented an example of the weld condition about which Stein and I had disagreed. He told me that he would "get Stein straightened out on that."

The remaining radiographs that I reviewed while Nick was present were of the eight vertical joints in the 1/2" SR-2 shell course of Tk-102 primary, a total of eighty feet of film. In my review I found five areas of unacceptable weld that had been accepted by the Conam radiograph interpreter. Each time I called Nick's attention to the defect and solicited comments from him. He was completely surprized that the Conam interpreter was missing the defects. When he asked what type of radiograph viewer Conam had at the site, I told him that it was a "Campco", using fluorescent bulbs for illumination. He was surprized that a radiography company would utilize that type of viewer on a job of this kind. Nick promised to contact the Portland supervisor of Conam and insist that he provide a high intensity viewer for this job as expeditiously as possible.

Nick seemed quite surprized with several factors that he observed on site. One was Stein's intransigence in relation to repairing an obviously unacceptable weld. Another was the viewing equipment used by Conam, and their obviously rough handling of radiographic film prior to and/or during development. However, at no time did Nick complain or indicate any degree of dissent or disagreement with my interpretation of radiographs.

Al Short
Al Short

AS:ms

cc: A. Short
FE Proj. File

HES-59 (12-66)
AEC-RL RICHLAND, WASH.

1.24 WSI, 1970, “PUREX Waste Storage Facility 241-AY Refractory,” (Letter to J. Slaughter and B. Kirz, September 25), William Smith Inc., Seattle, Washington.

JS/ JLS
BK Ha 5 Bee
MT

WILLARD SMITH, INC.
ENGINEERS-CONSTRUCTORS
OF
REFRACTORY, INSULATED AND ACID PROOF STRUCTURES
3155 ELLIOTT AVENUE • SEATTLE, WASHINGTON 98121 • AT 4-4435

September 25, 1970

United States Atomic Energy Commission
P. O. Box 550
Richland, Washington, 99352

Attention: Mr. Ben Kirz
Mr. John Slaughter

Subject: Purex Waste Storage Facility 241-AY
Refractory

Gentlemen:

Subsequent to our July 21, 1970, meeting at Hanford to inspect and discuss Kaolite 2200 LI in Tank 101, we ran some tests on pieces of Kaolite 2200 LI removed from the perimeter of the two Tanks 101 and 102.

Three inch thick cut pieces approximately 10" x 10" were saturated with water and then frozen at approximately 10°F; then heated to 500°F to remove all water. Some pieces were wet only approximately 1/4" deep and 3/4" deep.

After this treatment, pieces of each type were cut into following shapes and subjected to a constant 2,000# load applied to steel plates on top and bottom of samples; horizontal force was applied to top plate to note effects.

A. 1/4" Surface Wetted Samples

Sample #	Sample Size	Compressive Load
1.	3" x 3" x 3" thick	222#/in.^{2}
	held up under vertical load, failed upon excessive horizontal loading	
2.	3" x 4" x 3" thick	167#/in.^{2}
	same as Sample #1	
3.	3" x 6" x 3" thick	111#/in.^{2}
	same as Sample #1	

Conclusion: Vertical load capability above 222#/in^2; horizontal load failure skimming inconclusive.

B. 3/4" Surface Wetted Samples

1.	3" x 3" x 3" thick	222#/in.^{2}
	held up under vertical load, failed upon horizontal loading substantially less than under "A" above.	
2.	3" x 4" x 3" thick	167#/in.^{2}
	same	
3.	3" x 6" x 3" thick	111#/in.^{2}
	same	

Conclusion: same as "A".

C. Completely wetted samples

1.	3" x 3" x 3" thick	222#/in.^{2}
	crushed under vertical load only.	
2.	3" x 4" x 3" thick	167#/in.^{2}
	crushed under vertical load only.	
3.	3" x 6" x 3" thick	111#/in.^{2}
	held up under vertical load, failed upon slight horizontal load.	

Conclusion: After complete wetting, freezing, drying, treatment, vertical compressive load carrying ability was reduced to less than 167#/in.^{2}; horizontal load resisting ability substantially reduced.

D. Completely wetted samples were cut into 2-1/2" cubes and marked for vertical and horizontal loading and delivered to Northwest Testing Laboratory for testing to destruction:

1. Vertical Loading

A.	149#/in.^{2}
B.	156

2. Horizontal Loading

C.	259#/in.^{2}
D.	266

Conclusion: Vertical load carrying capability is considerably lessened by freezing; horizontal load carrying capability is not appreciably lessened by freezing.

My opinion of these tests, is that it thoroughly substantuates our original presumption that freezing of Kaolite 2200 LI, after proper curing procedures have been completed, results in a severely lowered load carrying capability.

We still contend that the design for new tanks should be as described at our July 21, 1970, discussion:

Lightweight Castable of approximately 50#/ft.^{3} density with 225#/in.^{2} compressive strength and approximately k = 1.60 @ 500°F should be used in center zone; heavy castable of approximately 120#/ft.^{3} density with 3,000#/in.^{2} compressive strength and approximately k = 4.60 @ 500°F should be used for approximately 15" perimeter under the tank knuckle, with a rigid retaining band.

We are now running tests on materials of this nature which utilize a CA25 binder to see the effect of freezing on materials with this different binder. We will forward these results shortly.

Yours very truly,

WILLARD SMITH, INC.

Willard Smith

WS/ly

cc: Vitro Hanford Engineering Services
1392 George Washington Way
Richland, Washington, 99352
Attention: Mr. Max Schulze
Mr. Edgar Smith

cc: Pittsburgh Des Moines Steel Company
700 - 108th Avenue N. E.
Bellevue, Washington, 98004
Attention: Mr. Bob Wendlandt

2.0 Supporting Documentation for RPP-ASMT-53793, Section 4.1.1, Waste Transfers and Liquid Level

2.1 Tank AY-102 Liquid Level Data- February 1971 through December 1980

Tank AY-102 Liquid Levels
February 1971 through December 1980

Liquid Level		
Date	**LL (in)**	**Reference**
Feb-71	96	PPD-421-DEL
Mar-72	86.5455	WHC-MR-0132
Apr-72	86	PPD-493-4-DEL
Jul-72	91	PPD-493-7-DEL
6/8/1973	87.5	RHO-CD-213
11/2/1973	76.75	Status Report
12/1/1973	77.5	Status Report
1/2/1974	78.5	Status Report
2/1/1974	74.75	Status Report
3/1/1974	75.5	Status Report
4/1/1974	74.5	Status Report
5/1/1974	77.75	Status Report
6/1/1974	74.25	Status Report
7/1/1974	73.75	Status Report
8/1/1974	79	Status Report
9/1/1974	76.5	Status Report
10/1/1974	72	Status Report
11/1/1974	73.5	Status Report
12/1/1974	74.5	Status Report
1/1/1975	76.75	Status Report
2/1/1975	76.75	Status Report
3/1/1975	74.5	Status Report
2/10/1976	76.5	Status Report
3/8/1976	75	RHO-CD-213
3/9/1976	77.25	RHO-CD-213
4/10/1976	76.5	RHO-CD-213
4/11/1976	78.25	RHO-CD-213
5/8/1976	77.25	RHO-CD-213
5/9/1976	79.25	RHO-CD-213
9/30/1976	76	Status Report
10/22/1976	22.75	Status Report
10/23/1976	15.25	Status Report
10/25/1976	15	Status Report
10/29/1976	14.25	Status Report
10/30/1976	20	RHO-CD-213
11/3/1976	20	RHO-CD-213
1/9/1977	20	RHO-CD-213
3/27/1977	19	RHO-CD-213
4/30/1977	47	ARH-CD-822 APR

Solids Level			
Date	**LL (kgal)**	**LL (in)**	**Reference**
Jun-78	6	2.182	WHC-SD-WM-TI-689
Mar-80	6	2.182	WHC-SD-WM-TI-689
Apr-80	21	7.636	WHC-SD-WM-TI-689
Mar-82	21	7.636	WHC-SD-WM-TI-689
Apr-82	23	8.364	WHC-SD-WM-TI-689
Dec-86	23	8.364	WHC-SD-WM-TI-689
Jan-87	27	9.818	WHC-SD-WM-TI-689
Mar-87	27	9.818	WHC-SD-WM-TI-689
Apr-87	28	10.18	WHC-SD-WM-TI-689
Dec-87	28	10.18	WHC-SD-WM-TI-689
Jan-88	32	11.64	WHC-SD-WM-TI-689
9/4/1998		9.31	Sediment Level Readings
11/15/1998		9	Sediment Level Readings
11/19/1998		11.43	Sediment Level Readings
12/1/1998		12.2	Sediment Level Readings
12/29/1998		12.17	Sediment Level Readings
2/26/1999		11.88	Sediment Level Readings
3/9/1999		13.96	Sediment Level Readings
3/11/1999		16.78	Sediment Level Readings
3/16/1999		19.67	Sediment Level Readings
3/22/1999		18.34	Sediment Level Readings
3/29/1999		19.22	Sediment Level Readings
3/31/1999		26.89	Sediment Level Readings
4/5/1999		29.45	Sediment Level Readings
4/29/1999		29.47	Sediment Level Readings
5/20/1999		35.13	Sediment Level Readings
6/7/1999		49.63	Sediment Level Readings
7/6/1999		46.74	Sediment Level Readings
8/5/1999		51.34	Sediment Level Readings
9/8/1999		52.7	Sediment Level Readings
10/4/1999		68.92	Sediment Level Readings
11/2/1999		67.53	Sediment Level Readings
Feb-00		66.74	Sediment Level Readings
Jul-00		65.98	Sediment Level Readings
Sep-12	170	61.82	PCSACS

Liquid Level		
Date	LL (in)	Reference
5/31/1977	73	ARH-CD-822 MAY
6/14/1977	83	RHO-CD-213
6/24/1977	82.75	RHO-CD-213
6/30/1977	93.75	RHO-CD-213
8/5/1977	93	RHO-CD-213
8/6/1977	80.75	RHO-CD-213
9/23/1977	80.25	RHO-CD-213
9/30/1977	80.25	RHO-CD-213
12/5/1977	79	RHO-CD-213
12/6/1977	79.25	RHO-CD-213
12/8/1977	79.25	RHO-CD-213
2/3/1978	79	RHO-CD-213
4/1/1978	126	RHO-CD-213
4/11/1978	125.5	RHO-CD-213
4/19/1978	129.75	RHO-CD-213
5/9/1978	129.75	RHO-CD-213
5/15/1978	132.25	RHO-CD-213
5/30/1978	132	RHO-CD-213
5/31/1978	132.5	RHO-CD-213
6/7/1978	132.25	RHO-CD-213
7/13/1978	136.25	RHO-CD-213
8/12/1978	136.25	RHO-CD-213
9/10/1978	139.5	RHO-CD-213
10/13/1978	139	RHO-CD-213
10/15/1978	139.5	RHO-CD-213
11/22/1978	139	RHO-CD-213
11/23/1978	140.25	RHO-CD-213
12/3/1978	140.5	RHO-CD-213
12/4/1978	141.75	RHO-CD-213
12/22/1978	140.75	RHO-CD-213
1/5/1979	140.25	RHO-CD-213
1/17/1980	140.5	RHO-CD-213
1/18/1980	141.25	RHO-CD-213
1/31/1980	141.091	RHO-CD-14 JAN
2/29/1980	141.091	RHO-CD-14 FEB
3/31/1980	141.091	RHO-CD-14 MAR
4/30/1980	141.091	RHO-CD-14 APR
5/16/1980	141.25	RHO-CD-213
5/31/1980	176.727	RHO-CD-14 MAY
6/30/1980	250.909	RHO-CD-14 JUN
7/31/1980	250.909	RHO-CD-14 JUL
8/31/1980	258.909	RHO-CD-14 AUG
9/30/1980	258.909	RHO-CD-14 SEP

Solids Level			
Date	LL (kgal)	LL (in)	Reference

Liquid Level		
Date	LL (in)	Reference
10/18/1980	73.5	RHO-CD-213
10/31/1980	73.8182	RHO-CD-14 OCT
11/12/1980	73.5	RHO-CD-213
11/13/1980	71.3	RHO-CD-213
11/16/1980	71.35	RHO-CD-213
11/28/1980	77.9	RHO-CD-213
11/30/1980	77.8182	RHO-CD-14 NOV
12/26/1980	78.1	RHO-CD-213
12/27/1980	82.6	RHO-CD-213
12/31/1980	82.5455	RHO-CD-14 DEC

Solids Level			
Date	LL (kgal)	LL (in)	Reference

Note: Liquid level readings after 1980 were taken from PCSACS.

2.2 Tank AY-102 Status Reports- November 1973 to March 1975

STATUS REPORT – 241-AY TANK FARM

DATE: 11-2-73

OPERATOR'S NAME	GRAVEYARD	DAY	SWING
	"B J.W.	DJ.	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM (initials: cw, JB-DRF, JWB)	GY	29' 4 1/2"	–.6	~~29' 4 1/2~~ 6' 4 1/4 (6' 4 1/2)	–.77
	DAY	29' 4 1/2	–.55	6' 4 3/4	–.75
	SWING	29' 5"	.58	6' 5"	–.75

DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	SHIFT	101-AY	102-AY
	GY	170.5	167.4
	DAY	171.0	167.2
	SWING	177.2	168.0

AIR FLOW TO CIRCULATORS	SHIFT	101-AY	102-AY
	GY	24%	26%
	DAY	25%	27%
	SWING	25%	28%

	101-AY	102-AY
ALL CIRCULATORS FLUSHED ON DAY SHIFT, MONDAY THROUGH FRIDAY		

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY				
	DAY	0	1/8"	0	1/8"
	SWING		1/8"		1/8"

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.4
	DAY	2.5	.5	2.4
	SWING	2.5	.5	2.5
SPECIFIC GRAVITY	GY	1.035	0	1.0
	DAY	1.02	0	1.0
	SWING	1.025	0	1.0
RADIATION LEVEL	GY	.01	.11	.11
	DAY	.01	.11	.10
	SWING	.01	.20	.08

L.L.I. AZ SEAL LOOP	SHIFT	
	GY	29.3
	DAY	29.2
	SWING	29.1

BC-6500-033 (3-72)

STATUS REPORT – 241-AY TANK FARM

DATE: 12-1-73

OPERATOR'S NAME	GRAVEYARD	DAY	SWING
"C"		D	A

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29'3½	.8	6'5¼	.9
	DAY	29' 1"	.8	6'5½	.9
	SWING	29' 2¾	.8	6'5¾	.9
DASC: AVERAGE ~~DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F~~	GY	168		156.5	
	DAY	167		157	
	SWING	168.4		157.4	
AIR FLOW TO CIRCULATORS	GY				
	DAY	✓		✓	
	SWING	28		32	
ALL CIRCULATORS FLUSHED ON DAY SHIFT, MONDAY THROUGH FRIDAY					

ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8"		1/8"
	DAY		1/8"		1/8"
	SWING		1/8"		1/8"

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.4	.4	2.4
	DAY	2.4	.4	2.4
	SWING	2.4	.4	2.4
SPECIFIC GRAVITY	GY	1.04	—	1.0
	DAY	1.03	—	1.0
	SWING	1.03	—	1.0
RADIATION LEVEL	GY	.01	.15	.2
	DAY	.01	.15	.2
	SWING	.01	.2	.15
L. L. I. AZ SEAL LOOP	GY	29.2		
	DAY	29.0		
	SWING	29.2		

BC-6500-033 (3-72)

STATUS REPORT – 241-AY TANK FARM

DATE: 1-2-74

OPERATOR'S NAME	GRAVEYARD	DAY	SWING
	C	[signature]	B' H2

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 4		6' 7½	.8
	DAY	29' 4"	.8	6' 6½"	N.G.
	SWING	29' 4"	.8	6' 6½	.8
DASC: AVE CASE temp ~~DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F~~	GY	166.		163.7	
	DAY	163		164	
	SWING	163.4		163.9	
AIR FLOW TO CIRCULATORS	GY	26%		28%	
	DAY	33%		36%	
	SWING	26%		29%	
ALL CIRCULATORS FLUSHED ON DAY SHIFT, MONDAY THROUGH FRIDAY		✓		✓	

Handwritten initials beside tank liquid level/vacuum: OR am; AP 7.B; M am

ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8"		1/8"
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.5	.5	2.5
SPECIFIC GRAVITY	GY	1.04	—	1.0
	DAY	1.03	—	1.0
	SWING	1.04	—	1.05
RADIATION LEVEL	GY	.01	.1	.2
	DAY	.01	.2	.2
	SWING	.01	.20	.10

L. L. I. AZ SEAL LOOP	SHIFT	
	GY	29.0
	DAY	28.8
	SWING	28.8

BC-6500-033 (3-72)

STATUS REPORT – 241-AY TANK FARM

DATE: 2-1-74

OPERATOR'S NAME	GRAVEYARD	DAY	SWING
	C	[illegible]	"D" [illegible]

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 2 3/4	.6	6' 2 1/2	.6
	DAY	29' 2 3/4"	.5	6' 2 3/4"	.6
	SWING	29' 2 7/8"	.5	6' 2 7/8"	.6

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES ~~OF POINTS GREATER THAN 260 °F~~	GY	158.8	160.5
	DAY	160	160.3
	SWING	162.9	159.7
AIR FLOW TO CIRCULATORS	GY	24%	26%
	DAY	32%	34%
	SWING	26%	26%
ALL CIRCULATORS FLUSHED ON DAY SHIFT, MONDAY THROUGH FRIDAY		✓	✓

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.5	.5	2.5
SPECIFIC GRAVITY	GY	1.03	—	1.0
	DAY	1.03	—	1.0
	SWING	1.03	—	1.0
RADIATION LEVEL	GY	.01	.2	.01
	DAY	.01	.2	.01
	SWING	.01	.2	.01
L. L. I. AZ SEAL LOOP	GY	29.2		
	DAY	29.2		
	SWING	29.4		

BC-6500-033 (3-72)

STATUS REPORT – 241-AY TANK FARM

DATE: 3-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	C			

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL	GY	29' 1 7/8"	.6	6' 3 7/8	.6
TANK VACUUM	DAY	29' 1½"	.4	6' 3½"	.7
	SWING	29' 1½"	.58	6' 3½"	.68

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	160	153.5
	DAY	160.8	155.1
	SWING	161.2	155.9
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	26%	26%
	DAY	28%	28%
	SWING	26%	26%
CIRCULATORS FLUSHED		L.B.	L.B.

ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.5	.5	2.5
SPECIFIC GRAVITY	GY	1.03	—	1.0
	DAY	1.03	—	1.0
	SWING	1.03	—	1.0
RADIATION LEVEL	GY	.01	.3	.01
	DAY	.01	.3	.01
	SWING	.01	.3	.01

L. L. I. AZ SEAL LOOP	SHIFT	
	GY	29.2
	DAY	29.2
	SWING	29.3

BC-6500-033 (2-74)

STATUS REPORT - 241-AY TANK FARM

DATE 4/1/74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	D [illegible]	[illegible]		

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 2 1/2"	-.5	6' 2 1/2"	-.55
	DAY	29' 2 3/4"	-.5	6' 2 1/2"	-.5
	SWING	29' 2 1/2"	-.44	6' 2 1/4"	-.47
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	158.8		158.4	
	DAY	168.6		156.2	
	SWING	159.5		157.2	
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	22		24	
	DAY	22		24	
	SWING	24 %		25 %	
CIRCULATORS FLUSHED					

ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED - 1A, -1B, -1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.4	.5	2.4
SPECIFIC GRAVITY	GY	1.03	—	1.0
	DAY	1.03	—	1.0
	SWING	1.03	—	1.0
RADIATION LEVEL	GY	.01	.2	.01
	DAY	.01	.2	.01
	SWING	.01	.3	.017
L. L. I. AZ SEAL LOOP	GY	29.4		
	DAY	29.4		
	SWING	29.3		

BC-6500-033 (2-74)

STATUS REPORT - 241-AY TANK FARM

DATE 5-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	D #F LDT	M.E. Manthei	C	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 7"	-.5	6' 6"	-.48
	DAY	29' 7"	-.5	6' 5 3/4"	-.45
	SWING	29' 7 1/4	-.35	6' 5 1/2	-.4

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	157.6	166.3
	DAY	157.2	165.4
	SWING	158.8	167.1
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	25	26
	DAY	29	31
	SWING	28	28
CIRCULATORS FLUSHED		✓	✓

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED - 1A, -1B, -1C	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.5	.5	2.5
SPECIFIC GRAVITY	GY	1.03	—	1.0
	DAY	1.03	—	1.0
	SWING	1.03	—	1.0
RADIATION LEVEL	GY	.01	.03	.01
	DAY	.01	.3	.02
	SWING	.01	.3	.05

	SHIFT	
L. L. I. AZ SEAL LOOP	GY	29.2
	DAY	29.2
	SWING	29.2

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE 6-1-74

OPERATORS NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	[illegible]	T.C. [illegible]	[illegible]	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL	GY	29'6½	-.35	6'3"	-.32
TANK VACUUM	DAY	29'6"	-.35	6'2¼"	-.35
	SWING	29'6¼	-.35	6'1¾	-.30

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	156.7	166.5
	DAY	159.5	167.6
	SWING	159.2	167.3
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	25%	27%
	DAY	25%	27%
	SWING	24%	26%
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.5	.5	2.5
SPECIFIC GRAVITY	GY	1.03	—	.9
	DAY	1.03	—	1.0
	SWING	1.03	—	1.0
RADIATION LEVEL	GY	.01	.3	.01
	DAY	.01	.25	.01
	SWING	.01	.25	.005

	SHIFT	
L. L. I. AZ SEAL LOOP	GY	29.4
	DAY	29.6
	SWING	30.0

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE: 7-1-74

OPERATORS NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	20-"A"	M.E. Manthei	C	Chris Petersen

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 5"	.49	*6' 2 1/4"	.49
	DAY	29' 5"	.5	6' 1 3/4"	.5
	SWING	29' 5"	-.4	6' 3	-.4

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	159.0	163.2
	DAY	158.2	161.6
	SWING	158.	
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	28 %	32 %
	DAY	28%	31%
	SWING	27%	29.5 %
CIRCULATORS FLUSHED		✓	✓

ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.5	.5	2.5
	DAY	2.5	.5	2.5
	SWING	2.5 ✓	.5 ✓	2.5 ✓
SPECIFIC GRAVITY	GY	1.02	0	.98
	DAY	1.02	0	.98
	SWING	1.02	0	.98
RADIATION LEVEL	GY	.01	.3	.01
	DAY	.01	.3	.25
	SWING	.005	.01	.20

	SHIFT		
L. L. I. AZ SEAL LOOP	GY	29.1	*RECHECKED 0235
	DAY	29.0	102-AY STEAM COND VALVE BACK TO 102 AY
	SWING	29.2	

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE: 8-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	EJ.	M.E. Manthei D	GG LD	Chris A. Peterson

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL	GY	29' 7 3/4	-.4	6' 6 3/4	-.5
TANK VACUUM	DAY	29' 7 1/2"	-.4	6' 7"	-.4
RMG WD	SWING	29' 7 1/2"	-.4	6' 6 3/4"	-.45
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	156.7		160.0	
	DAY	157.2		156.5	
	SWING	157.9		156.7	
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	24		28	
	DAY	26		28	
	SWING	26		28	

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
CIRCULATORS FLUSHED						
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.2	.5	2.2
	DAY	2.3	.5	2.3
	SWING	2.3	.5	2.3
SPECIFIC GRAVITY	GY	1.02	0	-1.0
	DAY	1.02	0	<1.0
	SWING	1.02	—	.9
RADIATION LEVEL	GY	.01	.3	.01
	DAY	.01	.3	.01
	SWING	.01	.3	.01

L. L. I. AZ SEAL LOOP	SHIFT		Remarks
	GY	29.2	102-AY STEAM Coil Routed To A-08 Crib
	DAY	29.2	
	SWING	29.4	

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE 9-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	HD		OW D LD	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29'7"	.4	6'5"	.5
	DAY	29'7"	.35	6'4½	.45
	SWING	29'7"	-.35	6'4"	-.45

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	154.7	155.7
	DAY	153.6	155.8
	SWING	154.8	156.5
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	33%	32%
	DAY	27%	28%
	SWING	33	32
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.3	.5	2.3
	DAY	2.3	.5	2.3
	SWING	2.3	.5	2.3
SPECIFIC GRAVITY	GY	1.2	0	1.0
	DAY	1.16	0	1.0
	SWING	1.02	—	.9
RADIATION LEVEL	GY	.01	.14	.01
	DAY	.01	.17	.01
	SWING	.01	.16	.01
L. L. I. AZ SEAL LOOP	GY	29		
	DAY	29.4		
	SWING	29.4		

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE 10-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	JRO "B"	L B	OW D LD	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL	GY	29'6"	-.45	6'0 5/8"	-.55
TANK VACUUM	DAY	29'6"	-.4	6' 0"	-.5
*Read from 152-AX CH.TR.	SWING	29'6"	-.4	*6'2½"	-.45

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	~~29%~~ 152.5	~~32%~~ 162.5
	DAY	153.5	162.4
	SWING	153.0	162.8
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	29%	32%
	DAY	30%	32%
	SWING	30	35
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	GY	0	0	0	0
	DAY	0	1/8	0	1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.3	.5	2.2
	DAY	2.4	~~1.01~~ .5	2.3
	SWING	2.3	.5	2.3
SPECIFIC GRAVITY	GY	1.02	0	<1.0
	DAY	1.01	0	<1.0
	SWING	1.02	—	<1.0
RADIATION LEVEL	GY	.005	.7	.01
	DAY	.01	~~1.60~~ .16	.01
	SWING	.01	.6	.01

L. L. I. AZ SEAL LOOP	SHIFT	
	GY	29.0
	DAY	29.6
	SWING	29.8

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE: 11-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	JW	RBW		

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 7"	-.2	6' 1½"	-.48
	DAY	29' 7	-.15	6' 1½	-.4
	SWING	29' 7"		6' 2"	

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	149.5	165.7
	DAY	147.4	165.1
	SWING	149.0	163.9
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	34%	28%
	DAY	32%	30%
	SWING	32%	30%
CIRCULATORS FLUSHED		all	all

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.4	.5	2.3
	DAY	2.4	.5	2.3
	SWING	2.4	.5	2.3
SPECIFIC GRAVITY	GY	1.025	—	.99
	DAY	1.03	—	.99
	SWING	1.03	—	.99
RADIATION LEVEL	GY	.01	.6	.009
	DAY	.01	.6	.006
	SWING	.01	.6	.005
L. L. I. AZ SEAL LOOP	GY	29.3		
	DAY	29.2		
	SWING	29.2		

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE: 12-1-74

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	WRS	D GG LD	DDB	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM (DEB RMG WLC)	GY	29' 6 1/2	-.22	6' 2 1/2	-.26
	DAY	29' 6 1/2	-.2	6' 2 1/2	-.23
	SWING	29-6 1/2	-.17	6-2 1/4	-.25

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	141.3	168.1
	DAY	141.5	166.8
	SWING	141.9	169.1
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	28%	32%
	DAY	28	32
	SWING	28	32
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	GY	0	1/8	0	1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.3	.5	2.3
	DAY	2.2	.5	2.2
	SWING	2.2	.5	2.2
SPECIFIC GRAVITY	GY	1.02	—	1.0
	DAY	1.02	—	1.0
	SWING	1.025	—	1.0
RADIATION LEVEL	GY	.01	.6	.01
	DAY	.01	.5	.01
	SWING	.01	.6	.01
L. L. I. AZ SEAL LOOP	GY	29.0		
	DAY	29.2		
	SWING	29.2		

STATUS REPORT – 241-AY TANK FARM

DATE: 1-1-75

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	[illegible]	[illegible]	[illegible]	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL	GY	29'5 1/4	.1	6'5"	.16
TANK VACUUM	DAY	29'5 1/4"	.1	6'4 3/4"	.16
	SWING	29'5 1/4	-.1	6'4 3/4	-.18

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	138.5	170.7
	DAY	139.4	170.8
	SWING	139.4	171.4
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	34%	35%
	DAY	34%	35%
	SWING	34%	36%
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	GY	0	1/8	0	1/8
	DAY	0	1/8	0	1/8
	SWING	0	1/8	0	1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.3	.5	2.3
	DAY	2.3	.5	2.3
	SWING	2.2	.5	2.0
SPECIFIC GRAVITY	GY	1.03	—	1.0
	DAY	1.03	—	1.0
	SWING	1.08	—	.95
RADIATION LEVEL	GY	.01	.5	.01
	DAY	.01	.5	.01
	SWING	.01	.5	.01

	SHIFT	
L. L. I. AZ SEAL LOOP	GY	29.0
	DAY	29.0
	SWING	29.2

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE: 2-1-75

OPERATOR'S NAME:	GRAVEYARD	DAY	SWING	SUPERVISOR
	Deo & mike	A CR	MDJ	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM (WLL)	GY	29'4"	.15	6'4¾	.3
(CR)	DAY	29'4"	.15	6' 4¾	.3
(MDJ)	SWING	29'4"	-.1	6' 3¾"	-.25

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	136.6	169.9
	DAY	139.3	170.5
	SWING	138.1	169.7
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	✓ 31	✓ 32
	DAY	✓ 31	✓ 32
	SWING	31%	32%
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, –1B, –1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2	.05	2
	DAY	2	.05	2
	SWING	2.2	.05	2
SPECIFIC GRAVITY	GY	1.04	—	1.0
	DAY	1.04	—	1.0
	SWING	1.04	—	1.0
RADIATION LEVEL	GY	.01	.4	.01
	DAY	.01	.4	.01
	SWING	.01	.5	.01

L. L. I. AZ SEAL LOOP	SHIFT		
	GY	29	102AY condensate to crib
	DAY	29	
	SWING	29.2	

BC-6500-033 (2-74)

STATUS REPORT – 241-AY TANK FARM

DATE	3-1-75				
OPERATOR'S NAME:	GRAVEYARD: RAC. Owal.	DAY: Dick "A"	SWING: B-F. P	SUPERVISOR:	

TANK	SHIFT	101-AY L.L.-INCHES	101-AY VAC.-INCHES WG	102-AY L.L.-INCHES	102-AY VAC.-INCHES WG
TANK LIQUID LEVEL / TANK VACUUM	GY	29' 3½"	.2	6' 3¾"	.3
	DAY	29' 3¾"	.25	6' 2½" *	.35
	SWING	29-3½	.1	6-2¼	.25

	SHIFT	101-AY	102-AY
DASC: DASC NUMBERS AND TEMPERATURES OF POINTS GREATER THAN 260 °F	GY	136.8	173.3
	DAY	139	172.5
	SWING	137.6	174.2
CONFIRM THAT AIR FLOW TO CIRCULATORS IS AS POSTED	GY	36%	36.5%
	DAY	36%	36%
	SWING	36%	36%
CIRCULATORS FLUSHED			

	101-AY GY	101-AY DAY	101-AY SWING	102-AY GY	102-AY DAY	102-AY SWING
ASSIGNED CURCULATORS FLUSHED SATURDAY AND SUNDAY						

HIGHEST ANNULUS LEAK DETECTION PROBES CONTACTED – 1A, -1B, -1C	SHIFT	101-AY FEET	101-AY INCHES	102-AY FEET	102-AY INCHES
	GY		1/8		1/8
	DAY		1/8		1/8
	SWING		1/8		1/8

LEAK DETECTION PITS	SHIFT	101-A	101-B	102
WEIGHT FACTOR	GY	2.0	.5	2.3
	DAY	2.0	.5	2.3
	SWING	2.0	.5	2.3
SPECIFIC GRAVITY	GY	1.03	0	1.0
	DAY	1.035	0	1.0
	SWING	1.03	0	1.0
RADIATION LEVEL	GY	0	2.8	.01
	DAY	.002	3.5	.005
	SWING	.001	5.0	.01
L. L. I. AZ SEAL LOOP	GY	29.2	* Rechecked	
	DAY	29.2		
	SWING	29.2		

BC-6500-033 (2-74)

2.3 AY Farm Liquid Level Readings- February 1976

AY FARM L.L. FEBRUARY 1976

MULTIPLEX COLUMNAR — FORM 50-14 — MADE IN U.S.A.

DATE	101 TAPE	102 TAPE	Leak Detection Pit – WF: 101-A 13.8	101-B 1.2	102 15.6	Radiation Level: 101-A .02	101-B .5	102 .02		
1	356.50	75.00	13.0	0	13.0	<.01	.06	<.02		
2	356.25	74.75	13.0	0	13.0	<.01	.06	.01		
3	356.25	74.50	13.0	0	13.0	<.01	.05	.01		
4	356.25	74.50	13.0	0	13.0	<.01	.05	.01		
5	356.25	74.50	13.0	–	13.0	.005	.05	.01	CMM 2-6-76	mcj 2/6/76
6	356.25	74.50	12.5	0	13.0	.01	.06	.01		
7	356.25	74.50	13.0	0	13.5	<.01	.05	.01		
8	356.25	74.25	13.0	0	13.5	<.01	.04	.01		
9	356.25	74.25	12.7	0	13.0	<.01	.05	.01		
10	356.25	76.50	12.7	0	13.0	<.01	.06	<.01		
11	356.25	76.50	13.0	0	13.50	<.01	.06	.01		
12	355.75	76.25	12.8	0	13.0	<.01	.06	<.01	CMM 2-13-76	mcj 2/13/76
13	356.50	76.25	12.7	0	13.0	<.01	.06	<.01		
14	355.75	75.75	12.6	0	13.0	<.01	.06	<.01		
15	356.00	76.00	12.6	0	13.0	.005	.05	.01		
16	355.75	76.00	12.7	0	13.2	.01	.05	<.01		
17	355.75	75.50	13.0	0	13.5	<.01	.04	<.01		
18	355.75	75.75	12.7	0	13.0	<.01	.06	<.01		
19	355.75	75.50	12.7	0	13.0	<.01	.05	<.01	CMM 2-20-76	mcj 2/20/76
20	355.50	75.50	12.6	0	12.8	<.01	.05	<.01		
21	355.75	75.50	12.6	–	13.0	<.01	.05	.01		
22	355.50	75.25	12.7	–	13.0	.01	.05	.01		
23	355.75	75.50	12.8	0	13.0	.01	.05	<.01		
24	355.75	75.25	12.6	0	13.0	.01	.05	.01		
25	355.50	75.25	12.7	0	13.0	<.01	.05	<.01		mcj 2/26/76
26	355.75	75.25	13.0	0	13.0	0.01	.05	.01	CMM 2-[illegible]-76	
27	355.75	75.00	13.0	0	13.5	0.001	.05	.01		
28	355.50	75.50	13.0	0	13.0	.01	.04	.01		
29	355.50	75.25	12.5	0	13.0	<.01	.05	<.01		
30										
31										
32										
33										
34										
35										
36										

2.4 AY Farm Liquid Level Monthly Reports- September 1976, April 1977 and May 1977

INVENTORIES BY TANK

SECTION I: C

REPORT DATE 9/30/76

DOCUMENT NO. ARH-CD-702 I
PAGE 5

ALL VALUES IN K GALLONS

TANK	AVAIL SPACE	TOTAL WASTE	UNUSED SPACE	SUPERNATE VOLUME TOTAL	TYPE (1)	SOLIDS VOLUME TOTAL	SLUDGE	SALT CAKE	STATUS-CONDITION TANKS (2)	REMARKS-USE (CONTENTS)
101 AY	976	976	0	924	AGING	52	52	0	A-AGING WASTE	SPACE AGING WST
102 AY	209	209	0	209	EVAP	0	0	0	A-SPACE AG WSTE	SPACE AGING WST
TOTAL	1185	1185	0	1133		52	52	0		

2-27

(1) AGING: AGING WASTE RESID: HANFORD DEFENSE RESIDUAL LIQUOR EVAP: EVAPORATOR FEED
(2) SEE PAGE 18 FOR COMPLETE STATUS-CONDITIONS

COMPILED BY TANK FARM PROCESS ENGINEERING
RELEASED BY PLANNING, SCHEDULING & OPERATION CONTROL

APPROVED BY ________________
COMPUTER RUN DATE: 10/14/76

INVENTORIES BY TANK

DOCUMENT NO. ARH-CD-822 APR

SECTION I: C

PAGE 8

REPORT DATE 4/30/77

ALL VALUES IN K GALLONS

TANK	TOTAL WASTE	AVAIL SPACE	SUPERNATE VOLUME TOTAL	TYPE (1)	SOLIDS VOLUME TOTAL	SLUDGE	SALT CAKE	STATUS-CONDITION TANKS (2)	REMARKS-USE (CONTENTS)
101 AY	971	0	919	AGING	52	52	0	A-AGING WASTE	
102 AY	129	871	129	EVAP	0	0	0	A-SPACE-AG WSTE	
TOTAL	1100	871	1048		52	52	0		

2-28

(1) AGING: AGING WASTE RESID: HANFORD DEFENSE RESIDUAL LIQUOR EVAP: EVAPORATOR FEED
STABL: STABILIZED ISO: ISOLATED I & S: ISOLATED AND STABILIZED
(2) SEE PAGE 21 FOR COMPLETE STATUS-CONDITIONS

COMPILED BY TANK FARM PROCESS ENGINEERING APPROVED R.J. JULIAN
RELEASED BY ADMINISTRATIVE REPORTING DEPARTMENT COMPUTER RUN DATE: 05/11/77

SECTION I: C

INVENTORIES BY TANK

REPORT DATE 5/31/77

DOCUMENT NO. ARH-CD-822 MAY
PAGE 8

ALL VALUES IN K GALLONS

TANK	TOTAL WASTE	AVAIL SPACE	SUPERNATE VOLUME TOTAL	TYPE (1)	SOLIDS VOLUME TOTAL	SLUDGE	SALT CAKE	STATUS-CONDITION TANKS (2)	REMARKS-USE (CONTENTS)
101 AY	968	0	916	AGING	52	52	0	A-AGING WASTE	
102 AY	201	799	201	AGING	0	0	0	A-AGING WASTE	BNW WST RECEIVR
TOTAL	1169	799	1117		52	52	0		

2-29

(1) AGING: AGING WASTE RESID: HANFORD DEFENSE RESIDUAL LIQUOR EVAP: EVAPORATOR FEED
STABL: STABILIZED ISO: ISOLATED I & S: ISOLATED AND STABILIZED
(2) SEE PAGE 21 FOR COMPLETE STATUS-CONDITIONS

COMPILED BY TANK FARM PROCESS ENGINEERING
RELEASED BY ADMINISTRATIVE REPORTING DEPARTMENT

APPROVED R. J. JULIAN
COMPUTER RUN DATE: 06/10/77

2.5 Tank AY-102 Liquid Level Readings- October 1976

Reference: Occurrence Report 76-148, 1976, Possible Specification Violation: Liquid Level Decrease to Below a Minimum Level, Atlantic Richfield Hanford Company, Richland, Washington.

TABLE I: TANK 102-AY RECORD OF TANK VACUUM AND LIQUID LEVEL

Date		inches, WG Annulus Vacuum	inches, WG Tank Vacuum	inches Tank Liquid Level (4)
10-22-76	GY	-1.6	-.15	22.75
	D	-1.6	-.15	22.75
	SW	-1.6	-.15	15.00 (1)
10-23-76	GY	-1.6	-.15	15.25
	D	-1.7	-.17	15.25
	SW	-1.6	-.20	15.00
10.24-76	GY	-1.6	-.25	15.25
	D	-1.6	-.25	15.25
	SW	-1.6	-.22	15.00
10-25-76	GY	-1.6	-.25	15.00
	D	-1.7	-.20	15.25
	SW	-1.9	-.15	15.00
10-26-76	GY	-1.6	-.25	15.00
	D	-1.6	-.75	15.00
	SW	-1.8	-.05	15.00
10-27-76	GY	-1.6	-.25	15.00
	D	-1.6	-.10	15.00
	SW	-1.6	-.10	15.00
10-28-76	GY	-1.7	-.20	15.00
	D	-1.6	-.10	15.00
	SW	-1.65	-.10	14.25 (2)
10-29-76	GY	-1.55	-.20	14.25
	D	off	-.10	14.25
	SW	-	0.00	20.00 (3)
10-30-76	GY	-	-.10	20.00
	D	-	-.07	20.00
	SW	-	0.00	20.00
10-31-76	GY	-	-.10	20.00
	D	-	-.10	20.00
	SW	-	-.20	20.00

(1) Transfer to Tank 101-A

(2) Tape repair performed by Instrument Maintenance

(3) Added process condensate from Tank 417

(4) Manual Tape Readings ± .25 inches

2.6 Tank AY-102 Liquid Level Readings- September 1998 through July 2000

Sediment Level Readings for 241-AY-102 from ENRAF Densitometer			
Source of Data:			
D - dat file			
L = activity log file			
E = e-mail			
T = text file			
Source of Data	**Date**	**Level (inches)**	**Questionable Date**
T	9/4/98 10:40	9.31	
T	10/27/98 16:44	9.15	
L	11/15/98 10:14	9.11	
L	11/15/98 11:15	9	
D	11/18/98 18:40	9.46	
D	11/19/98 10:28	10.49	
D	11/19/98 18:55	11.43	
D	11/20/98 17:54	12.29	
D	11/20/98 23:05	12.16	
L	11/21/98 9:22	12.64	
D	11/21/98 17:28	12.73	
E	11/23/98 0:00	12.9	
L	11/24/98 17:20	12.78	
L	11/25/98 9:27	12.47	
D	11/30/98 10:01	12.4	
D	12/1/98 9:20	12.2	
D	12/7/98 13:09	12.11	
D	12/17/98 10:42	12.14	
D	12/17/98 18:28	12.17	
D	12/18/98 13:20	12.26	
D	12/18/98 18:14	12.22	
D	12/19/98 13:03	12.28	
D	12/19/98 19:46	12.25	
L	12/22/98 13:22	12.17	
L	12/29/98 13:54	12.17	
L	1/6/99 13:18	12.15	
D	2/26/99 13:27	11.88	
D	3/4/99 10:03	11.93	
D	3/8/99 1:02	12.55	
D	3/8/99 2:31	12.31	
L	3/8/99 17:45	12.94	
D	3/9/99 10:02	13.93	
D	3/9/99 13:42	13.88	
D	3/9/99 17:15	13.96	
D	3/9/99 18:40	13.96	
D	3/10/99 9:34	15.19	
D	3/10/99 17:34	15.71	
D	3/10/99 18:31	15.51	
D	3/11/99 9:52	17.35	
D	3/11/99 11:21	16.78	

Source of Data	Date	Level (inches)	Questionable Date
L	3/12/99 9:43	18.85	
D	3/15/99 9:53	20.16	
D	3/16/99 10:31	19.67	
D	3/17/99 9:00	19.2	
D	3/18/99 13:30	18.69	
D	3/19/99 10:11	18.63	
D	3/22/99 10:23	18.34	
D	3/23/99 10:19	18.21	
D	3/25/99 9:24	18.05	
D	3/29/99 3:11	18.74	
D	3/29/99 4:16	18.57	
D	3/29/99 9:32	18.87	
D	3/29/99 18:02	19.22	
D	3/30/99 9:45	20.3	
D	3/30/99 17:35	20.17	
L	3/31/99 9:17	26.89	
L	3/31/99 9:27		23.98
L	3/31/99 9:32		22.14
L	3/31/99 9:33		21.33
L	3/31/99 9:39		21.35
L	3/31/99 9:43		21.22
L	3/31/99 9:46		21.19
L	3/31/99 17:10	26.34	
L	3/31/99 17:13		23.94
L	3/31/99 17:14		23.65
D	3/31/99 17:27		23.57
D	4/1/99 9:56		20.34
D	4/2/99 9:11		21.02
D	4/5/99 9:35	29.45	
D	4/6/99 9:13	28.29	
D	4/7/99 13:34	27.36	
D	4/8/99 9:50	27.01	
D	4/9/99 9:33	26.6	
D	4/12/99 10:23	26.45	
D	4/13/99 9:40	26.23	
L	4/14/99 9:08	26.24	
D	4/15/99 9:17	26.1	
D	4/16/99 13:22	26.11	
D	4/19/99 9:36	25.91	
D	4/21/99 12:50	25.88	
D	4/24/99 1:11	26.05	
D	4/24/99 8:32	26.33	
D	4/24/99 17:11	26.61	
L	4/25/99 8:47	27.14	
L	4/25/99 9:47	27	
D	4/25/99 16:47	27.24	
D	4/26/99 9:47	27.84	

Source of Data	Date	Level (inches)	Questionable Date
D	4/26/99 17:24	27.96	
D	4/27/99 14:28	28.45	
D	4/29/99 14:29	29.47	
D	5/1/99 1:05	30.5	
D	5/1/99 8:48	30.91	
D	5/1/99 16:35	31.38	
D	5/2/99 8:30	31.99	
D	5/2/99 17:17	32.18	
D	5/3/99 9:44	32.63	
D	5/3/99 17:18	33.04	
D	5/4/99 9:35	35.3	
D	5/5/99 10:08	37.2	
D	5/6/99 9:03	37.59	
D	5/7/99 9:02	37.34	
D	5/10/99 9:58	36.38	
D	5/11/99 9:31	36.19	
D	5/12/99 8:53	36.08	
D	5/13/99 9:38	35.89	
D	5/14/99 8:53	35.7	
D	5/17/99 9:16	35.35	
D	5/18/99 9:15	35.18	
D	5/19/99 9:50	35.17	
D	5/20/99 14:02	35.13	
D	5/25/99 1:39	35.29	
D	5/25/99 8:56	35.43	
D	5/25/99 17:29	35.73	
D	5/26/99 9:31	36.38	
D	5/26/99 18:48	36.58	
D	5/27/99 9:31	37.05	
D	5/27/99 17:58	37.3	
D	6/1/99 9:39	39.26	
D	6/2/99 10:12	38.69	Densitometer fixed, reference level was high by 1 inch
D	6/4/99 1:16	39.94	
D	6/4/99 9:06	40.96	
D	6/4/99 17:15	41.81	
D	6/5/99 8:33	44.25	
D	6/5/99 16:48	45.61	
D	6/6/99 8:19	48.08	
D	6/6/99 16:41	48.28	
D	6/7/99 9:38	49.63	
D	6/8/99 13:14	51.07	
D	6/9/99 9:03	50.47	
D	6/10/99 9:31	49.94	
D	6/14/99 9:30	48.91	
D	6/15/99 9:25	48.56	
D	6/16/99 9:11	48.33	

Source of Data	Date	Level (inches)	Questionable Date
D	6/17/99 14:30	48.18	
D	6/18/99 9:18	48.12	
D	6/21/99 9:29	47.91	
D	6/28/99 9:08	47.46	
D	7/6/99 9:17	46.74	
D	7/12/99 13:14	46.66	
D	7/19/99 10:04	46.63	
D	7/22/99 18:23	48.86	
D	7/23/99 9:16	49.65	
D	7/24/99 8:27	51.55	
D	7/25/99 9:03	51.77	
L	7/26/99 9:40	51.8	
D	8/2/99 13:12	51.4	
D	8/3/99 10:06	51.25	
D	8/5/99 9:00	51.34	
E	8/10/99 9:30	50.93	
D	8/13/99 12:55	50.98	
D	8/20/99 19:12	51.37	
D	8/21/99 10:17	51.84	
D	8/22/99 8:47	53	
D	8/23/99 13:47	53.3	
D	8/24/99 8:45	53.3	
D	8/25/99 8:38	53.34	
D	8/26/99 14:07	53.1	
D	8/30/99 10:10	52.88	
D	9/8/99 10:18	52.7	
D	9/11/99 9:34	53.88	
D	9/12/99 10:25	55.66	
D	9/15/99 3:11	57.04	
D	9/17/99 1:56	60.97	
D	9/17/99 8:32	61.65	
D	9/18/99 8:30	63.97	
D	9/19/99 9:00	64.72	
D	9/20/99 10:03	64.31	
D	9/22/99 0:57	64.56	
D	9/22/99 8:59	65.16	
D	9/22/99 20:47	65.73	
D	9/24/99 9:13	65.82	
D	9/25/99 1:37	66.69	
D	9/25/99 8:46	67.12	
D	9/27/99 0:57	67.67	
D	9/27/99 9:33	68.21	
D	9/29/99 0:42	68.26	
D	9/29/99 8:54	68.7	

Source of Data	Date	Level (inches)	Questionable Date
D	10/1/99 0:34	69.37	9/30/1999 12:34:17 Enraf Profiles/Sediment Levels were not taken on 9/30/99, date stamp should be 10/1/99. Therefore date stamp changed to 10/1/99.
D	10/4/99 9:54	68.92	
D	10/5/99 10:26	68.84	
D	10/7/99 0:59	68.72	
D	10/7/99 8:46	68.83	
D	10/8/99 10:05	68.76	
D	10/11/99 10:41	68.5	
D	10/14/99 10:26	68.41	
D	10/18/99 9:09	68.13	
D	11/2/99 9:32	67.53	
D	2/1/00 18:56	66.74	
L	7/27/00 10:17	65.98	

3.0 Supporting Documentation for RPP-ASMT-53793, Section 4.1.4, Chemistry

3.1 Occurrence Report 74-30, 1974, Failure to Obtain Routine Monthly Samples in Tank 102-AY, Atlantic Richfield Hanford Company, Richland, Washington.

File

ARHCO OCCURRENCE REPORT

CONTRACTOR	FACILITY	WORK AREA
Atlantic Richfield Hanford Company	AY Tank Farm - 102-AY Tank	200 East

REPORT NO.		DATE AND TIME OF OCCURRENCE
74-30	☐ PRELIMINARY ☐ INTERIM ☒ FINAL	

OCCURRENCE SUBJECT

Failure to obtain routine monthly samples in Tank 102-AY

1. DESCRIPTION OF OCCURRENCE AND DESIGNATION OF APPARENT CAUSE

☐ DESIGN ☐ MATERIAL ☒ PERSONNEL ☒ PROCEDURE ☐ OTHER

Specification RL-SEP-269 section 5.3 states that monthly samples are to be taken of liquid in the spare standby tank (102-AY). Records show that this tank was not sampled during March.

CORRECTION — ON RL OCCURRENCE 74-30:

Page 1: No. 2 last sentence: should read

"a pH of 11.1...."

instead of 1.1

bcc: CE Backman
G. Burton, Jr.
HE Campbell
GT Dukelow
CW Malody
GC Oberg
HP Shaw
RM Smithers (2)
GT Stocking
JA Teal
JH Warren
RA Zinsli
Central File

2. OPERATING CONDITIONS OF THE FACILITY AT TIME OF OCCURRENCE (IF APPLICABLE)

Tank 102-AY is the boiling waste spare tank in 200 East Area. It presently contains about six feet of water kept hot by a steam coil. The typical analysis of the liquid shows a ph of 11.1 and 20 millirad per hour.

(OVER)

\# 74-30

3. IMMEDIATE EVALUATION, CORRECTIVE ACTION TAKEN AND RESULTS

Instructions were issued to sample the tank and to place the sampling routine on an appropriate notification or "tickle card" system.

4. RECOMMENDATIONS

A. TEMPORARY CORRECTIVE ACTION

Tank was sampled during April and May as required.

B. PERMANENT CORRECTIVE ACTION

This and other similar sampling routines have been reviewed and placed on a notification system.

C. IS DESIGN CHANGE NECESSARY?	IF YES, WHEN	
☐ YES ☒ NO		
D. IS FURTHER EVALUATION NECESSARY?	IF YES, BY WHOM	WHEN
☐ YES ☒ NO		

5. SIMILAR OCCURRENCE: BY REPORT NUMBER AND OCCURRENCE SUBJECT

None.

cc: OJ Elgert, AEC-RL (3)
HE Smith, AEC-RL
JR Straub, AEC-RL

ORIGINATED BY	TITLE	DATE
J. A. Teal [signature]	Manager, Tank Farm Operations	21 MAY 74
REVIEWED BY	TITLE	DATE
G. C. Oberg [signature]	Manager, Operations Technical Support	5/21/74
APPROVED BY (PER CONTRACTOR OPERATING INSTRUCTIONS)	TITLE	DATE
R. M. Smithers [signature]	Manager, Tank Farm Management Dept.	5/22/74

3.2 Letter from R. E. Wheeler to R. L. Walser, "Tank Farm Samples," June 25, 1974.

TCRC-3

emw AY-102

Atlantic ... field Hanford Company

AY-102-1

(17) 6/25/1974

Date: June 25, 1974

To: R. L. Walser

From: R. E. Wheeler *RWheeler*

Subject: TANK FARM SAMPLES

★ T-5314 102 AY

Vis-OTR: Clear, yellow. No solids. 200 mrad/hr

pH: 11.2

Na: 0.744 M

GEA: $^{134}Cs - 7.12 \times 10^2$ µCi/gal
$^{137}Cs - 7.27 \times 10^4$ µCi/gal

T-5315 - 101A

T-5315 101-A

Vis-OTR: Dark Brown. 5% solids. 3500 mrad/hr

pH: 11.15

Na: 3.60 M

GEA: $^{60}Co - 3.28 \times 10^3$ µCi/gal
$^{125}Sb - 8.14 \times 10^3$ µCi/gal
$^{134}Cs - 7.27 \times 10^3$ µCi/gal
$^{137}Cs - 7.04 \times 10^5$ µCi/gal
$^{154}Eu - 4.69 \times 10^3$ µCi/gal

Could this go to 241 as feed?

T-5316 106-A

Vis-OTR: Dark brown, ~5% solids. 2500 mrad/hr

pH: 12.60

Na: 2.20 M

GEA: $^{60}Co - 2.42 \times 10^3$ µCi/gal
$^{134}Cs - 3.36 \times 10^3$ µCi/gal
$^{137}Cs - 3.31 \times 10^5$ µCi/gal
$^{154}Eu - 6.58 \times 10^3$ µCi/gal

REW:jd

How about 104A supernate? ? Cs 137 1.3 c/gal

54-6000-030 (10-68)

3.3 Letter to J. C. Womack, "Analyses of Tank Farm Sample, Sample No. T5510 Tank 102-AY Received July 21, 1976, September 20, 1976.

Date: 9-20-76

To: J. C. Womack

From: Supervisor, Analytical Services

Subject: ANALYSES OF TANK FARM SAMPLE
Sample No: T5510 Tank: 102-AY Received: 7-1-76

VIS-OTR: Yellow, green, small black specs, no organic 400 mRAD/hr

pH	10.2	CO_3	8.88×10^{-2} M	Al	2.05×10^{-3} M
SpG	—	PO_4	$< 1 \times 10^{-2}$ M	Na	— M
$\%H_2O$	98.16%	SO_4	— M	~~Cu~~	— M
OH	1.44×10^{-2} M	Cl	— M	~~Pb~~	— M
NO_3	$< 3 \times 10^{-3}$ M	F	— M	~~Hg~~	— M
NO_2	$< 1 \times 10^{-2}$ M				

Pu	$< 2.83 \times 10^{-6}$ g/gal	89,90Sr	4.35×10^{3} μCi/gal
GEA: 137Cs	6.78×10 μCi/gal	106RuRh	3.26×10^{4} μCi/gal
134Cs	— μCi/gal	154Eu	— μCi/gal
60Co	— μCi/gal	155Eu	— μCi/gal
144Ce	— μCi/gal	125Sb	— μCi/gal
144Pr	— μCi/gal		

COOLING CURVE: (crossed out)
35° for ____ minutes ____
30° for ____ minutes ____
25° for ____ minutes ____
20° for ____ minutes ____
15° for ____ minutes ____
10° for ____ minutes ____
5° for ____ minutes ____

DTA: No Exotherms below 200°C

BEST AVAILABLE COPY

54-6000-030 (10-69)

3.4 Letter, "Analyses of Tank Farm Samples," August 10, 1978.

Internal Letter

Rockwell International

Date: 8/10/78

No.

TO: (Name, Organization, Internal Address)

FROM (Name, Organization, Internal Address, Phone)
Manager, Special Analysis
2704-S Building
200 West Area
2-2449

Subject: Analyses of Tank Farm Samples
Serial No. 1986 Tank 242-AFD TK 102AY
Received 7/27/78

VIS-OTR Clear Light Yellow .15 Rad/HG

PH	9.8	SO_4	< 6×10^{-3} M
SPG	1.000	Pm^{147}	4.84×10^{3} µCi/gal.
OH	5.16×10^{-3} M	NO_3	.235 M
AL	< 1.79×10^{-3} M		
NO_2	1.81×10^{-2} M	COOLING CURVE	
PO_4	1.16×10^{-3} M		No Solids
CO_3	2.90×10^{-2} M		
Pu	2.36×10^{-5} g/gal.		
$Sr^{89,90}$	Sample Slurped µCi/gal.		
%H2O	98.5 wt.%		
Na	.771 M		
F^-	1.45×10^{-4} M		
CL^-	< 1.9×10^{-3} M		
DTA	No Exotherm		

GEA:

^{137}Cs	5.90×10^{4} µCi/gal.	$^{106}PuRh$	µCi/gal.
^{134}Cs		^{154}Eu	
^{60}CO		^{155}Eu	
^{144}Ce		^{125}Sb	
^{144}Pr			

Form 131-R Rev. 3-76

3.5 Letter to D. R. Autery, "Analyses of Tank Farm Samples," September 1, 1978.

Internal Letter

Rockwell International

Date 9/1/78

TO: (Name, Organization, Internal Address)

D. R. Autery

Manager, Special Analysis
222-S Bldg.
200 West Area
2-2449

Subject:

Analyses of Tank Farm Samples
Serial No. 2517 Tank 102 AY
Received 8/7/78

VIS-OTR Light Green c.149 Rad/Hr.

PH	10.3	SO_4	<.003 M
SPG	0.997	Pm^{147}	.00678 Ci/gal.
OH	.021 M	NO_3	.302 M
AL	.00087 M	Total Carbon	3.8 g/gal.
NO_2	.026 M		
PO_4	.021 M	Cooling Curve	No Solids Throughout all temp's.
CO_3	.036 M		
Pu	.00015 g/gal.		
$Sr^{89,90}$	.0401 Ci/gal.		
%H20	97.8 wt.%		
Na	.466 M		
F^-	.00019 M		
CL^-	.033 M		
DTA	No Exotherm		

GEA:

^{137}Cs	.0685 Ci/gal.	$^{106}PuRh$	Ci/gal.
^{134}Cs		^{154}Eu	
^{60}CO		^{155}Eu	
^{144}Ce		^{125}Sb	
^{144}Pr			

BEST AVAILABLE COPY

54-6000-(?)

3.6 Internal Letter 66120-79-151 from C. H. Delegard to L. D. Vanselow, " Analytical Data for Tanks 101-AZ, 102-AZ, 103-TX, and 102-AY Hot and Synthetic Liquors," September 21, 1979.

TCRC-4 AY102 2 AY-102 22

Internal Letter

Rockwell International

Date September 21, 1979

No. 65120-79-151 J

(15) 9/21/1979

TO: (Name, Organization, Internal Address)
L. D. Vanselow
Systems Engineering
2750-E, 200 East

FROM: (Name, Organization, Internal Address, Phone)
C. H. Delegard
Chemical Sciences Group
222-S, 200 West
2-1571

Subject: Analytical Data for Tanks 101-AZ, 102-AZ, 103-TX, and 102-AY Hot and Synthetic Liquors

Homogeneity of waste liquors held in a given tank has been accepted in practice, but never confirmed. This statistically-based experiment has been designed to test if tanked liquor is indeed homogeneous.

Four tanks; 101-AZ, 102-AZ, 103-TX, and 102-AY; were selected for this test. Each tank was sampled in four locations. Two samples, one near the top and one near the bottom surfaces of the liquor, were taken through each of two different risers in each tank. These samples were analyzed for density and chemical and radionuclide content by the Analytical Laboratory. Synthetic waste simulations were then prepared based on the average of the four samples' analyses. In the case of Tank 101-AZ, however, two simulations (one for each riser) were prepared based on the average of the "top" and "bottom" samples' analyses. The synthetics were submitted and the original samples resubmitted together for analyses by the Analytical Laboratory.

The duplicate analyses of the original hot samples provide data to determine analytical error. Analyses of the synthetics help in evaluating our accuracy in simulating hot wastes. Statistical comparison of the four samples taken from each tank determine if the tank contents are homogeneous.

The analytical data, as obtained to date, are presented in the attached tables. The high organic carbon concentration in samples from Tank 102-AZ caused fluorescent interference in the laser Raman technique used to measure nitrate and sulfate. As indicated in the table, the laser Raman nitrate ion determination for the first set of hot samples was subject to high error. To eliminate this error, the second set of hot samples was analyzed for nitrate by specific ion electrode. No alternate technique for sulfate analysis exists. Paired comparison of the first and second nitrate analyses for the Tank 102-AZ should, therefore, not be used to ascertain analytical error. In a similar way, due to low concentration, aluminum and hydroxide in the Tank 102-AZ samples were quantified by atomic absorption and pH titration, respectively. The other tanks' samples' aluminum and hydroside values were determined by thermal titration. These data should be considered separately in evaluating analytical error. In each of the other physical, chemical, and radionuclide analyses, a single analytical method was used.

Please call me if you have any questions regarding this work.

C. H. Delegard, Advanced Chemist
Waste Chemistry Unit

CHD:jkr

Attachment

Information: J. S. Buckingham
K. G. Carothers
G. T. Dukelow
L. R. Hill
F. M. Jungfleisch FMJ
T. A. Lane
D. L. Merrick
S. B. Wilson-Wright
File Code: KF55E
Process Aids (8)

[illegible] top — 24-5 bottom — 24-15 top — 24-15 bottom — Synth. — Synth.

Sample No.	1463	1494A	1464	1494B	1465	1495A	1466	1495B	1490	1491
Sp G (g/ml)	1.584	1.414	1.409	1.418	1.411	1.419	1.414	1.448	1.453	1.456
% H_2O	48.34	47.46	49.65	53.68	48.94	50.72	48.29	47.42	44.57	44.00
Al (M)	1.09	1.36	1.03	1.42	1.43	1.38	1.44	1.42	1.088	1.426
OH (M)	2.94	2.66	3.04	2.65	2.68	2.66	2.64	2.70	3.04	2.72
NO_2 (M)	2.43	2.68	2.49	2.65	2.65	2.64	2.37	2.68	2.48	2.44
NO_3 (M)	2.67	2.91	2.80	3.01	2.95	2.98	2.94	2.90	3.14	3.16
PO_4 (M)	0.022	0.0283	0.026	0.0273	0.028	0.0290	0.024	0.0294	0.030	0.032
CO_3 (M)	0.20	0.180	0.20	0.160	0.20	0.160	0.20	0.170	0.20	0.26
SO_4 (M)	—	0.053	—	—	—	0.231	—	—	—	—
TOC (g/l)	11.6	15.8, 9.84	11.6	13.1, 9.08	13.6	16.1	13.6	17.0	25.6	22.4
Pu (g/l)	5.96^{-5}	—	6.81^{-5}	—	6.05^{-5}	—	6.05^{-5}	—	—	—
Sr (μCi/l)	1.09^{4}	—	1.08^{4}	—	1.07^{4}	—	9.61^{3}	—	—	—
^{137}Cs (μCi/l)	3.97^{5}	—	3.86^{5}	—	3.75^{5}	—	3.83^{5}	—	—	—

101112

24

	24-G top		24G bottom		24-E top		24-E bottom		Synth.	Synth. rerun
Sample No.	1456	1496A	1457	1496B	1458	1496C	1459	1496D	1492B	1492B rerun
SpG (g/ml)	1.393	1.378	1.398	1.320	1.391	1.379	1.386	1.360	1.280	—
% H_2O	49.03	48.22	48.89	47.85	48.85	48.00	48.76	48.83	62.02	—
Al (M) *	0.136	0.106	0.127	0.109	0.136	0.111	0.123	0.113	—	0.134
OH (M) ǂ	1.04	1.15	0.992	1.22	1.04	1.21	0.868	1.22	2.02	1.596
NO_2 (M)	0.263	0.418	0.274	0.418	0.297	0.418	0.283	0.418	0.324	0.318
NO_3 (M)	2.29 ± 75% +	4.33 ×	2.92 ± 95% +	4.32 ×	3.74 +	4.32 ×	3.59 +	4.20 ×	1.312 +	3.22 +
PO_4 (M)	0.00328	0.00817	0.00712	0.00842	0.00553	0.00831	0.00761	0.00809	0.00288	—
CO_3 (M)	0.690	0.750	0.700	0.770	0.700	0.650	0.60	0.650	0.40	0.94
SO_4 (M)	—	—	—	—	—	—	—	—	—	—
TOC (g/l)	112	88.0, 87.0	112	86.8, 87.8	112	122, 87.2	123	88.2, 85.2	31.2	188.8, 174.8
Pu (g/l)	1.53^{-3}	—	1.67^{-3}	—	1.83^{-3}	—	1.74^{-3}	—	—	—
Sr (µCi/l)	2.50^{5}	—	2.60^{5}	—	2.59^{5}	—	2.49^{5}	—	—	—
134 Cs (µCi/l)	2.96^{5}	—	3.01^{5}	—	3.07^{5}	—	2.93^{5}	—	—	—

+ Nitrate analyzed by laser-Raman technique; high error due to fluorescent interference from organic carbon.
× Nitrate analyzed by specific ion electrode.
* Aluminum analyzed by atomic absorption, instead of thermal titration, due to low concentration.
ǂ Hydroxide analyzed by pH titration, instead of thermal titration, due to low concentration.

102 AZ
√

Sample No.	1467	1497A	1465	1497B	1461	1497C	1470	1497D	1493
SpG (g/ml)	1.261	1.250	1.241	1.250	1.243	1.236	1.251	1.242	1.266
% H_2O	69.55	68.92	65.82	69.36	69.32	69.07	68.57	68.50	65.69
Al (M)	0.638	0.643	0.651	0.638	0.653	0.642	0.646	0.637	0.656
OH (M)	1.38	1.38	1.41	1.43	1.36	1.39	1.40	1.43	1.398
NO_2 (M)	0.990	1.06	0.924	1.07	0.406	1.06	0.435	1.07	1.072
NO_3 (M)	2.00	1.78	1.96	1.85	1.96	2.00	1.88	1.93	2.14
PO_4 (M)	0.037	0.036	0.058	0.038	0.035	0.036	0.035	0.041	0.048
CO_3 (M)	0.23	0.160	0.210	0.150	0.230	0.170	0.220	0.160	0.188
SO_4 (M)	0.021	0.017	0.020	—	—	—	—	0.018	—
TOC (g/l)	3.24	3.38	3.28	3.40	3.04	3.16	3.46	2.68	4.2
Pu (g/l)	2.01^{-4}	—	2.24^{-4}	—	2.21^{-4}	—	2.02^{-4}	—	—
Sr (µCi/l)	1.74^{3}	—	2.12^{3}	—	1.71^{3}	—	1.80^{3}	—	—
^{137}Cs (µCi/l)	1.85^{5}	—	1.84^{5}	—	1.85^{5}	—	1.89^{5}	—	—

103-TX

Allow — 15-D Top — 15-D bottom

Sample No.	1501	1508A	1502	1508B	1503	1508C	1504	1508D	1507
SpG (g/ml)	1.400	1.347	1.480	1.419	1.404	1.399	1.405	1.346	1.445
% H_2O	49.14	53.73	46.52	52.01	47.60	50.46	46.01	49.57	50.06
Al (M)	1.30	1.13	1.36	1.05	1.30	1.33	1.38	1.16	1.23
OH (M)	2.32	2.43	2.56	2.88	2.39	2.39	2.61	2.76	2.63
NO_2 (M)	2.33	2.08	2.44	2.28	2.35	2.12	2.34	2.10	1.36
NO_3 (M)	3.08	2.83	3.16	3.14	3.08	3.09	3.39	2.73	3.74
PO_4 (M)	0.028	0.026	0.027	0.028	0.025	0.024	0.026	0.023	0.031
CO_3 (M)	0.290	0.310	0.180	0.170	0.250	0.250	0.180	0.170	0.280
SO_4 (M)	0.044	0.10	0.032	0.074	0.030	0.086	0.034	0.043	0.0472
TOC (g/l)	10.5	7.28	10.8	7.76	10.0	6.40	10.8	7.96	18.6
Pu (g/l)	3.67^{-5}	—	3.47^{-5}	—	3.42^{-5}	—	3.55^{-5}	—	—
Sr (μCi/l)	2.22^{4}	—	2.43^{4}	—	2.27^{4}	—	2.26^{4}	—	—
^{137}Cs (μCi/l)	3.92^{5}	—	4.03^{5}	—	3.78^{5}	—	4.08^{5}	—	—

ENTER — ENTER — ENTER — ENTER

160 AY

3.7 Internal Letter 65124-79-029 from C. H. Delegard, "Relative Random Error Standard Deviation and Accuracy in Hanford Waste Liquor Analytical Data," December 3, 1979.

TCRC-5 (16) 12/3/1979 AY-102 13

Internal Letter

Rockwell International

Date December 3, 1979 No. 65124-79-029

TO: (Name Organization Internal Address)
Those Listed

FROM: (Name Organization Internal Address Phone)
C. H. Delegard
Chemical Sciences Group
222-S, MO-037, 200 West
2-1571

Subject: Relative Random Error Standard Deviation and Accuracy in Hanford Waste Liquor Analytical Data

Ref: Letter, September 21, 1979, C. H. Delegard to L. D. Vanselow, Analytical Data for Tanks 101-AZ, 102-AZ, 103-TX, and 102-AY

In the referenced letter, chemical, phsyical, and radionuclide analytical data were presented for waste liquor samples taken from the Tanks 101-AZ, 102-AZ, 103-TX, and 102-AY. Four samples were taken from each tank. Duplicate chemical and phsyical analyses were run on these samples in separate, blind submissions to the Analytical Laboratory (AL). In addition, five synthetic waste simulations of these various hot samples were prepared. These synthetics were each analyzed once by AL.

Paired comparison of the hot samples' analyses may be used to estimate the random error standard deviation (RESD) of the analysis. Comparison of the nominal and analyzed composition of the synthetics may be used to estimate analytical accuracy. The formula used to evaluate the RESD is:

$$RESD = \left(\frac{\sum_{i=1}^{n} (M_{1i} - M_{2i})^2}{n - 1} \right)^{1/2}$$

Where M_{1i}, M_{2i} = the first and second measurements of sample and n = total number of samples.

Since a given analysis (e.g., nitrite ion concentration) may exhibit a wide range of values in our set of waste liquor samples, the relative random error standard deviation (RRESD) was calculated as a more meaningful measure of random error. RRESD is:

$$RRESD = \left(\frac{\sum_{i=1}^{n} \left(\frac{M_{1i} - M_{2i}}{\overline{M}_i} \right)^2}{n - 1} \right)^{1/2}$$

Where $\overline{M} = (M_{1i} + M_{2i})/2$.

Those Listed
Page 2
December 3, 1979

Each analytical technique was considered separately in evaluating RRESD. For example, aluminum was analyzed using thermal titration for samples with concentration $\gtrsim$ 0.5 M and by atomic absorption spectrometry for samples of $\lesssim$ 0.5 M Al. The RRESD was calculated for each of these techniques individually.

Several factors contribute to RRESD. Besides the intrinsic RRESD of the analytical technique used, differing shifts, analysts, and standards recovery contribute to RRESD. Precipitation/dissolution of components in these high salt waste liquor samples is possible and would also contribute to RRESD.

The RRESD's calculated from the referenced data are presented in Table I. The RRESD's are a measure of the precision or reproducibility of the analytical data.

To crudely assess the accuracy of the AL waste liquor analyses, the percent recoveries of components were calculated for the five synthetic waste liquors prepared. Percent recovery equals:

$$\text{Percent Recovery} = \frac{\text{Concentration, As Analyzed}}{\text{Concentration, As Prepared}} \times 100\%$$

The percent recoveries are presented in Table II. Except for aluminum and hydroxide, the standard deviation of these percent recoveries generally correspond to the RRESD's given in Table I. The hot and synthetic waste liquor analytical data used in these evaluations are shown in Table III.

This information is presented to aid in evaluating analytical data received from AL. Please call me regarding any questions on this work.

C. H. Delegard, Advanced Chemist
Waste Chemistry Unit

CHD:jkr

Those Listed
J. S. Buckingham
D. A. Dodd
D. L. Herting
C. B. Honaker
J. E. Horton
K. Iwatate
J. R. Jewett
F. M. Jungfleisch
L. P. McRae
M. E. Mitchell
K. J. Patterson
R. R. Rietz
W. H. Sant
A. E. Schilling
D. A. Sebelien
D. Shephard
D. L. Uebelacker
S. B. Wilson-Wright

1

Table I

RELATIVE RANDOM ERROR STANDARD DEVIATION
OF ANALYTICAL LABORATORY DATA ON HANFORD WASTE LIQUORS

Analysis	Technique	Procedure Number	Range of Values	Relative Random Error Std. Deviation(%)	Number Data Pairs
SpG(g/ml)	weigh pipet	DW-03	1.236-1.456	1.7	16
% H_2O	105° C evap.	PWTF-01	44.06-69.55	5.1	16
Al (M)	therm. titr.	ALTTM-01	0.637-1.44	15	12
	AAS	AAS-02	0.106-0.136	21	4
OH (M)	therm. titr.	ALTTM-01	1.36-3.04	6.9	12
	pH titr.	OHV-01	0.968-2.02	21	4
NO_2 (M)	color.	NO2SP-01	0.263-2.68	23	16
NO_3 (M)	Raman	ANRAM-01	1.78-3.74	8.8	12
PO_4 (M)	extr./color.	PS-02	0.00288-0.048	24	16
CO_3 (M)	acid./gas anal.	CO3IR-01	0.16-0.94	20	16
SO_4 (M)	Raman	ANRAM-01	0.017-0.10	75	5
TOC (g/l)	pyrolysis	CTOTO-01	2.68-188.8	25	16

1

Table II

PERCENT RECOVERIES OF
SYNTHETIC WASTE COMPONENTS

Component	Percent Recovery					Ave. % Recovery	Standard Deviation
Al	102.6	99.4	102.7	101.4	92.1	99.6	4.4
OH	101.7	102.3	158	100.8	106.5	113.9	25
NO_2	100.8	97.2	113.9	114.2	57.5	96.7	23
NO_3	114.8	107.3	102.7	109.7	117.7	110.4	6.0
PO_4	122	123	48.9	132	117.0	108.6	34
CO_3	100.0	130	140	84.5	124	115.7	23
TOC	221	165	159	129	177	170	33

The synthetic waste liquors were made without sulfate.
EDTA and HEDTA were the chemicals used as organic carbon sources.

Table III

Tank 101-AZ

Riser	24-E Top		24-E Bottom		24-G Top		24-G Bottom		24-E Synth.	24-G Synth.
Sample No.	1463	1494A	1464	1494B	1465	1495A	1466	1495B	1490	1491
SpG(g/ml)	1.384	1.414	1.409	1.418	1.411	1.419	1.414	1.448	1.453	1.456
% H_2O	48.34	47.46	49.65	53.68	48.94	50.72	48.29	47.42	44.51	44.06
Al (M)	1.09	1.36	1.03	1.42	1.43	1.38	1.44	1.42	1.088	1.426
OH (M)	2.94	2.66	3.04	2.65	2.68	2.66	2.64	2.70	3.04	2.72
NO_2 (M)	2.43	2.68	2.49	2.65	2.65	2.64	2.37	2.68	2.48	2.44
NO_3 (M)	2.67	2.91	2.80	3.01	2.95	2.98	2.94	2.90	3.14	3.16
PO_4 (M)	0.022	0.0283	0.026	0.0273	0.028	0.0290	0.024	0.0294	0.030	0.032
CO_3 (M)	0.20	0.180	0.20	0.160	0.20	0.160	0.20	0.170	0.20	0.26
SO_4 (M)	--	0.053	--	--	--	0.231	--	--	--	--
TOC (g/l)	11.6	15.8, 9.84	11.6	13.1, 9.08	13.6	16.1	13.6	17.0	25.6	22.4
Pu (g/l)	5.96^{-5}	--	6.81^{-5}	--	6.05^{-5}	--	6.05^{-5}	--	--	--
Sr (μCi/l)	1.09^{4}	--	1.08^{4}	--	1.07^{4}	--	9.61^{3}	--	--	--
^{137}Cs (μCi/l)	3.97^{5}	--	3.86^{5}	--	3.75^{5}	--	3.83^{5}	--	--	--

Tank 102-AZ

Riser	24-G Top		24-G Bottom		24-E top		24-E Bottom		Synth.	Rerun Synth.
Sample No.	1456	1496A	1457	1496B	1458	1496C	1459	1496D	1492B	1492B Rerun
SpG (g/ml)	1.393	1.378	1.398	1.380	1.391	1.379	1.386	1.360	1.280	--
% H_2O	49.03	48.22	48.89	47.85	48.85	48.00	48.76	48.83	62.02	--
Al (M)*	0.136	0.106	0.127	0.109	0.136	0.111	0.123	0.113	--	0.134
OH (M)†	1.04	1.15	0.992	1.22	1.04	1.21	0.968	1.22	2.02	1.596
NO_2 (M)	0.263	0.418	0.274	0.418	0.297	0.418	0.283	0.418	0.324	0.318
NO_3 (M)	2.29±75%[+]	4.33[x]	2.92±95%[+]	4.32[x]	3.74[+]	4.32[x]	3.59[+]	4.20[x]	1.312[+]	3.22[+]
PO_4 (M)	0.00328	0.00817	0.00712	0.00842	0.00553	0.00831	0.00761	0.00809	0.0288	--
CO_3 (M)	0.690	0.750	0.700	0.770	0.700	0.650	0.60	0.650	0.40	0.94
SO_4 (M)	--	--	--	--	--	--	--	--	--	--
TOC (g/l)	112	88.0, 87.0	112	86.8, 87.8	112	122, 87.2	123	88.2, 85.2	31.2	188.8, 174.8
Pu (g/l)	1.53^{-3}	--	1.67^{-3}	--	1.83^{-3}	--	1.74^{-3}	--	--	--
Sr (µCi/l)	2.50^{5}	--	2.60^{5}	--	2.59^{5}	--	2.49^{5}	--	--	--
^{137}Cs (µCi/l)	2.96^{5}	--	3.01^{5}	--	3.07^{5}	--	2.93^{5}	--	--	--

+Nitrate analyzed by laser Raman technique; high error due to fluorescent interference from organic carbon.
xNitrate analyzed by specific ion electrode.
*Aluminum analyzed by atomic absorption, instead of thermal titration, dur to low concentration.
†Hydroxide analyzed by pH titration, instead of thermal titration, due to low concentration.

Tank 103-TX

Riser	9-A Top		9-A Bottom		? Top		? Bottom		Synth.
Sample No.	1467	1497A	1468	1497B	1469	1497C	1470	1497D	1493
SpG (g/ml)	1.261	1.250	1.241	1.250	1.243	1.236	1.251	1.242	1.266
% H_2O	69.55	68.92	68.82	69.36	69.32	69.07	68.57	68.50	65.69
Al (<u>M</u>)	0.638	0.643	0.651	0.638	0.653	0.642	0.646	0.637	0.656
OH (<u>M</u>)	1.38	1.38	1.41	1.43	1.36	1.39	1.40	1.43	1.398
NO_2 (<u>M</u>)	0.990	1.06	0.924	1.07	0.906	1.06	0.935	1.07	1.072
NO_3 (<u>M</u>)	2.00	1.78	1.96	1.85	1.96	2.00	1.88	1.93	2.14
PO_4 (<u>M</u>)	0.037	0.036	0.038	0.038	0.035	0.036	0.035	0.041	0.048
CO_3 (<u>M</u>)	0.23	0.160	0.210	0.150	0.230	0.170	0.220	0.160	0.188
SO_4 (<u>M</u>)	0.021	0.017	0.020	--	--	--	--	0.018	--
TOC (g/l)	3.24	3.38	3.28	3.40	3.04	3.16	3.46	2.68	4.2
Pu (g/l)	2.01^{-4}	--	2.24^{-4}	--	2.21^{-4}	--	2.02^{-4}	--	--
Sr (µCi/l)	1.74^{3}	--	2.12^{3}	--	1.71^{3}	--	1.80^{3}	--	--
^{137}Cs (µCi/l)	1.85^{5}	--	1.84^{5}	--	1.85^{5}	--	1.89^{5}	--	--

Tank 102-AY

Riser	15-D Top		15-D Bottom		15-L Top		15-? Bottom		Synth.
Sample No.	1501	1508A	1502	1508B	1503	1508C	1504	1508D	1507
SpG (g/ml)	1.400	1.397	1.480	1.419	1.404	1.399	1.405	1.396	1.445
% H_2O	49.14	53.73	46.52	52.01	47.60	50.46	46.01	49.51	50.06
Al (M)	1.30	1.13	1.36	1.05	1.30	1.33	1.38	1.16	1.23
OH (M)	2.32	2.43	2.56	2.88	2.39	2.39	2.61	2.76	2.63
NO_2 (M)	2.33	2.08	2.44	2.28	2.35	2.12	2.34	2.10	1.36
NO_3 (M)	3.08	2.83	3.16	3.14	3.08	3.09	3.39	2.73	3.74
PO_4 (M)	0.028	0.026	0.027	0.028	0.025	0.024	0.026	0.023	0.031
CO_3 (M)	0.290	0.310	0.180	0.170	0.250	0.250	0.180	0.170	0.280
SO_4 (M)	0.044	0.10	0.032	0.074	0.030	0.086	0.034	0.043	0.0472
TOC (g/l)	10.5	7.28	10.8	7.76	10.0	6.90	10.8	7.96	18.6
Pu (g/l)	3.67^{-5}	--	3.47^{-5}	--	3.42^{-5}	--	3.55^{-5}	--	--
Sr (μCi/l)	2.22^{4}	--	2.43^{4}	--	2.27^{4}	--	2.26^{4}	--	--
^{137}Cs (μCi/l)	3.92^{5}	--	4.03^{5}	--	3.78^{5}	--	4.08^{5}	--	--

3.8 Analytical Results Tank 102-AY from March 1980 through September 1980.

...rnal Letter

Rockwell Interna...

From: Manager, Services
222-S Laboratory
200 W
2-2965 or 2-2435

Subject: Analytical Results

TANK SAMPLE NUMBER 102 AY- 242-A-Bm

AL SERIAL NUMBER T8880

DATE RECEIVED 3/16/80

DILUTION FACTOR* None.

VIS-OTR Dk Green <6 mrad. <1% Solids

ANALYSIS	RESULTS		ANALYSIS	RESULTS	
pH	NR		PO_4	6.24^{-3}	M
SpG	1.418		CL	NR	M
% H_2O	50.58	wt %	F	NR	M
TA	NR		SO_4	NR	M
Al	2.608	M	CO_3	.21	M
OH	1.397	M	TorgC	11.5	g/l C
NO_3	2.86	M	NA	NR	M
NO_2	2.42	M			

Cooling Curve

TEMP C	% SOLIDS
50	no solids %
40	%
30	%
20	%
10	%
5	%
0	%

Pm 147	NR	uCi/l
Sr 89,90	2.02×10^4	uCi/l
Pu	3.87×10^{-5}	g/l

GEA

Cs-137	4.11×10^5	uCi/l		uCi/l
Cs-134		uCi/l		uCi/l
		uCi/l		uCi/l

NR = Not Requested ND = Not Detected

*The dilution factor is included in the calculations.

Rockwell Hanford

Manager, Services
222-S Laboratory
200 W
2-2965 or 2-2435

Analytical Results

TANK SAMPLE NUMBER 102 AY - 242 ABm.

AL SERIAL NUMBER T8851

DATE RECEIVED 3/16/80

DILUTION FACTOR* None

VIS-OTR DK Green <6mrad <1% Solids.

ANALYSIS	RESULTS		ANALYSIS	RESULTS	
pH	NR		PO_4	6.41^{-3}	M
SpG	1.414		CL	NR	M
% H_2O	56.56	wt %	F	NR	M
TA	NR		SO_4	NR	M
Al	2.612	M	CO_3	.21	M
OH	1.455	M	TorgC	12.5	g/l C
NO_3	3.17	M	NA	NR	M
NO_2	2.24	M			

Cooling Curve

TEMP C	% SOLIDS
50	5.4 %
40	%
30	%
20	%
10	%
5	%
0	%

Pm 147	NR	uCi/l
Sr 89,90	2.09×10^{4}	uCi/l
Pu	3.82×10^{-5}	g/l

GEA

Cs-137	3.99×10^{5}	uCi/l		uCi/l
Cs-134		uCi/l		uCi/l
		uCi/l		uCi/l

NR = Not Requested ND = Not Detected *The dilution factor is included in the calculations.

Manager, Services
222-S Laboratory
200 W
2-2965 or 2-2435

Analytical Results

TANK SAMPLE NUMBER 102-AY 242-A BM

AL SERIAL NUMBER T-2944

DATE RECEIVED 8-1-80 DILUTION FACTOR* 2.2766

VIS-OTR Light Green 1 rad/Hr

ANALYSIS	RESULTS	ANALYSIS	RESULTS
pH	NR	PO_4	.064 M
SpG	1.401 (CALC)	CL	NR M
% H_2O	66.22 wt %	F	NR M
DTA	NR	SO_4	NR M
Al	.450 M	CO_3	.364 M
OH	2.03 M	TorgC	14.3 g/l C
NO_3	2.97 M	NA	NR M
NO_2	1.83 M		

Cooling Curve

TEMP C	% SOLIDS
50	NR %
40	%
30	%
20	%
10	%
5	%
0	%

Pm 147	NR	uCi/l
Sr 89,90	8.06^3	uCi/l ← Not Run on Dil.
Pu	3.28×10^{-5}	g/l

GEA

Cs-137	3.08^5 uCi/l		uCi/l
Cs-134	uCi/l		uCi/l
	uCi/l		uCi/l

NR = Not Requested ND = Not Detected

*The dilution factor is included in the calculations.

Manager, Services
222-S Laboratory
200 W
2-2965 or 2-2435

Analytical Results

TANK SAMPLE NUMBER 102-AY 242-A BM

AL SERIAL NUMBER T-2945

DATE RECEIVED 8-1-80 DILUTION FACTOR* 2.3172

VIS-OTR LT Green No sol 2.0 Rad

ANALYSIS	RESULTS		ANALYSIS	RESULTS	
pH	NR		PO_4	.062	M
SpG	1.414 (CALC.)		CL	NR	M
% H_2O	61.37	wt %	F	NR	M
DTA	NR		SO_4	NR	M
Al	.395	M	CO_3	.440	M
OH	2.14	M	TorgC	14.6	g/l C
NO_3	2.94	M	NA	NR	M
NO_2	1.77	M			

Cooling Curve

TEMP C	% SOLIDS
50	NR %
40	%
30	%
20	%
10	%
5	%
0	%

Pm 147	NR	uCi/l
Sr 89,90	7.37×10^{3}	uCi/l
Pu	3.87×10^{-5}	g/l

GEA

Cs-137	3.03^{5}	uCi/l		uCi/l
Cs-134		uCi/l		uCi/l
		uCi/l		uCi/l

NR = Not Requested ND = Not Detected

*The dilution factor is included in the calculations

To:

From: Manager Services
222-S Laboratory
200 West Area
3-2965 or 3-2435

Tank Number 102-AY 242-A-BM

AL serial No. T-4876

Date Received 9-22-80

Dilution Factor NONE *

ANALYSIS	RESULTS		ANALYSIS	RESULTS	
VIS-OTR	LT. GREEN .5 Rad/hr		PO_4	2.82^{-2}	M
PH	NR		Cl^-	NR	M
SPG	1.429		F^-	NR	M
% H_2O	51.34	wt. %	SO_4	NR	M
DTA	NR		CO_3	.360	M
Al	1.34	M	TorgC	4.88	g/l
OH	2.01	M	Na	NR	M
NO_3	2.98	M			
NO_2	2.36	M			
Pm 147	NR	uCi/l			
Sr 89/90	1.40×10^4	uCi/l			
Pu	3.33^{-5}	g/l			

Cooling Curve

Temp. C	% Solids
50	0 %
40	0 %
30	0 %
20	0 %
10	0 %
5	<1.0 %

GEA

Cs 137	4.09×10^5	uCi/l
Cs 134		uCi/l
		uCi/l

NR = Not Requested
N.D= Not Detected

* The dilution factor is included in the calculations.

3.9 Internal Letter 65453-81-130 from M. T. Jansky to M. Teats, "Composition of Waste from Tanks 101AY and 102AY," April 15, 1981.

(15) 4/15/1981

TC RC-7 AY/102-5 AY-102

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ernal Letter

Rockwell International

April 15, 1981

65453-81-130

Organization (Internal Address)
M. . Teats
Plant Engineering
2750E/A100/200E

FROM
M. T. Jansky
Separations Process Development Unit
222S/MO-037/200W
3-1571

Composition of Waste from Tanks 101AY and 102AY

samples of waste from the AY tank farm were shipped to the 222-S Labora-ry. Personnel from the Separations Process Development Unit received the ples and prepared them for analyses. The samples are discussed below.

AY - The sample from Tank 101AY was a dark brown liquid with only a few settled solids. The sample was thoroughly mixed, and an aliquot taken analyses. The remainder of the sample was filtered on a 0.45 micrometer posal filter. An aliquot of the filtrate was submitted for analyses. analytical data for both the total slurry and the filtrate are shown in le I. There were insufficient solids for solids characterization.

2AY - The sample from 102AY, in contrast to 101AY, contained approximately percent settled, coagulated solids. The sample did not mix well, turning to a brown, muddy-looking mixture when agitated. An aliquot of the total rry was taken, diluted, and submitted for analyses. It was noted that n a thin film of the slurry evaporated slightly, a voluminous quality of dle-like crystals formed. In the past, this phenomenon has been associated th sodium phosphate solids.

e remainder of the sample was filtered on a 0.45 micrometer disposable lter. The filtrate was diluted and submitted for analysis. The solids re readily dissolved in water and also submitted for analysis. The lytical data are shown in Table II for total slurry, filtrate, and solids.

e analytical data are questionable. The results for Tank 102AY indicate t the major components in the solids are carbonates and "complexants". wever, complexants should not precipitate, making the TOC analysis high. so, the presence of the phosphate needles in the waste, which was not rified by analytical data, indicates that the phosphate analyses are correct. Therefore, the data should be regarded as suspect.

lease call if you have any questions regarding these samples.

M. T. Jansky, Chemist
Separations Process Development Unit

MTJ/pjm

cc: J. S. Buckingham
H. J. Eding
L. A. Gale
D. L. Herting
T. B. Veneziano
D. G. Wilkins
Process Aids (8)
File Code: WB663

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TABLE I

Composition of Tank 101AY Waste (In Moles Per Liter)

Component	Total Slurry	Filtrate
$NaAlO_2$	Not Available	0.76
NaOH	1.04	0.53
$NaNO_2$	1.15	1.45
$NaNO_3$	1.92	1.75
Na_2CO_3	0.55	0.55
Na_3PO_4	0.79	0.05
TOC (g/L)	19.4	26.4
^{137}Cs (µCi/L)	3.86×10^5	3.41×10^5
^{90}Sr (µCi/L)	Not Available	Not Available
^{60}Co (µCi/L)	390	467
^{155}Eu (µCi/L)	1755	Not Available
^{240}Pu (g/L)	4.79×10^{-5}	5.3×10^{-4}
SpG	1.261	1.247

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AY-102 4/15/1981

TABLE II

Composition of Tank 102AY Waste

Component	Total Slurry (moles/liter)	Filtrate (moles/liter)	Solids* (wt. %)
$NaAlO_2$	1.12	0.83	
NaOH	1.88	2.05	
$NaNO_2$	1.97	0.47	21
$NaNO_3$	2.74	2.10	
Na_2CO_3	0.06	0.16	37
Na_3PO_4	0.06*	0.01**	**
TOC (g/L)	8.1	15.4	39**
^{137}Cs (μCi/L)	3.74×10^5	3.38×10^5	
^{90}Sr (μCi/L)	Not Available	Not Available	
^{240}Pu (g/L)	1.20×10^{-4}	1.17×10^{-5}	
SpG	1.385	1.343	

* Weight percent solids are based on an estimated aluminum content

** See text for discussion

3.10 Internal Letter 65453-082-228 from J. V. Panesko to N. W. Kirch, "Analysis of 102-AY Supernate," June 18, 1982.

AY/102-6 (14) 6/18/1982

60 TCRC-8

Internal Letter

Rockwell International

Date June 18, 1982

No. 65453-082-228

TO: (Name, Organization, Internal Address)
N. W. Kirch
Waste Management Process Technology Ut
2750E/A227/200 East

FROM: (Name, Organization, Internal Address, Phone)
J. V. Panesko
Separations Process Developm
222-S/MO-037/200 West
3-1228

Subject: Analysis of 102-AY Supernate

A sample of 102-AY supernate was taken 4 feet below the liquid surface on June 12, 1982. Analytical results are as follows:

pH - 13.01
SpG - 1.056
TOC - 0.36 g/l
Na - 1.9 M
Al - 0.047 M
NO_2^- - 0.054 M
OH^- - 0.23 M
NO_3^- - 0.18 M
$CO_3^=$ - 0.3 M
F^- - 0.0002 M
$SO_4^=$ - <0.0003 M
Cs-137 - 3.5×10^5 µCi/l
Sr ~~89~~-90 - 1.2×10^4 µCi/l
NH_3 - to be reported (call 3-2435)

J. V. Panesko (naj)
J. V. Panesko
Staff Chemist

JVP/naj

cc:
J. S. Buckingham
K. G. Carothers
J. H. Lawler
Process Aids
File: 102-AY
Letterbook

Inter
Date
TO:
Subject
Please
6 foot c
milestor
experime
energy.
T.D. Coo
Staff Ch
TDC/vlo
Attachme
cc: B.N.
L.C.
J.S.
K.G.
I.E.
R.C.
D.G.

3.11 SD-WM-PE-018, 1985, 242-A Evaporator/Crystallizer FY84 Campaign Run 84-3 Post Run Document, Rev. 0.

AY/102-7 (12) 12/7/1983 AY-102
Evaporator Campaign

ORIGINAL
Rockwell Hanford Operations

SUPPORTING DOCUMENT

Number	SD-WM-PE-018
Rev. Ltr./Chg. No.	REV 0
Page 1 of Total Pages	169

PROGRAM: Waste Management

Document Title:
242-A Evaporator/Crystallizer FY 84 Campaign Run 84-3 Post Run Document

Baseline Document ☐ Yes ☒ No

WBS No. or Work Package No.: W853C

Key Words:
242-A Evaporator, Double-Shell Slurry Feed, DSSF, Waste Volume Reduction, WVR, Throughput, TP, Tank Farms, Linked Runs, EC1 Condenser Leak, PREDICT, Recycle Transfers

Prepared by (Name and Dept. No.): N. J. Certa 65950 — Date: 7/25

See reverse side for additional approvals

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Abstract

The 242-A Evaporator processed 1,559 in. (4.29 million gal) of Dilute Double-Shell Slurry Feed (DDSSF) from December 1983 through March 1984. The total 242-A Throughput (TP) was 2,928 in. (8.05 million gal) and the Waste Volume Reduction (WVR) was 1,166 in. (3.21 million gal).

The first pass processed DDSSF from Tanks 102-AW, 104-AW, 105-AW, 101-AN, 103-AN, 102-AY, 102-SY, 244-BX, and 25-1 into an intermediate product requiring one nominal evaporator pass to reach Double-Shell Slurry Feed (DSSF). The pass employed a linked-run recycle transfer processing scheme: feed from selected storage tanks was transferred to the evaporator feed tank (102-AW), processed through the evaporator, and the slurry sent to Tank 104-AW. The slurry in Tank 104-AW was recycled by transferring it back to Tank 102-AW concurrent with evaporator operation. This allowed processing large amounts of dilute feed in a relatively short time, since discrete feed staging operations were avoided.

The second pass processed 767 in. (2.11 million gal) of slightly diluted intermediate product temporarily stored in Tanks 102-AW and 104-AW. The 425 in. of DSSF product from this pass was stored in Tanks 103-AN and 104-AN. The product will be processed into Double-Shell Slurry at a later date. Process Control for the second pass used run time feed samples and the PREDICT computer program to adjust Pressure-Temperature curves during the pass. This control method worked well, however,

Distribution

	Name	Mail Address
	J.F. Albaugh	2750E/200E
*	J.M. Allison	2750E/200E
*	J.S. Buckingham	222S/200W
*	K.G. Carothers	2750E/200E
	R.D. Claghorn	2750E/200E
	C.V. DiPol	2750E/200E
*	J.E. Dreher	2750E/200E
	M.T. Fineman	2750E/200E
*	J.C. Fulton	2750E/200E
*	M.J. Kelly	2750E/200E
	D.J. Lindsey	2750E/200E
*	J.P. Murphy	272AW/200E
	J.W. Patterson	2750E/200E
*	N.L. Pontious(3)	2750E/200E
	A.L. Reeser	2750E/200E
	D.A. Reynolds	2750E/200E
	W.H. Trott	2750E/200E
	T.B. Veneziano	2750E/200E
*	R.D. Wojtasek	2750E/200E

DOE-RL

Name	Mail Address
J.J. Krupar	FED/700
A.R. Schwankoff	FED/700
J.D. White	FED/700

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*COMPLETE DOCUMENT
(No asterisk, title page/summary of revision page only)

Release Stamp

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Apr 30 1 05 PM '85

(19)

Prepared By: ____________________

Used By: ____________________

A-6400-073 (R-2-83)

AY-102 Evaporator Campaign Samples.
12/7/1983

SAMPLE STATUS REPORT FOR T8916 102-AY A-FD TIME: 12-13-83 9:33
DISPATCHED: 12- 7-83 13:39 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 12- 8-83 19:13

EXT.	DETER.	RESULTS OR STATUS	OUT OF RANGE?	GOOD ANS?	CHARGE CODE
****	********	**********************************	***	***	******
1001	APPR/OTR	YELLOW -- CLEAR NO SOLIDS NO ORGANIC			WB65C
1101	Al	1.590E-01 M	N	Y	WB65C
1113	OH-	5.300E-01 M	N	Y	WB65C
[illegible]1	CO3	1.680E-01 M	N	Y	WB65C
1621	TOC	4.620E-01 GM/L C	N	Y	WB65C
1763	DENSITY	1.085E 00 NONE	N	Y	WB65C
2912	NO2	1.540E-01 M	N	Y	WB65C
2937	NO3	4.830E-01 M	N	Y	WB65C
3201	pH	1.313E 01 NONE	N	Y	WB65C
3261	PO4	5.380E-03 M	N	Y	WB65C
3707	SO4	3.280E-02 M	N	Y	WB65C

END OF REPORT

SAMPLE STATUS REPORT FOR T8901

SERIAL NUMBER T8901 HAS NO ANALYSES DEFINED

SAMPLE STATUS REPORT FOR T8917 102-AY A-FD TIME: 12-13-83 9:38
DISPATCHED: 12- 7-83 13:41 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 12- 8-83 19:13

EXT.	DETER.	RESULTS OR STATUS	OUT OF RANGE?	GOOD ANS?	CHARGE CODE
****	********	**********************************	***	***	******
1001	APPR/OTR	YELLOW 15% DARK BROWN SOLIDS 1.7 RADS			WB65C
1001	APPR/OTR	ALL ANALYSES WILL BE RUN ON SUPERNATE			WB65C
1101	Al	1.560E-01 M	N	Y	WB65C
1113	OH-	5.400E-01 M	N	Y	WB65C
1601	CO3	1.790E-01 M	N	Y	WB65C
1621	TOC	4.320E-01 GM/L C	N	Y	WB65C
1763	DENSITY	1.086E 00 NONE	N	Y	WB65C
2912	NO2	1.604E-01 M	N	Y	WB65C
2937	NO3	5.010E-01 M	N	Y	WB65C
3201	pH	1.262E 01 NONE	N	Y	WB65C
3261	PO4	OUT FOR RERUN			WB65C
3261	PO4	5.840E-03 M ← ??	N	Y	WB65C
3707	SO4	3.280E-02 M	N	Y	WB65C

END OF REPORT

9

3.12 Internal Letter 65453-84-134 from M. T. Jansky to E. G. Gratny, "Laboratory Support for Upcoming 242-A Evaporator Campaign, Run 84-5," May 10, 1984.

(11) 5/10/1984

AY-102
22

SD-WM-PE-022 Rev 0

Internal Letter **Rockwell International**

Date May 10, 1984 No 65453-84-134

TO: (Name Organization Internal Address)
E. G. Gratny
Process Engineering
2750E/A100/200 East Area

FROM: (Name Organization Internal Address Phone)
M. T. Jansky
Chemical Laboratory
MO-037/222S/200 West Area
3-1571

Subject: Laboratory Support for Upcoming 242-A Evaporator Campaign, Run 84-5

The Chemical Laboratory Unit (CLU) received six samples from various sources. Two samples were from Tank 102AY, two were from Tank 105 AN, and two were from Tank 105 AW. These samples were to be analyzed in support of the upcoming evaporator campaign producing double-shell slurry feed (DSSF), Run 84-5. Details of the laboratory support are discussed below.

AY-2

Two samples were taken from Tank 102AY. The surface sample (R9833) and the four feet sample (R9834) were both clear yellow solutions with only a slight trace of settled solids. Aliquots of each sample were prepared for analyses and submitted to Analytical Laboratories (AL) for analyses. The analytical data are shown in Table I.

Two of the samples were from Tank 105AN. The surface sample, R9839, contained approximately 15 volume percent black settled solids (4 volume percent centrifuged solids). The four feet sample (R9840) appeared to contain only a trace of solids. The supernatants were prepared for analyses and submitted to AL. Solids from R9839 were dissolved and also submitted to AL. The analytical data for Tank 105AN are shown in Table II.

The final two samples, from Tank 105AW, were R9837 and R9838. The deeper sample, R9838, was a clear yellow solution with a slight trace of solids. The surface sample, R9837, was very different. There were two phases present. There was approximately 65 volume percent immiscible organic floating over an aqueous phase. The organic phase was found to be 27.5 volume percent tributyl phosphate (TBP). Both phases were analyzed, with the results shown in Table III.

As the attached tables show, there are several analyses that are incomplete. Priority discrimination has prompted AL to place these efforts in other directions, getting to these samples when they can. The additional data will be forwarded to you when it becomes available. Updated tables will follow immediately. Please call if you have any questions in the interim.

M T Jansky
M. T. Jansky
Chemist

Note: 11-10-94 AY-102
New Data
Complete Doc.
in Ref. Lib.

MTJ/pdk

Att.

cc: J. F. Albaugh
J. M. Allison
R. B. Bendixsen
J. S. Buckingham
K. G. Carothers
D. L. Herting
D. W. Lindsey
N. L. Pontious
L. H. Rodgers
T. B. Veneziano
R. A. Van Meter
R. D. Wojtasek
Process Aids
File Code WB

TABLE I

Composition of Tank 102AY
(Supporting Run 84-5)

Composition	Concentration (Moles/Liter) Surface (R9833)	4 Feet (R9834)
Al^{+3}	0.117	0.125
OH^-	0.425	0.422
NO_2^-	0.125	0.120
NO_3^-	0.706	0.461
CO_3^{-2}	0.181	0.189
TOC (g/L)	0.222	0.173
Na^+	1.60	1.83
K^+	0.0067	0.0105
Cl^-	0.014	0.012
Cs^{137} (µCi/L)	1.95×10^5	1.91×10^5
Sr^{90} (µCi/L)	NA	NA
PO_4^{-3}	0.0049	0.0048
SO_4^{-2}	0.0544	0.0593
Am (µCi/L)	NA	NA
Pu (g/L)	NA	NA
Pm (µCi/L)	NA	NA
Np (µCi/L)	NA	NA
pH	12.86	13.10
SpG	1.06	1.07

NA - Not Available.

First Pass Samples.

Tank	Sample LL*	Sample number	Date
102-SY			11-21-82
104-AW	90 in.	T8793	11-30-83
	284 in	T8797	11-30-83
103-AN	74 in.	T8882	12-05-83
	220 in.	T8883	12-05-83
101-AN	97 in.	T8902	12-06-83
	289 in.	T8903	12-06-83
102-AY	80 in.	T8916	12-07-83
	240 in.	T8917	12-07-83
105-AW		T9706 T9707	1-06-84 1-06-84

*Measured from bottom of tank.

3.13 Internal Letter 65453-84-348 from B. M. Mauss to E. G. Gratny, "Chemical Compositions of 102-AY, 101-AW, 105-AN, and 104-AW," November 9, 1984.

TCRC-10 (10) 11/9/1984 AY-102

Internal Letter

Rockwell International

Date. November 9, 1984 No. 65453-84-348

TO: (Name, Organization, Internal Address)
- E. G. Gratny
- Waste Concentration
- 2750E/A100/200E

FROM: (Name, Organization, Internal Address, Phone)
- B. M. Mauss
- Chemical Laboratory
- 222S/MO-037/200W
- 3-2529

Subject: Chemical Compositions of 102-AY, 101-AW, 105-AN, and 104-~~AN~~ AW

Five tank samples were received by the Chemical Laboratory Unit (CLU). They were: 102-AY (R-3214 and 3215), 101-AW (R-3185), 105-AN (no R-number available), and 104-AW (R-3206).

Aliquots of each of these samples were taken and submitted to Analytical Laboratories (AL) for chemical analysis. These data are shown in Tables I and II.

If there are any questions, please contact me.

B M Mauss

B. M. Mauss
Chemist

BMM/pjm

cc: J. M. Allison
J. S. Buckingham JSB
K. G. Carothers
M. T. Jansky
M. G. Kelly
D. W. Lindsey
N. L. Pontious
L. H. Rodgers
D. M. Tulberg
File WB53G
[redacted]

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TABLE I

Composition of 102-AY Samples: R-3214 and R-3215

Component	Concentration ($\underline{M}$) R-3214	Concentration ($\underline{M}$) R-3215
Al	*a*	0.005
OH	0.265	0.327
NO_2	0.013	0.023
NO_3	0.315	0.430
CO_3	0.056	0.065
TOC	0.215	0.238
PO_4	0.003	0.003
SO_4	0.007	0.020
[illegible]	*a*	*a*
Cl	0.003	0.003
HEDTA	*b*	0.001
EDTA	*b*	*a*
Na	0.750	0.988
K	0.001	0.002
NH_3	0.013	*a*
DTA	No Exotherm	No Exotherm
^{137}Cs (µCi/L)	5.925×10^5	7.525×10^{-1}
^{90}Sr (µCi/L)	2.318×10^4	*c*
SpG	1.03	1.04
% H_2O	95.0	94.6

[illegible] Below detectable limit
[illegible] Data unavailable
c - Insufficient sample

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TABLE II

Composition of Tanks 101-AW (R-3185), 105-AN, and 104-AW (R-3206)

Component	Concentration (M)		
	101-AW	105-AN	104-AW
Al	a	0.938	0.868
OH	0.745	2.225	3.100
NO_2	0.043	1.362	1.405
NO_3	0.190	2.173	2.725
CO_3	0.053	0.453	0.502
TOC	0.757	3.360	4.675
PO_4	0.001	0.015	0.040
SO_4	a	a	0.080
F	0.005	a	a
Cl	a	0.018	0.150
HEDTA	b	0.002	b
EDTA	b	0.003	b
Na	1.110	7.850	10.625
K	0.006	0.093	0.119
NH_3	0.007	0.010	a
DTA	Exotherm	Exotherm	Exotherm
^{134}Cs (µCi/L)	1.5×10^2	a	8.55×10^5
^{137}Cs (µCi/L)	2.18×10^4	3.60×10^5	6.03×10^2
^{90}Sr (µCi/L)	4.25×10^2	2.24×10^3	3.63×10^4
SpG (/L)	1.024	1.434	1.410
% H_2O	94.7	54.7	54.7

a - Below detectable limits
b - Data unavailable

11/9/1984

TABLE I

Composition of 102-AY Samples: R-3214 and R-3215

Component	Concentration (M) R-3214	R-3215
Al	*a*	0.005
OH	0.265	0.327
NO_2	0.013	0.023
NO_3	0.315	0.430
CO_3	0.056	0.065
TOC	0.215	0.238
PO_4	0.003	0.003
SO_4	0.007	0.020
~~F~~	*a*	*a*
Cl	0.003	0.003
HEDTA	*b*	0.001
~~ED~~TA	*b*	*a*
Na	0.750	0.988
K	0.001	0.002
NH_3	0.013	*a*
DTA	No Exotherm	No Exotherm
^{137}Cs (μCi/L)	5.925×10^5	7.525×10^{-1}
^{90}Sr (μCi/L)	2.318×10^4	*c*
SpG	1.03	1.04
% H_2O	95.0	94.6

a - Below detectable limits
b - Data unavailable
c - Insufficient sample

3.14 WHC-SD-WM-ER-454, 1997, Tank Characterization Report for Double-Shell Tank 241-AY-102, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

ANALYTICAL RESULTS FOR THE 1987 CORE SAMPLE DOUBLE-SHELL TANK 241-AY-102

Table A-1. Anion Content of 102-AY Waste and Derivatives.

Anion	Supernatant, M		Interstitial solution, M		Composite solids, mmol/g		Washed solids mmol/g		Wash, M	
	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis
F^-	9.3 E-03	8.7 E-03	7.5 E-02	6.1 E-02	1.8 E-01	9.3 E-02	1.6 E-01	6.9 E-02	3.7 E-02	2.4 E-02
Cl^-	1.6 E-02	1.7 E-02	4.2 E-01	4.0 E-02	2.3 E-01	2.4 E-01	7.3 E-02	8.0 E-02	1.1 E-01	9.1 E-02
NO_2^-	2.5 E-02	2.4 E-02	1.7 E-01	1.6 E-01	1.1 E-01	1.8 E-02	2.4 E-02	4.7 E-03	5.0 E-02	3.7 E-02
NO_3-	4.4 E-03	3.6 E-03	3.0 E-02	3.0 E-02	1.7 E-02	5.4 E-03	9.6 E-03	2.6 E-03	8.6 E-04	6.8 E-03
PO_4^{3-}	5.5 E-04	<3 E-06	7.2 E-03	5.4 E-03	2.4 E-02	1.1 E-02	2.0 E-02	5.1 E-03	3.4 E-02	1.8 E-03
SO_4^{2-}	1.1 E-03	1.1 E-03	1.2 E-02	1.2 E-02	8.1 E-03	7.6 E-03	2.7 E-03	4.0 E-03	3.4 E-03	2.8 E-03
TIC	2.9 E-02	NM	2.8 E-01	NM	NM	NM	NM	NM	9.9 E-02	NM
TOC	2.4 E-02	2.4 E-02	3.8 E-01	3.0 E-01	NM	3.82 E+0 0	NM	2.19 E+00	1.1 E-01	7.8 E-02

NM = Not measured.
TIC = Total inorganic carbon (inorganic carbon is carbonate or bicarbonate).
TOC = Total organic carbon.

Table A-2. Elemental Concentrations in 102-AY Waste. (2 sheets)

Anion	Supernatant, M		Interstitial solution, M		Composite solids, mmol/g		Washed solids mmol/g		Wash, M	
	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis
Ag	NM	6.4 E-05	NM	5.7 E-04	NM	6.7 E-02	NM	7.2 E-03	NM	1.6 E-04
Al	5.9 E-05	(5.1 E-05)	5.6 E-04	(2.3 E-04)	1.2 E+00	1.6	1.1 E+00	9.4 E-01	2.4 E-04	<6.6 E-05
B	3.8 E-04	7.7 E-04	1.8 E-03	7.2 E-03	7.5 E-02	0.44	9.5 E-02	4.3 E-01	3.1 E-04	1.9 E-03
Ba	2.9 E-06	2.5 E-06	1.1 E-05	7.2 E-05	1.5 E-02	1.4 E-02	1.7 E-02	1.7 E-02	5.0 E-06	3.3 E-05
Ca	1.1 E-04	8.3 E-05	1.0 E-05	6.5 E-05	4.2 E-01	2.8 E-01	4.6 E-01	3.1 E-01	2.5 E-06	4.0 E-05
Cd	NM	<1 E-06	NM	<1 E-06	4.0 E-03	3.4 E-03	3.2 E-03	3.5 E-03	NM	<1 E-06
Ce	<4 E-06	<4 E-06	4 E-05	<1 E-05	8.6 E-03	7.2 E-03	7.1 E-03	6.2 E-03	<4 E-06	<3 E-06
Cr	2.1 E-04	2.5 E-04	4.6 E-03	5.1 E-03	7.2 E+02	6.3 E-02	7.1 E-02	7.3 E-02	1.3 E-03	1.6 E-03
Dy	<1 E-07	<1 E-07	<1 E-06	<1 E-06	ND	ND	ND	<5 E-05	<1 E-07	<1 E-06
Fe	7.2 E-06	(1.2 E-06)	5.4 E-05	<4 E-06	1.6 E+00	1.4	1.5 E+00	1.4	<7 E-06	<4 E-06
Hg	NM	NM	NM	NM	3.8 E-04	NM	2.0 E-04	NM	NM	NM
K	1.1 E-03	1.1 E-03	1.4 E-03	1.6 E-02	1.5 E-02	5.9 E-02	2.6 E-02	2.1 E-02	4.1 E-03	5.0 E-03
La	<4 E-07	<4 E-07	<4 E-06	<2 E-06	3.0 E-02	2.7 E-02	3.5 E-02	3.5 E-02	<4 E-07	<4 E-07
Li	(Be-06)	<1 E-05	<1 E-04	<3 E-05	ND	ND	ND	<1 E-03	(3 E-05)	<3 E-05
Mg	2.3 E-05	1.7 E-05	1.8 E-04	<4 E-06	3.0 E-01	2.6 E-01	3.5 E-01	3.5 E-01	5.3 E-05	8.7 E-06
Mn	<2 E-07	<2 E-07	<2 E-06	<5 E-07	1.7 E-01	1.5 E-01	1.9 E-01	1.8 E-01	2 E-07	<1 E-07
Mo	1.1 E-06	4.3 E-06	4.0 E-05	8.0 E-05	(9 E-04)	(2 E-03)	(9 E-04)	(1 E-03)	9.9 E-06	2.4 E-05
Na	9.1 E-02	9.6 E-02	1.3 E+00	1.4	a	1.8	a	1.2	3.8 E-01	5.0 E-01
Nd	<7 E-07	<7 E-07	<7 E-06	<7 E-07	1.9 E-02	1.6 E-02	1.8 E-02	1.7 E-02	<7 E-07	<1 E-06

Table A-2. Elemental Concentrations in 102-AY Waste. (2 sheets)

Anion	Supernatant, M		Interstitial solution, M		Composite solids, mmol/g		Washed solids mmol/g		Wash, M	
	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis
Ni	(1.4 E-06)	<2 E-06	(1 E-05)	<2 E-05	5.6 E-02	4.7 E-02	6.5 E-02	5.7 E-02	<1 E-06	<6 E-06
P	1 E-04	(1 E-04)	7 E-03	7.5 E-3	1.6 E-01	2.3 E-01	1.7 E-01	2.5 E-01	2.9 E-03	3.4 E-03
Rh	<2 E-06	<2 E-06	<2 E-05	<1 E-05	ND	ND	ND	<4 E-04	<2 E-06	<2 E-06
Ru	<1 E-06	<1 E-06	<1 E-05	<1 E-05	ND	ND	ND	<4 E-04	<1 E-06	<2 E-06
Si	4.6 E-03	5.9 E-03	2.4 E-02	5.2 E-03	4.3 E-01	4.3 E-01	4.1 E-01	4.4 E-01	3.0 E-02	2.8 E-02
Sr	2.6 E-06	1.6 E-06	1.0 E-05	<1 E-08	9.0 E-03	7.7 E-03	9.8 E-03	9.4 E-03	3.0 E-06	<2 E-09
Te	<2 E-06	<2 E-06	<2 E-05	<2 E-05	(4 E-03)	ND	3.9 E-03	(3 E-03)	2.4 E-06	<4 E-06
Ti	<4 E-07	<4 E-07	<4 E-06	<4 E-06	7.1 E-03	7.0 E-03	7.7 E-03	7.2 E-03	4.2 E-07	<7 E-07
U	3.3 E-03	3.5 E-03	3.8 E-02	4.4 E-02	6.5 E-02	5.9 E-02	5.8 E-02	5.8 E-02	1.2 E-03	1.4 E-02
Zn	5.0 E-06	3.7 E-06	1.7 E-05	1.6 E-05	5.8 E-03	8.1 E-03	7.0 E-03	7.9 E-03	(3 E-06)	1.3 E-05
Zr	<4 E-07	(7.6 E-07)	4.1 E-05	<1 E-05	b	6.3 E-03	b	5.2 E-03	3.9 E-06	(1.9 E-06)

[a]Potassium Hydroxide fusion.
[b]Zirconium crucible used.
NM = Not measured (analysis not requested for sample).
ND = Not detected.
( ) = Indicates at detection limit.

Table A-3. Concentration of Radioisotopes in 102-AY Waste and Wash Components.

Radioisotope	Supernatant µCi/mL	Standard ±%	Wash solution µCi /mL	Standard ±%	Interstitial solution µCu/ml	Standard ±%	Composite solids µCi/g	Standard ±%	Washed solids µCi/g	Standard ±%
^{241}Am	1.5 E-06		6.67 E-06		1.9 E-04		1.82 E+01		1.57 E+01	
^{14}C	NM		NM		NM		<1.0 E-03		<3.2 E-03	
^{242}Cm	ND		ND		ND		ND		5.41 E-02	
$^{243}Cm/^{244}Cm$	ND		ND		ND		6.31 E-01		5.41 E-01	
^{60}Co	ND		ND		1.7 E-02	4.5	1.44 E+00	5.7	1.17 E+00	8.3
^{134}Cs	4.95 E-03	11.0	5.41 E-03	13.0	2.1 E-02	3.9	ND		ND	
^{137}Cs	4.32 E+00	3.5	1.09 E+01	3.5	4.4 E+01	3.4	2.65 E+02	3.6	2.62 E+02	3.5
^{154}Eu	ND		ND		ND		5.14 E+01	3.1	4.38 E+01	
^{129}I	NM		NM		NM		<1.2 E-03		<1.3 E-03	
^{238}Pu	ND		ND		1.25 E-04	5.7	1.14 E+00	5.2	9.82 E-01	5
$^{239}Pu/^{240}Pu$	2.34 E-04	3.9	1.21 E-05	69	3.91 E-04	4.2	3.61 E+00	3.1	3.36 E+00	3.1
^{106}Ru	ND		1.89 E-01	10.0	6.8 E-01	4.1	ND		ND	
^{125}Sb	ND		ND		1.1 E-01	13.4	9.9 E+00	6.2	1.0 E+01	7.7
^{79}Se	NM		NM		NM		<5.40 E-03		<5.9 E-03	
^{90}Sr	6.58 E+00	5.9	1.26 E+00	5.7	2.52 E+00		2.95 E+04		3.09 E+04	
^{99}Tc	NM		NM		NM		2.5 E-02		1.8 E-02	

Note: 1 Ci = 3.7 E+10 Bq.
NM = Not measured (analysis was not requested for this sample).
ND = Not detected.

(4) 1987 Sludge
1994 Grab

Table 4-2. Tank Characterization Summary for Double-Shell Tank 241-AY-102. (3 sheets)

Analyte	1987 sludge sample				1994 grab samples	
	Centrifuged sludge concentration	Interstitial liquid concentration	Calculated average sludge concentration	Total projected sludge inventory	Liquid concentration	Total projected supernatant inventory
Ion						
	μg/g	μg/g	μg/g	kg	μg/mL	kg
Cl^-	8,340.0	8,170.0	8,247.5	1,182.0	94.2	255.5
F^-	8,490.0	1,290.0	4,573.2	740.7	11.9	32.3
OH_3^-	NM	NM	NM	NM	307.0	832.8
NO_3^-	69.4	1,860.0	1,043.5	127.8	526.0	1,426.8
NO_2^-	3,970.0	10,200.0	7,359.1	978.1	884.0	2,397.9
PO_4^{3-}	1,660.0	599.0	1,082.8	167.7	65.6	177.9
SO_4^{2-}	754.0	1,150.0	969.4	133.9	160.0	434.0
Radiochemistry						
	μCi/g	μCi/g	μCi/g	Ci	μCi/g	Ci
^{241}Am	18.0	1.2 E-04	8.2	990.0	6.9 E-04	1.9
^{14}C	<0.001	--	<<0.001	<0.1	--	--
^{242}Cm	ND	ND	--	--	--	--
^{134}Cs	ND	2.1 E-02	1.1 E-02	1.3	--	--
^{137}Cs	270.0	44.0	147.1	18,000.0	3.4	9,195.7
^{60}Co	1.4	1.7 E-02	0.6	79.0	--	--
$^{234/244}Cm$	0.6	ND	0.3	35.0	--	--
^{154}Eu	51.0	ND	23.0	2,800.0	--	--
^{129}I	<0.0012	--	<<0.0012	<0.1	--	--
^{238}Pu	1.1	1.3 E-04	0.5	63.0	--	--
$^{239/240}Pu$	3.6	3.9 E-04	1.6	190.0	2.6 E-05	0.1
^{106}Ru	ND	0.7	0.4	45.0	--	--
^{125}Sb	9.9	0.1	4.6	560.0	--	--
^{79}Se	<0.0054	NM	<2.5 E-03	<0.3	--	--
^{90}Sr	23,585.0	2.5	10,756.1	1.7 E+06	0.2	599.5
^{99}Tc	2.5 E-02	NM	1.1 E-02	1.3	--	--
Physical property						
			g/mL			
Grav %H_2O	45.6	54.4	--	--	98.4	--
TGA H_2O	--	--	--	--	98.5	--
pH	--	--	--	--	11.1	--
Density	1.4	--	1.40	--	0.990	--

Table 4-2. Tank Characterization Summary for Double-Shell Tank 241-AY-102. (3 sheets)

Analyte	1987 sludge sample				1994 grab samples	
	Centrifuged sludge concentration	Interstitial liquid concentration	Calculated average sludge concentration	Total projected sludge inventory	Liquid concentration	Total projected supernatant inventory
Metal						
	µg/g	µg/g	µg/g	kg	µg/mL	kg
Al	37,800.0	10.7	17,242.6	2,920.6	13.7	37.2
Ba	1,990.0	5.7	910.5	154.1	--	--
B	2,770.0	48.6	1,289.6	217.2	--	--
Cd	414.0	0.1	188.8	32.0	--	--
Ca	14,000.0	1.5	6,384.8	1,081.5	--	--
Ce	1,110.0	3.5	508.1	86.0	--	--
Cr	3,510.0	252.0	1,737.6	287.7	--	--
Dy	ND	<0.163	<0.1	<0.02	--	--
Fe	83,700.0	1.6	38,168.1	6,465.6	<0.550	<1.5
La	3,960.0	0.4	1,806.0	305.9	--	--
Li	ND	<0.451	<0.2	<0.04	--	--
Mg	6,800.0	2.2	3,102.0	525.4	--	--
Mn	8,780.0	<0.0686	<4,003.7	<678.2	--	--
Mo	139.0	5.8	66.5	11.1	--	--
Nd	2,660.0	<0.554	<1,213.3	<205.5	--	--
Ni	3,020.0	0.9	1,377.6	233.3	--	--
P	6,050.0	225.0	2,881.2	482.2	--	--
K	1,450.0	340.0	846.2	134.4	--	--
Rh	ND	<1.55	<0.8	<0.1	--	--
Ru	ND	<1.01	<0.5	<0.1	--	--
Si	12,100.0	410.0	5,740.6	961.7	--	--
Ag	7,240.0	61.6	3,335.0	563.3	--	--
Na	41,400.0	31,000.0	35,742.4	5,238.5	2,450.0	6,645.9
Sr	732.0	0.4	334.0	56.6	--	--
Te	512.0	<2.56	<234.9	<39.7	--	--
Ti	342.0	<0.192	<156.1	<26.4	--	--
U	14,800.0	9,760.0	12,058.2	1,785.7	--	--
Zn	455.0	1.1	208.1	35.2	--	--
Zr	575.0	1.6	263.1	44.5	--	--

3.15 Tank AY-102 Report Analysis January 1988

TCRC - 28

AY102-13

AY-102

(8) 1/29/88
sample data

?/07/?? TIME :14:45:18

REPORT ANALYSIS

GENERAL TANK INFORMATION FOR TANK 102 AY

DATE OF ANALYSIS = 01/29/88
SAMPLE NUMBER = PNL12986
TODAY 'S DATE = 07/21/88
WASTE TYPE = waste solids

?T/NOTE : Three solids samples from 102 AY were mi
xed and analysed for their TRU content.

Ref PNL letter from P. A. Scott to A. J.
DiLiberto on 1/29/88.

PHYSICAL PROPERTIES OF THE SAMPLE :

SLURRY(SLUDGE) DENSITY (G/ml)	=	1.106
SUPERNATE DENSITY (G/ml)	=	0.000
CENTRIFUGED SOLIDS DENSITY (G/ml)	=	0.000
WT% CENTRIFUGED(FILTERED) SOLIDS	=	0.000
WT% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
VOL% CENTRIFUGED(FILTERED) SOLIDS	=	25.000
VOL% CENTRIFUGED(FILTERED) SUPERNATE	=	75.000
WT% INSOLUBLE SOLIDS	=	11.750
WT% WATER	=	88.250
WT% OF TOTAL SOLIDS	=	0.000
SAMPLE pH READING	=	12.100

FLUID RHEOLOGY OF THE SAMPLE :

TYPE OF FLUID :

YIELD STRESS (N/m2)	=	0.000
SHEAR STRESS (N/m2)	=	0.000
CONSISTENCY INDEX (Nsec/m2)	=	0.000
FLOW BEHAVIOR INDEX	=	0.000
CRITICAL VELOCITY (m/sec)	=	0.000

PAGE 2(28)

Composition of Tank 102 AY (AY-1022)

COMPONENTS		CONCENTRATION				
		Supernate	Water Wash	Solids	Acid Leach	Slurry/Sludge
FIRST ANALYSIS						
F-	(M)	7.5E-02		1.6E-01		
Cl-	(M)	4.2E-01		7.3E-02		
NO2	(M)	1.7E-01		2.4E-02		
NO3	(M)	3.0E-02		7.6E-03		
PO3/4	(M)	7.2E-03		2.0E-03		
SO2/4	(M)	1.2E-02		2.7E-03		
TIC	(M)	2.8E-01		NM		
TOC	(M)	3.8E-01		NM		
SECOND ANALYSIS						
F-	(M)	5.1E-02		4.9E-02		
Cl	(M)	4.0E-02		9.0E-02		
NO2	(M)	1.6E-01		4.7E-03		
PO3/4	(M)	5.4E-03		5.1E-03		
SO2/4	(M)	1.2E-02		4.0E-03		
TIC	(M)	NM		NM		
TOC	(M)	3.0E-01		2.19E+00		
******************		********	********	********		
ELEMENTAL CON.						
FIRST ANALYSIS						
Ag		NM		NM		
Al		5.6E-04		1.1E+00		
B		1.8E-03		9.5E-02		
Ba		1.1E-05		1.7E-02		
Ca		1.0E-05		4.6E-01		
Cd		NM		3.2E-03		
Ce		4E-05		7.1E-03		
Cr		4.6E-03		7.1E-02		
Dy		<2E-05		ND		
Fe		5.4E-05		1.5E+00		
Hg		NM		2.0E-04		
K		1.4E-03		2.6E-02		
La		<4E-06		3.5E-02		
Li		<1E-04		ND		
Mg		1.6E-04		3.5E-01		
Mn		<2E-06		1.7E-01		
Mo		4.0E-05		(9E-04)		
Na		1.3E+00		(d)		
Nd		<7E-06		1.8E-02		
Ni		(1E-05)		6.5E-02		
P		7E-03		1.7E-01		
Rh		<2E-05		ND		
Ru		<1E-05		ND		
Si		2.4E-02		4.1E-01		
Sr		1.0E-05		9.8E-03		
Te		<2E-05		3.9E-03		
Ti		<4E-06		7.7E-03		
U		3.8E-02		5.8E-02		
Zn		1.7E-05		7.0E-03		
Zr		4.1E-05		(e)		
SECOND ANALYSIS						
Ag		5.7E-04		7.2E-03		
Al		<2.3E-04		9.4E-01		
B		7.2E-03		4.3E-01		
Ba		7.2E-05		1.7E-02		
[illegible]		[illegible]		[illegible]		

Cd	<1E-06	3.5E-03
Ca	<1E-05	6.2E-03
Cr	5.1E-03	7.3E-02
Dy	<1E-06	<5E-05
Fe	<4E-06	1.4
Hg	NM	NM
K	1.6E-02	2.1E-02
La	<2E-06	3.5E-02
Li	<3E-05	<1E-03
Mg	<4E-06	3.5E-01
Mn	<5E-07	1.8E-01
Mo	8.0E-05	(1E-03)
Na	1.4	1.2
Nd	<7E-07	1.7E-02
Ni	<2E-05	5.7E-02
P	7.5E-03	2.5E-01
Rh	<1E-05	<4E-04
Ru	<1E-05	<4E-04
Si	5.2E-03	4.4E-01
Sr	<1E-08	9.4E-03
Te	<2E-05	(3E-03)
Ti	<4E-06	7.2E-03
U	4.4E-02	5.8E-02
Zn	1.6E-05	7.9E-03
Zr	<1E-05	5.2E-03
RADIOISOTOPES		
Am-241	1.9E-04	1.57E+01
C-14	NM	<3.2E-03
Cm-242	ND	5.41E-02
Cm-243+244	ND	5.41E-01
Co60	1.7E-02	1.17E+00
Cs-134	2.1E-02	ND
Cs-137	4.4E+01	2.62E+02
Eu-154	ND	4.38E+01
I-129	NM	<1.3E-03
Pu-238	1.25E-04	9.82E-01
Pu-239+240	3.91E-04	3.36E+09
Ru-106	6.8E-01	ND
Sb-125	1.1E-01	1.0E+01
Se-79	NM	<5.9E-03
Sr-90	2.52E+00	3.09E+04
Tc-99	NM	1.8E-02

3.16 Letter from J. C. Womack to H. F. Daugherty, "Tank 102-AY Solids Heel Analysis," April 21, 1989.

TCRC-22
2-12-90

DISTRIBUTION COVERSHEET

(9) 4124MMU Report copy

AY-102

Author	Addressee	Correspondence No.
ME Peterson/PNL	AJ Diliberto/WHC LM Sasaki/WHC	Incoming: 9000855

Subject Revised Report on the Results of 102-AY Characterization

AY/102-12

Internal Distribution

Approval	Date	Name	Location	w/att
		Correspondence Control		X
		HF Daugherty (Assignee)		X
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		TD Blankenship	S5-15	X

54-6000-117 (09-88)

TCRC-2 AY102-11 AY-102

DON'T SAY IT --- *Write It!*

DATE April 21, 1989

TO H. F. Daugherty R2-53

FROM J. C. Womack R2-18
3-1765

cc: A. J. DiLiberto R2-12
L. M. Sasaki R2-12
D. D. Wodrich R2-23
JCW LB/File

RECEIVED
APR 24 1989
A.J. DILIBERTO

SUBJECT: TANK 102-AY SOLIDS HEEL ANALYSIS

Tank 102-AY will be the receiver tank for Hanford Waste Vitrification Plant (HWVP) feed resulting from the pretreatment of neutralized current acid waste (NCAW) at PUREX. The solids heel in Tank 102-AY was sampled and characterized in FY 1988 to determine its composition and to determine if in-tank washing was necessary prior to the addition of pretreated NCAW solids to the tank.

The HWVP reviewed the results of the sample analyses on both washed and unwashed solids. As part of their feed characterization/qualification evaluation, HWVP requested some reanalyses be done to confirm some of the FY 1988 results, as well as some additional analyses. Our letter to Pacific Northwest Laboratories (PNL) (attached) was simply a reiteration of HWVP's request. The PNL has not yet committed to a schedule for completion of the analyses, but because of other ongoing priorities, it is expected to take at least 3 months. We will in turn transmit the results to HWVP for their evaluation.

The table on the next page provides additional information on the requested analyses. If the components of interest are not within the HWVP feed specifications, corrective actions could include heel washing, feed dilution, glass reformulation, or plant/process redesign.

srr

Attachment

"TO MAKE LIFE LAST, PUT SAFETY FIRST"

3.17 Letter from M. Peterson to A. J. Diliberto and L. M. Sasaki, "Revised Report on the Results of 102-AY Characterization," February 12, 1990.

9000855

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509) 376-8258

RECEIVED FEB 26 1990 CORRESPONDENCE CONTROL

February 12, 1990

Mr. A. J. DiLiberto
Ms. L. M. Sasaki
Westinghouse Hanford Company
MSIN R2-05
Richland, WA 99352

Dear Tony and Leela:

REVISED REPORT ON THE RESULTS OF 102-AY CHARACTERIZATION

Attached is the revised report documenting the results of the characterization of samples from DST 102-AY. This report summarizes the characterizations of this waste which were conducted in FY88 and FY89. This completes the requirements of milestone #10 of the technical program plan.

If you have any questions regarding this report, please call me at 376-8258 or Randy Scheele at 376-0956.

Very truly yours,

Mary Peterson

Mary Peterson
Technical Project Manager
Process Development Section

MEP:pg

Attachment

cc: W. F. Bonner
R. D. Scheele
J. M. Tingey
File/LB

INTRODUCTION

In second quarter FY 1988, a total of four samples of waste from DST 102-AY were received from Westinghouse Hanford Company (WHC). Three of the samples were solids from the lower segment of the 102-AY waste core. The fourth sample consisted of supernate and solids from the upper segment of the core. Portions of the three solid samples were combined and submitted for radiochemical analysis to determine if the waste would be classified as TRU. The results of the radiochemical analyses indicated that the waste would be classified as TRU waste (>100 nCi/g). Physical, rheological and further chemical characterizations of the 102-AY waste were conducted to provide additional data for evaluating retrieval systems and/or treatment processes. This report provides the results of these characterizations.

EXPERIMENTAL DESIGN AND PROCEDURES

Four samples of waste from DST 102-AY were received. These samples were labeled 102-AY Seg-1, 102-AY Seg 1R Top, 102-AY Seg 1R Mid, and 102-AY Seg 1R Bot. The 102-AY Seg-1 samples was approximately 99% supernate with the remaining 1% consisting of dark reddish brown solids. The 102-AY Top solids were dark brown in color and were formed into a 1 in. dia. cylinder. The core stood up to the shoulder of the jar. The 102-AY Bot solids were dark reddish brown in color and were formed into three 1-in. dia. cylindrical sections. The 102-AY Mid solids were dark reddish brown in color and also maintained the 1 in. dia. cylindrical shape. The 102-AY Mid solids appeared softer than the other two samples. The samples had been located in the shielded facility in the 325 building for approximately 7 months prior to the shear strength measurements and rheological characterization. Visual observation indicated that the solids were still moist and did not appear to have dried out during this period. The solids were contained in narrow mouthed jars which limited access to the solids.

A flow diagram was prepared for the analyses of the samples. The first characterization performed was the shear strength. The shear strength was measured on each of the three solid samples using a shear vane and the Haake

The chemical analyses were conducted to determine the concentration of anions, elements, total organic carbon and inorganic carbon. Inductively coupled argon plasma atomic emission spectroscopy (ICP) was used to determine the concentration of a majority of the elements. Mercury was determined using atomic absorption spectroscopy after separating the mercury from the solids using an EPA procedure. A water leach procedure was used to measure the chromium (VI)/chromium (III) and anions in the solids. In this water leach procedure, one volume of solids is washed with 100 volumes of DI water. This procedure assumes that the chromium (VI) and the anions in the solids will dissolve in the large excess of water. The chromium (VI) concentration was measured in the water leach solution using UV/Visible spectroscopy. The water leach solution was also analyzed for chromium (III) by adding an oxidant which converts the chromium (III) to chromium (VI) and analyzing for the resulting chromium (VI). The anions were measured using ion chromatography (IC). IC and ICP both provided a phosphorous/phosphate measurement. Total organic carbon (TOC) and total inorganic carbon (TIC) were analyzed using the coulometric carbon analyzer.

A gamma scan analysis (GSA), $^{239+240}Pu$, ^{90}Sr, ^{241}Am, ^{129}I, ^{14}C, ^{79}Se, and ^{99}Tc analyses were performed. Alpha energy Analysis (AEA) was used to measure the $^{239+240}Pu$ and the ^{241}Am after separation. Gamma scan analysis was used to measure the gamma emitters such as ^{60}Co and ^{137}Cs. Chemical separations followed by beta or gamma analysis were used to determine the ^{90}Sr, ^{129}I, or ^{99}Tc content. ^{14}C was analyzed using the coulometric carbon analyzer.

EXPERIMENTAL RESULTS

The results of the physical rheological, chemical and radiochemical characterizations ae provided below.

Shear Strength Measurements and Rheological Characterization for 102-AY Waste

The shear strength measurements were obtained for all three samples of waste solids. Because it was not possible to remove the entire solid sample from the jar without disturbing the rheology, the shear strength measurements were made as best as possible on the waste in the jars. The position of the waste in the jars required careful positioning of the shear vane. The solids

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3

were not compacted in the jars with a uniform solid depth. Instead the solids maintained the shape of a 1 in. dia. cyclinder. The position of solids in each jar was assessed and the shear vane was positioned such that it was centered as best as possible in the solids and was located close to the bottom of the jars.

The small shear vane (H_V=D_V=0.975 cm) was used for these measurements. The shear strength was measured at the cell temperature which was approximately 35°C. The shear vane rotational speed used for this evaluation was 0.3 rpm.

The results of the shear strength measurements are provided in Table 1 below. Visual observation suggested that the 102-AY-Mid sample would be softer than the remaining samples. The result that the 102-AY-Top solids have a higher shear strength is reasonable. The history of the pumping solids into DST-102-AY suggests that different layers of solids probably exist.

The solids from all three samples were blended together to form a composite solids sample. The rheological characterization was performed on a 1:1 volume dilution of the composite solids. The solids were diluted with deionized water. Rheological characterization of the composite solids was desired; however, the composite solids would not flow. They could not be poured into the viscometer. Rheological data for the 102-AY waste was obtained with the Haake Rotovisco viscometer equipped with an M500 measuring/drive head and the MV I sensor system.

TABLE 1. Results of the Shear Strength Measurements

Waste Samples	Shear Strength dynes/cm^2
102-AY-Top	53,639
102-AY-Middle	16,660
102-AY-Bottom	21,708

The rheogram for the diluted composite solids was obtained. The data from this plot was "fit" to the yield pseudoplastic model. The following rheological model was obtained.

$$\tau = 4.70 + 0.0191(\gamma)^{0.84} \qquad R^2 = 0.91$$

where τ = shear stress

γ = shear rate

R^2 = regression coefficient

The rheological parameters along with the density of the 1:1 dilution (1.2 g/mL) were input into the Hanks' computer model to obtain the critical Reynolds number and the critical velocity for transporting this material. A 3.067 in. I.D. pipe diameter was selected for this evaluation. The critical Reynolds number is 10,470 and the critical velocity is 3.48 ft/s.

Physical Properties

The physical properties for the composite solids, the 1:1 solids dilution, washed solids and supernate are provided in Table 2. Table 3 presents the solids settling behavior for the 1:1 volume dilution for the duplicate analyses. The change in the solids measurements divided by the time period is the solids settling rate. The total measurement is the total volume of material in the centrifuge cone.

Chemical Properties

Analysis of both the anions and elements were performed in duplicate. The anion and elemental concentrations in the supernate, interstitial solution, composite solids, washed solids, and wash solution are presented in Tables 4 (anions) and 5 (elements). For those elements below the detection limits of the instruments, a "less than" value is reported. This value is a factor of 5 higher than the detection limits for samples containing low concentrations of all of elements. The 1st and 2nd Analysis column present the results of analysis which were performed approximately one year apart. During that year interim partial evaporation of the samples occurred, and the anions and elements were concentrated. A correction factor was determined for each sample from the ratio [illegible] concentrations for the 1st and [illegible]

TABLE 2. Physical Properties of 102-AY Waste

Property	AY-102 Composite Solids	AY-102D 1:1 Solids Dilution	AY-102Z Solids & Water Wash	AY-102I Supernate
Density, g/mL	1.4	1.2	1.2	1.00
Vol% Settled Solids	100.0	81.9	ND(a)	0
Vol% Centrifuged Solids	79.0	51.0	38	0
Centrifuged Solids Density, g/mL	1.5	1.3	1.4	0
Centrifuged Solution Density, g/mL	1.0	1.02	1.1	NA(b)
Particle Size, micron	ND	ND	ND	NA
Wt% water	54.4	ND	56	ND
Wt% Solids	45.6	ND	44	ND
Wt% Oxide	43.5	ND	37.72	ND

(a) ND = Not determined
(b) NA = Not applicable

Table 3. Solids Settling Behavior for 102-AY 1:1 Dilution

Time, h	Solids #1, mL	Total #1, mL	Solids #2, mL	Total #2, mL
0.00	14.5	14.5	14.8	14.8
1.17	14.5	14.5	14.8	14.8
3.17	12.3	14.5	13.0	14.8
5.17	12.0	14.5	12.0	14.8
22.5	12.0	14.5	12.0	14.8

analysis. The data reported for the second analysis were corrected to take into account this concentration effect and enable a direct comparison of the 1st and 2nd analysis. The ratios used for this correction were 1.5, 1.9, 2.1, 2.3, and 5.7 for the supernate, interstitial solution, composite solids, washed solids, and wash solution respectively.

The major elements of the composite solids are aluminum, iron, and sodium with the major anions comprising fluoride, chloride, and nitrite. The principal soluble elements as observed in the supernate and interstitial

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solution are potassium, sodium and uranium. Significant concentrations of all the anions except for phosphate were observed in these solutions. The primary element removed in the washing procedure was the sodium.

A mass balance performed on the major elements indicated that for the 2nd analysis 50% of the aluminum, 88% of the iron, 97% of the sodium, and 124% of the uranium were recovered. Similar results were obtained in the 1st analysis with 76% of the aluminum, 80% of the iron, and 105% of the uranium being recovered. No sodium was reported for the 1st analysis since only the sodium peroxide fusion was performed. The mass balances included comparing the concentrations of the major elements in the composite core with the concentrations of the same elements in the washed solids, wash solution, and the interstitial fluid. At the present time, no good explanation is available for the poor mass balance for aluminum. The remainder of the mass balances for the major elements found in the composite core indicate that the analytical results are accurate.

The total organic carbon data indicates that a significant amount of organic matter is present in all the samples. The data also indicated that the concentration of the organic carbon in the interstitial solution was an order of magnitude higher than in the supernate. Because of the small percentage of interstitial liquid in the composite solids, only the top layer of the interstitial solution could be decanted from the centrifuge cones. This top layer may have contained a high percentage of the organic carbon present in the solution due to separation of the aqueous and organic components, thus causing the data to indicate higher concentrations of organic carbon in the interstitial solution than actually existed. At the measured pH of the supernate of 9.5, all of the total inorganic carbon should be bicarbonate.

Radiochemical Analyses

The results of the radiochemical analyses for the supernate, wash solution, interstitial solution, composite solids and washed solids is provided in Table 6. In the aqueous samples, ^{137}Cs is the principle radioisotope present and it's high level of activity prevents the detection of other radioisotopes.

Supernate ISL Data Solids 2/12/1990.

TABLE 4. Anion Content of 102-AY Waste and Derivatives

AY-1022 AY-102 AY-1022

Anion	Supernate, M 1st Analysis	Supernate, M 2nd Analysis	Interstitial Solution, M 1st Analysis	Interstitial Solution, M 2nd Analysis	Composite Solids, mmol/g 1st Analysis	Composite Solids, mmol/g 2nd Analysis	Washed Solids mmol/g 1st Analysis	Washed Solids mmol/g 2nd Analysis	Wash, M 1st Analysis	Wash, M 2nd Analysis
F^-	9.3E-03	8.7E-03	7.5E-02	6.1E-02	1.8E-01	9.3E-02	1.6E-01	6.9E-02	3.7E-02	2.4E-02
Cl^-	1.6E-02	1.7E-02	4.2E-01	4.0E-02	2.3E-01	2.4E-01	7.3E-02	8.0E-02	1.1E-01	9.1E-02
NO_2^-	2.5E-02	2.4E-02	1.7E-01	1.6E-01	1.1E-01	1.8E-02	2.4E-02	4.7E-03	5.0E-02	3.7E-02
NO_3^-	4.4E-03	3.6E-03	3.0E-02	3.0E-02	1.7E-02	5.4E-03	9.6E-03	2.6E-03	8.6E-04	6.8E-03
PO_4^{3-}	5.5E-04	<3E-06	7.2E-03	5.4E-03	2.4E-02	1.1E-02	2.0E-02	5.1E-03	3.4E-02	1.8E-03
SO_4^{2-}	1.1E-03	1.1E-03	1.2E-02	1.2E-02	8.1E-03	7.6E-03	2.7E-03	4.0E-03	3.4E-03	2.8E-03
TIC[a]	2.9E-02	NM	2.8E-01	NM	NM[b]	NM	NM	NM	9.9E-02	NM
TOC[c]	2.4E-02	2.4E-02	3.8E-01	3.0E-01	NM	3.82E+00	NM	2.19E+00	1.1E-01	7.8E-02

(a) TIC = Total Inorganic Carbon. Inorganic carbon is carbonate or bicarbonate.
(b) NM = Not measured.
(c) TOC = Total Organic Carbon.

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TABLE 5. Elemental Concentrations in 102-AY Waste

	AY1021 ~~AY-1022~~ Supernate, M		AY-1022 Interstitial Solution, M		AY-102 Composite Solids, mmol/g		AY-1022 Washed Solids mmol/g		AY1021 ~~AY-1022~~ Wash, M	
Anion	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis	1st Analysis	2nd Analysis
Ag	NM	6.4E-05	NM	5.7E-04	NM	6.7E-02	NM	7.2E-03	NM	1.6E-04
Al	5.9E-05	(5.1E-05)	5.6E-04	(2.3E-04)	1.2E+00	1.6	1.1E+00	9.4E-01	2.4E-04	<6.6E-05
B	3.8E-04	7.7E-04	1.8E-03	7.2E-03	7.2E-02	0.44	9.5E-02	4.3E-01	3.1E-04	1.9E-03
Ba	2.9E-06	2.5E-06	1.1E-05	7.2E-05	1.5E-02	1.4E-02	1.7E-02	1.7E-02	5.0E-06	3.3E-05
Ca	1.1E-04	8.3E-05	1.0E-05	6.5E-05	4.2E-01	2.8E-01	4.6E-01	3.1E-01	2.5E-06	4.0E-05
Cd	NM[a]	<1E-06	NM	<1E-06	4.0E-03	3.4E-03	3.2E-03	3.5E-03	NM	<1E-06
Ce	<4E-06	<4E-06	4E-05	<1E-05	8.6E-03	7.2E-03	7.1E-03	6.2E-03	<4E-06	<3E-06
Cr	2.1E-04	2.5E-04	4.6E-03	5.1E-03	7.2E-02	6.3E-02	7.1E-02	7.3E-02	1.3E-03	1.6E-03
Dy	<1E-07	<1E-07	<1E-06	<1E-06	ND[b]	ND	ND	<5E-05	<1E-07	<1E-06
Fe	7.2E-06	(1.2E-06)	5.4E-05	<4E-06	1.6E+00	1.4	1.5E+00	1.4	<7E-06	<4E-06
Hg	NM	NM	NM	NM	3.8E-04	NM	2.0E-04	NM	NM	NM
K	1.1E-03	1.1E-03	1.4E-03	1.6E-02	1.5E-02	5.9E-02	2.6E-02	2.1E-02	4.1E-03	5.0E-03
La	<4E-07	<4E-07	<4E-06	<2E-06	3.0E-02	2.7E-02	3.5E-02	3.5E-02	<4E-07	<4E-07
Li	(8e-06)[c]	<1E-05	<1E-04	<3E-05	ND	ND	ND	<1E-03	(3E-05)	<3E-05
Mg	2.3E-05	1.7E-05	1.8E-04	<4E-06	3.0E-01	2.6E-01	3.5E-01	3.5E-01	5.3E-05	8.7E-06
Mn	<2E-07	<2E-07	<2E-06	<5E-07	1.7E-01	1.5E-01	1.9E-01	1.8E-01	2e-07	<1E-07
Mo	1.1E-06	4.3E-06	4.0E-05	8.0E-05	(9E-04)	(2E-03)	(9E-04)	(1E-03)	9.9E-06	2.4E-05
Na	9.1E-02	9.6E-02	1.3E+00	1.4	(d)	1.8	(d)	1.2	3.8E-01	5.0E-01
Nd	<7E-07	<7E-07	<7E-06	<7E-07	1.9E-02	1.6E-02	1.8E-02	1.7E-02	<7E-07	<1E-06
Ni	(1.4E-06)	<2E-06	(1E-05)	<2E-05	5.6E-02	4.7E-02	6.5E-02	5.7E-02	<1E-06	<6E-06
P	1E-04	(1E-04)	7E-03	7.5E-03	1.6E-01	2.3E-01	1.7E-01	2.5E-01	2.9E-03	3.4E-03
Rh	<2E-06	<2E-06	<2E-05	<1E-05	ND	ND	ND	<4E-04	<2E-06	<2E-06
Ru	<1E-06	<1E-06	<1E-05	<1E-05	ND	ND	ND	<4E-04	<1E-06	<2E-06
Si	4.6E-03	5.9E-03	2.4E-02	5.2E-03	4.3E-01	4.3E-01	4.1E-01	4.4E-01	3.0E-02	2.8E-02
Sr	2.6E-06	1.6E-06	1.0E-05	<1E-08	9.0E-03	7.7E-03	9.8E-03	9.4E-03	3.0E-06	<2E-09
Te	<2E-06	<2E-06	<2E-05	<2E-05	(4E-03)	ND	3.9E-03	(3E-03)	2.4E-06	<4E-06
Ti	<4E-07	<4E-07	<4E-06	<4E-06	7.1E-03	7.0E-03	7.7E-03	7.2E-03	4.2E-07	<7E-07
U	3.3E-03	3.5E-03	3.8E-02	4.4E-02	6.5E-02	5.9E-02	5.8E-02	5.8E-02	1.2E-03	1.4E-02
Zn	5.0E-06	3.7E-06	1.7E-05	1.6E-05	5.8E-03	8.1E-03	7.0E-03	7.9E-03	(3E-06)	1.3E-05
Zr	<4Ee-07	(7.6E-07)	4.1E-05	<1E-05	(e)	6.3E-03	(e)	5.2E-03	3.9E-06	(1.9E-06)

(a) NM = Not measured. Analysis not requested for sample.
(b) ND = Not detected.
(c) ( ) indicates at detection limit.
(d) Sodium peroxide fusion.
(e) Zirconium crucible used.

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TABLE 6. Concentration of Radioisotopes in 102-AY Waste and Wash Components

	AY-1021				AY-1022		AY-102		AY-1022	
Radioisotope	Supernate µCi/mL	Std. ±%	Wash Solution µCi/mL	Std. ±%	Interstitial Solution µCu/mL	Std. ±%	Composite Solids µCi/g	Std. ±%	Washed Solids µCi/g	Std. ±%
Am-241	1.5E-06		6.67E-06		1.9E-04		1.82E+01		1.57E+01	
C-14	NM[a]		NM		NM		<1.0E-03		<3.2E-03	
Cm-242	ND[b]		ND		ND		ND		5.41E-02	
Cm-243+244	ND		ND		ND		6.31E-01		5.41E-01	
Co-60	ND		ND		1.7E-02	4.5	1.44E+00	5.7	1.17E+00	8.3
Cs-134	4.95E-03	11.0	5.41E-03	13.0	2.1E-02	3.9	ND		ND	
Cs-137	4.32E+00	3.5	1.09E+01	3.5	4.4E+01	3.4	2.65E+02	3.6	2.62E+02	3.5
Eu-154	ND		ND		ND		5.14E+01	3.1	4.38E+01	3.6
I-129	NM		NM		NM		<1.2E-03		<1.3E-03	
Pu-238	ND		ND		1.25E-04	5.7	1.14E+00	5.2	9.82E-01	5
Pu-239+240	2.34E-04	3.9	1.21E-05	6.9	3.91E-04	4.2	3.61E+00	3.1	3.36E+00	3.1
Ru-106	ND		1.89E-01	10.0	6.8E-01	4.1	ND		ND	
Sb-125	ND		ND		1.1E-01	13.4	9.91E+00	6.2	1.0E+01	7.7
Se-79	NM		NM		NM		<5.40E-03		<5.9E-03	
Sr-90	6.58E+00	5.9	1.26E+00	5.7	2.52E+00		2.95E+04		3.09E+04	
Tc-99	NM		NM		NM		2.5E-02		1.8E-02	

(a) NM = Not measured. Analysis was not requested for this sample.
(b) ND = Not detected.

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3.18 WHC-SD-WM-TI-578, 1994, 101-AY, 102-AY, and 106-C Data Compedium, Rev. 0.

2/90 1/29/88 102-AY 11/9/84

Component	Reference: 1 Date: 2/90 Solids Reported Amount	Units	Liquids Reported Amount	Units	Reference: 2 Date: 1/29/88 Solids Reported Amount	Units	Liquids Reported Amount	Units	Reference: 3 Date: 11/9/84 Solids Reported Amount	Units	Liquids Reported Amount	Units
Density	1.4	g/mL	1.0	g/mL	1.3	g/mL						
Bulk Density												
Particle Density												
% Solids	45.6				34						5.2	
% Water	54.4				66						94.8	
Specific Heat												
Softening Pt.												
Particle Size												
Water Solubility												
Viscosity												
SpG											1.04	g/mL
Cl	8,343	mg/kg	604	mg/L							107	mg/L
CN												
CO3											3,660	mg/L
F	2,660	mg/kg	171	mg/L								
NO2	2,944	mg/kg	1,150	mg/L							828	mg/L
NO3	682	mg/kg	248	mg/L							23,126	mg/L
OH											5,032	mg/L
PO4	1,710	mg/kg	27	mg/L							285	mg/L
SO4	758	mg/kg	106	mg/L							1,344	mg/L
Antimony												
Aluminium	37,800	mg/kg	1.5	mg/L							135	mg/L
Arsenic												
Barium	2,055	mg/kg	0.37	mg/L								
Beryllium												
Bismuth												
Boron	2,808	mg/kg	6.3	mg/L								
Cadmium	414	mg/kg	<0.112	mg/L								
Calcium	14,000	mg/kg	3.9	mg/L								
Chromium	3,744	mg/kg	11	mg/L								
Cobalt	466	mg/kg	<0.236	mg/L								
Copper												
Iron	83,700	mg/kg	0.23	mg/L								
Lanthanum	4,031	mg/kg	0.056	mg/L								
Lead												
Magnesium	6,804	mg/kg	0.49	mg/L								
Manganese	8,784	mg/kg	<0.011	mg/L								
Mercury	76	mg/kg										
Nickel	3,052	mg/kg	0.10	mg/L								
Palladium												
Phosphorus	6,200	mg/kg	3.1	mg/L								
Potassium	1,443	mg/kg	43	mg/L							78.2	mg/L
Plutonium												
Selenium												
Silicon	12,040	mg/kg	149	mg/L								

(1) 11/9/1984
Feb 1990

	Reference: 1		Date: 2/90		Reference: 2		Date: 1/29/88		Reference: 3		Date: 11/9/84	
	Solids		Liquids		Solids		Liquids		Solids		Liquids	
	Reported		Reported		Reported		Reported		Reported		Reported	
Component	Amount	Units	Amount	Units	Amount	Units	Amount	Units	Amount	Units	Amount	Units
Silver	7,236	mg/kg	6.9	mg/L								
Sodium	41,400	mg/kg	2,162	mg/L							19,987	mg/L
Strontium	736	mg/kg	0.18	mg/L								
Thallium												
Uranium	14,756	mg/kg	785	mg/L								
Vanadium												
Zinc	458	mg/kg	0.29	mg/L								
Zirconium	593	mg/kg	0.053	mg/L								
TOC	3.82	mol/kg	288,000	mg/L							2,724	mg/L
TIC			348,000	mg/L								
pH			9.5									
T alpha												
T beta												
Am-241	18,200	uCi/kg	0.00150	uCi/L	27,000	uCi/kg						
C-14	<1.0	uCi/kg										
Ce-144												
Co-60	1,440	uCi/kg										
Cs-137	265,000	uCi/kg	4,320	uCi/L							296,000	uCi/L
Eu-154	51,400	uCi/kg										
I-129	<1.2	uCi/kg										
Pu-239/240	3,610	uCi/kg	0.234	uCi/L	3,000	uCi/kg						
Ru/Rh 106												
Sb-125	9,910	uCi/kg										
Sr-89/90	2.95E+07	uCi/kg	6,580	uCi/L							23,180	uCi/L
Tc-99	25.0	uCi/kg										
Total Gamma												
Rare Earths												
TRU	21,810	uCi/kg	0.236	uCi/L	30,000	uCi/kg						

Averaged Component Amounts

Component	Solids Reported Amount	Units	Liquids Reported Amount	Units
Density	1.35	g/mL	1.0	g/mL
Bulk Density				
Particle Density				
% Solids	39.8		5.2	
% Water	60.2		94.8	
Specific Heat				
Softening Pt.				
Particle Size				
Water Solubility				
Viscosity				
SpG			1.04	g/mL
Cl	8,343	mg/kg	355	mg/L
CN				
CO3			3,660	mg/L
F	2,660	mg/kg	171	mg/L
NO2	2,944	mg/kg	989	mg/L
NO3	341	mg/kg	11,687	mg/L
OH			5,032	mg/L
PO4	1,710	mg/kg	156	mg/L
SO4	758	mg/kg	725	mg/L
Antimony				
Aluminium	37,800	mg/kg	68.2	mg/L
Arsenic				
Barium	2,055	mg/kg	0.37	mg/L
Beryllium				
Bismuth				
Boron	2,808	mg/kg	6.3	mg/L
Cadmium	414	mg/kg	<0.112	mg/L
Calcium	14,000	mg/kg	3.9	mg/L
Chromium	3,744	mg/kg	11	mg/L
Cobalt	466	mg/kg	<0.236	mg/L
Copper				
Iron	83,700	mg/kg	0.23	mg/L
Lanthanum	4,031	mg/kg	0.056	mg/L
Lead				
Magnesium	6,804	mg/kg	0.49	mg/L
Manganese	8,784	mg/kg	<0.011	mg/L
Mercury	76	mg/kg		
Nickel	3,052	mg/kg	0.100	mg/L
Palladium				
Phosphorus	6,200	mg/kg	3	mg/L
Potassium	1,443	mg/kg	43	mg/L
Plutonium				
Selenium				
Silicon	12,040	mg/kg	149	mg/L

Range of Component Amounts

Component	Solids Reported Amounts High	Low	Units	Liquids Reported Amounts High	Low	Units
Density	1.4	1.3	g/mL	1.0	1.0	g/mL
Bulk Density						
Particle Density						
% Solids	45.6	34		5.2	5.2	
% Water	66	54.4		94.8	94.8	
Specific Heat						
Softening Pt.						
Particle Size						
Water Solubility						
Viscosity						
SpG				1.04	1.04	g/mL
Cl	8,343	8,343	mg/kg	604	107	mg/L
CN						
CO3				3,660	3,660	mg/L
F	2,660	2,660	mg/kg	171	171	mg/L
NO2	2,944	2,944	mg/kg	1,150	828	mg/L
NO3	682	682	mg/kg	23,126	248	mg/L
OH				5,032	5,032	mg/L
PO4	1,710	1,710	mg/kg	285	27	mg/L
SO4	758	758	mg/kg	1,344	106	mg/L
Antimony						
Aluminium	37,800	37,800	mg/kg	135	1.6	mg/L
Arsenic						
Barium	2,055	2,055	mg/kg	0.37	0.37	mg/L
Beryllium						
Bismuth						
Boron	2,808	2,808	mg/kg	6.3	6.3	mg/L
Cadmium	414	414	mg/kg		<0.112	mg/L
Calcium	14,000	14,000	mg/kg	3.9	3.9	mg/L
Chromium	3,744	3,744	mg/kg	11	11	mg/L
Cobalt	466	466	mg/kg		<0.236	mg/L
Copper						
Iron	83,700	83,700	mg/kg	0.23	0.23	mg/L
Lanthanum	4,031	4,031	mg/kg	0.056	0.056	mg/L
Lead						
Magnesium	6,804	6,804	mg/kg	0.49	0.49	mg/L
Manganese	8,784	8,784	mg/kg		<0.011	mg/L
Mercury	76	76	mg/kg			
Nickel	3,052	3,052	mg/kg	0.100	0.100	mg/L
Palladium						
Phosphorus	6,200	6,200	mg/kg	3.1	3.1	mg/L
Potassium	1,443	1,443	mg/kg	43	43	mg/L
Plutonium						
Selenium						
Silicon	12,040	12,040	mg/kg	149	149	mg/L

Averaged Component Amounts

Component	Solids Reported Amount	Units	Liquids Reported Amount	Units
Silver	7,236	mg/kg	6.9	mg/L
Sodium	41,400	mg/kg	2,162	mg/L
Strontium	736	mg/kg	0.18	mg/L
Thallium				
Uranium	14,756	mg/kg		mg/L
Vanadium				
Zinc	458	mg/kg	0.29	mg/L
Zirconium	593	mg/kg	0.044	mg/L
TOC	3.82	mol/kg	1506.000	mg/L
TIC			348.000	mg/L
pH			9.5	
T alpha				
T beta				
Am-241	22,600	uCi/kg	0.00150	uCi/L
C-14	<1.0	uCi/kg		
Ce-144				
Co-60	1,440	uCi/kg		
Cs-137	265,000	uCi/kg	150,160	uCi/L
Eu-154	51,400	uCi/kg		
I-129		uCi/kg		
Pu-239/240	3,305	uCi/kg	0.234	uCi/L
Ru/Rh 106				
Sb-125	9,910	uCi/kg		
Sr-89/90	2.95E+07	uCi/kg	14,880	uCi/L
Tc-99	25.0	uCi/kg		
Total Gamma				
Rare Earths				
TRU	25,905	uCi/kg	0.236	uCi/L

Range of Component Amounts

Component	Solids Reported Amounts High	Low	Units	Liquids Reported Amounts High	Low	Units
Silver	*7,236*	*7,236*	mg/kg	*6.9*	*6.9*	mg/L
Sodium	*41,400*	*41,400*	mg/kg	*2,162*	*2,162*	mg/L
Strontium	*736*	*736*	mg/kg	*0.18*	*0.18*	mg/L
Thallium						
Uranium	*14,756*	*14,756*	mg/kg			
Vanadium						
Zinc	*458*	*458*	mg/kg	*0.29*	*0.29*	mg/L
Zirconium	*593*	*593*	mg/kg	0.053	0.036	mg/L
TOC	*3.82*	*3.82*	mol/kg	2,724	288	M
TIC				*348*	*348*	M
pH				*9.5*	*9.5*	
T alpha						
T beta						
Am-241	27,000	18,200	uCi/kg	*0.00150*	*0.00150*	uCi/L
C-14		*<1.0*	uCi/kg			
Ce-144						
Co-60	*1,440*	*1,440*	uCi/kg			
Cs-137	*265,000*	*265,000*	uCi/kg	298,000	4,320	uCi/L
Eu-154	*51,400*	*51,400*	uCi/kg			
I-129						
Pu-239/240	3,610	3,000	uCi/kg	*0.234*	*0.234*	uCi/L
Ru/Rh 106						
Sb-125	*9,910*	*9,910*	uCi/kg			
Sr-89/90	*2.95E+07*	*2.95E+07*	uCi/kg	23,180	6,580	uCi/L
Tc-99	*25.0*	*25.0*	uCi/kg			
Total Gamma						
Rare Earths						
TRU	30,610	21,200	uCi/kg	0.236	0.236	uCi/L

Note: Numbers in italics have only one data point.

3.19 Tank AY-102 Report Analysis from February 1990

TCRC-1

AY102-16

AY-102

(6) 2/12/1990
Sample.

REPORT ANALYSIS

GENERAL TANK INFORMATION FOR TANK 102 AY:

DATE OF ANALYSIS = 02/12/90
SAMPLE NUMBER = AY-102[illegible]
TODAY 'S DATE = 11/05/90
WASTE TYPE = TRU

102 AY Supernatant.

COMMENT/NOTE : Physical properties of the supernate from 102AY waste, analysis of Anion, Radioicotopes and element concentrations of supernate and wash. 1st and 2nd analysis.
See TFD3 log books for documentation.

Ref: Correspondence No. 9090855.

PHYSICAL PROPERTIES OF THE SAMPLE :

SLURRY(SLUDGE) DENSITY (G/ml)	=	[illegible]
SUPERNATE DENSITY (G/ml)	=	[illegible]
CENTRIFUGED SOLIDS DENSITY (G/ml)	=	0.000
WT% CENTRIFUGED(FILTERED) SOLIDS	=	0.000
WT% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
VOL% CENTRIFUGED(FILTERED) SOLIDS	=	0.000
VOL% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
WT% INSOLUBLE SOLIDS	=	0.000
WT% WATER	=	0.000
WT% OF TOTAL SOLIDS	=	0.000
SAMPLE pH READING	=	0.000

FLUID RHEOLOGY OF THE SAMPLE :

TYPE OF FLUID :

YIELD STRESS (N/m2)	=	0.000
SHEAR STRESS (N/m2)	=	0.000
CONSISTENCY INDEX (Nsec/m2)	=	0.000
FLOW BEHAVIOR INDEX	=	0.000
CRITICAL VELOCITY (m/sec)	=	0.000

CONCENTRATION

		Supernate	Water Wash
F-	(m)	9.3E-03	3.7E-02
Cl-	(m)	1.6E-02	1.1E-01
NO2	(m)	2.5E-02	5.0E-02
NO3	(m)	4.4E-03	9.1E-04
PO4	(m)	5.5E-04	3.4E-02
[illegible]	(m)	1.1E-03	3.4E-03
TIC	(m)	2.9E-02	9.9E-02
TOC	(m)	2.4E-02	1.1E-01
Ag	(m)	NM	NM
Al	(m)	5.9E-05	2.4E-04
B	(m)	3.8E-04	3.1E-04
Ba	(m)	2.9E-06	5.0E-06
Ca	(m)	1.1E-04	2.5E-06
Cd	(m)	<4E-06	<4E-06
Cr	(m)	2.1E-04	1.3E-03
Cu	(m)	<1.E-07	<1E-07
Fe	(m)	7.2E-06	<7E-06
K	(m)	1.1E-03	4.1E-03
La	(m)	<4E-07	<4E-07
Li	(m)	(8E-06)	(3E-05)
Mg	(m)	2.3E-05	5.3E-05
Mn	(m)	<2E-07	2e-07
M[illegible]	(m)	1.1E-06	9.9E-06
Na	(m)	9.1E-02	3.8E-01
Nd	(m)	<7E-07	<7E-07
Ni	(m)	(1.4E-06	<1E-06
P	(m)	1E-04	2.9E-03
Pb	(m)	<2E-06	<2E-06
Ru	(m)	<1E-06	<1E-06
Si	(m)	4.6E-03	3.0E-02
Sr	(m)	2.6E-06	3.0E-02
Te	(m)	<2E-06	2.4E-06
Ti	(m)	<4E-07	4.2E-07
U	(m)	3.3E-03	1.2E-03
Zn	(m)	5.0E-06	(3E-06)
Zr	(m)	<7Ee-07	3.9E-06
******************		********	********
Am-241	(uCi/mL)	1.5E-06	6.67E-06
C-14	(uCi/mL)	NM	NM
Cm-242	(uCi/mL)	ND	ND
Cm243+244	(uCi/mL)	ND	ND
Co-60	(uCi/mL)	ND	ND
Cs-134	(uCi/mL)	4.95E-03	5.41E-03
Cs-137	(uCi/mL)	4.32E+00	1.09E+01
Eu-154	(uCi/mL)	ND	ND
I-129	(uCi/mL)	NM	NM
Pu-238			
P[illegible]+240		2.34E-04	1.21E-05
Ru-106	(uCi/mL)	NM	1.89E-01
Sb-125	(uCi/mL)	ND	ND
Se-79	(uCi/mL)	NM	NM
Sr-90	(uCi/mL)	6.58E+00	1.26E+00
Tc-99	(uCi/mL)	NM	NM
******************		********	********
SECOND ANALYSIS			
F-	(m)	8.7E-03	2.4E-02

Cl	(m)	1.7E-02	9.1E-02
NO2	(m)	2.4E-02	3.7E-02
NO3-	(m)	3.6E-03	6.8E-03
PO3/4-	(m)	<3E-06	1.8E-03
SO2/4-	(m)	1.1E-03	2.8E-03
TIC	(m)	NM	NM
TOC	(m)	2.4E-02	7.8E-02
******************	********	********	
SECOND ANALYSIS			
Ag	(m)	6.4E-05	1.6E-04
Al	(m)	<5.1E-05	<6.6E-05
B	(m)	7.7E-04	1.9E-03
Ba	(m)	2.5E-06	3.3E-05
Ca	(m)	8.3E-05	4.0E-05
Cd	(m)	<1E-06	<1E-06
Ce	(m)	<4E-06	<3E-06
Cr	(m)	2.5E-04	1.6E-03
Dy	(m)	<1E-07	<1E-06
Fe	(m)	<1.2E-05	<4E-06
Hg	(m)	NM	NM
K	(m)	1.1E-03	5.0E-03
La	(m)	<4E-07	<4E-07
Li	(m)	<1E-04	<3E-05
Mg	(m)	1.7E-05	8.7E-06
Mn	(m)	<2E-07	<1E-07
[illegible]	(m)	4.3E-06	2.4E-05
Na	(m)	9.6E-02	5.0E-01
Nd	(m)	<7E-07	<1E-06
Ni	(m)	<2E-06	<6E-06
P	(m)	(1E-04)	3.4E-03
Rh	(m)	<2E-06	<2E-06
Ru	(m)	<1E-06	<2E-06
Si	(m)	5.9E-03	2.8E-02
Sr	(m)	1.6E-06	<2E-09
Te	(m)	<2E-06	<4E-06
Ti	(m)	<4E-07	<7E-07
U	(m)	3.5E-03	1.4E-02
Zn	(m)	3.7E-06	1.3E-05
Zr	(m)	<7.6E-07	<1.9E-06

TCRC-29

AY102-14

AY-102

(7) 2/12/90
sludge data

DATE :11/08/90

TIME :12:36:44

REPORT ANALYSIS

GENERAL TANK INFORMATION FOR TANK 102 AY

DATE OF ANALYSIS = 02/12/90
SAMPLE NUMBER = AY-102
TODAY'S DATE = 11/06/90
WASTE TYPE = TRU

COMMENT/NOTE : Three samples from 102-AY were received Top, Middle, Bottom. The solids from all three samples were blended together to form a composite solids sample. The rheological characterization was performed on a 1:1 dilution of the composite solids (sample # AY-102D) See TFDB log books for documentation.

REF: Correspondence No. 9000855

"Top, middle, & bottom samples blended together to form a composite sample"
1:1 dilution.

PHYSICAL PROPERTIES OF THE SAMPLE :

SLURRY(SLUDGE) DENSITY (G/ml)	=	[illegible]
SUPERNATE DENSITY (G/ml)	=	0.000
CENTRIFUGED SOLIDS DENSITY (G/ml)	=	1.400
WT% CENTRIFUGED(FILTERED) SOLIDS	=	0.000
WT% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
VOL% CENTRIFUGED(FILTERED) SOLIDS	=	79.000
VOL% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
WT% INSOLUBLE SOLIDS	=	0.000
WT% WATER	=	54.400
WT% OF TOTAL SOLIDS	=	45.600
SAMPLE pH READING	=	0.000

FLUID RHEOLOGY OF THE SAMPLE :

TYPE OF FLUID :

YIELD STRESS (N/m2)	=	0.000
SHEAR STRESS (N/m2)	=	0.000
CONSISTENCY INDEX (Nsec/m2)	=	0.000
FLOW BEHAVIOR INDEX	=	0.000
CRITICAL VELOCITY (m/sec)	=	0.000

Composition of Tank 102 AY (AY-102)

COMPONENTS		Supernate	Water Wash	Solids	Acid Leach	Slurry/Sludge
Am-241	(uCi/g)			1.82E+01		
C-14	(uCi/g)			<1.0E-03		
Cm-242	(uCi/g)			ND		
Cm-243+244	(uCi/g)			6.31E-01		
Co-60	(uCi/g)			1.44E+00		
Cs-134	(uCi/g)			ND		
Cs-137	(uCi/g)			2.65E+02		
Eu-154	(uCi/g)			5.14E+01		
I-129	(uCi/g)			<1.2E-03		
Pu-238	(uCi/g)			1.14E+00		
Pu-239+240	(uCi/g)			3.61E+00		
Ru-106	(uCi/g)			ND		
Sb-125	(uCi/g)			9.91E+00		
Se-79	(uCi/g)			<5.4E-03		
Sr-90	(uCi/g)			2.95E+04		
Tc-99	(uCi/g)			2.5E-02		
FIRST ANALYSIS						
F-	(mmol/g)			1.8E-01		
Cl-	(mmol/g)			2.3E-01		
NO2	(mmol/g)			1.1E-01		
NO3	(mmol/g)			1.7E-02		
PO3/4	(mmol/g)			2.4E-02		
SO2/4	(mmol/g)			8.1E-03		
TIC	(mmol/g)			NM		
TOC	(mmol/g)			NM		
SECOND ANALYSIS						
F-	(mmol/g)			9.3E-02		
Cl-	(mmol/g)			2.4E-01		
NO2	(mmol/g)			1.8E-02		
NO3	(mmol/g)			5.4E-03		
PO3/4	(mmol/g)			1.1E-02		
SO2/4	(mmol/g)			7.6E-03		
TIC	(mmol/g)			NM		
TOC	(mmol/g)			3.82E+00		
FIRST ANALYSIS	ELEMENT					
Ag	(mmol/g)			NM		
Al	(mmol/g)			1.2E+00		
B	(mmol/g)			7.2E-02		
Ba	(mmol/g)			1.5E-02		
Ca	(mmol/g)			4.2E-01		
Cd	(mmol/g)			4.0E-03		
Ce	(mmol/g)			8.6E-03		
Cr	(mmol/g)			7.2E-02		
Fe	(mmol/g)			1.6E+00		
Hg	(mmol/g)			3.8E-04		
K	(mmol/g)			1.5E-02		
La	(mmol/g)			3.0E-02		
Li	(mmol/g)			ND		
Mg	(mmol/g)			3.0E-01		
Mn	(mmol/g)			1.7E-01		
Mo	(mmol/g)			(9E-04)		
Na	(mmol/g)			(d)		
Nd	(mmol/g)			1.9E-02		

Ni	(mmol/g)	5.6E-02
P	(mmol/g)	[illegible]
Rh	(mmol/g)	ND
Si	(mmol/g)	[illegible]
Sr	(mmol/g)	9.0E-03
Te	(mmol/g)	(4E-03)
Ti	(mmol/g)	7.1E-03
U	(mmol/g)	6.5E-02
Zn	(mmol/g)	5.8E-03
Zr	(mmol/g)	(e)

SECOND ANALYSIS

Ag	(mmol/g)	6.7E-02
Al	(mmol/g)	1.6
B	(mmol/g)	0.44
Ba	(mmol/g)	1.4E-02
Ca	(mmol/g)	2.8E-01
Cd	(mmol/g)	3.4E-03
Ce	(mmol/g)	7.2E-03
Cr	(mmol/g)	6.3E-02
Fe	(mmol/g)	1.4
K	(mmol/g)	5.9E-02
La	(mmol/g)	2.7E-02
Li	(mmol/g)	ND
Mg	(mmol/g)	2.6E-01
Mn	(mmol/g)	1.5E-01
Mo	(mmol/g)	(2E-03)
Na	(mmol/g)	1.9
Nd	(mmol/g)	1.6E-02
Ni	(mmol/g)	4.7E-02
P	(mmol/g)	2.3E-01
Rh	(mmol/g)	ND
Si	(mmol/g)	4.3E-01
Sr	(mmol/g)	7.7E-03
Ti	(mmol/g)	7.0E-03
U	(mmol/g)	5.9E-02
Zn	(mmol/g)	8.1E-03
Zr	(mmol/g)	6.3E-03

TCRC-18 AY102-15 AY-102

~~(7) 2/12/90~~
~~Supernatant~~

REPORT ANALYSIS

GENERAL TANK INFORMATION FOR TANK 102 AY

DATE OF ANALYSIS = 02/12/90
SAMPLE NUMBER = AY-102D
TODAY 'S DATE = 11/08/90
WASTE TYPE = TRU

COMMENT/NOTE : 1:1 dilution of composite solids from tank 102AY. The solids were diluted with deionized water.
See TFDB log books for documentation.

Composite Solids from 102AY

Ref: Correspondence No. 9000855.

PHYSICAL PROPERTIES OF THE SAMPLE :

SLURRY(SLUDGE) DENSITY (G/ml)	=	[illegible]
SUPERNATE DENSITY (G/ml)	=	0.000
CENTRIFUGED SOLIDS DENSITY (G/ml)	=	1.300
WT% CENTRIFUGED(FILTERED) SOLIDS	=	0.000
WT% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
VOL% CENTRIFUGED(FILTERED) SOLIDS	=	51.000
VOL% CENTRIFUGED(FILTERED) SUPERNATE	=	0.000
WT% INSOLUBLE SOLIDS	=	0.000
WT% WATER	=	0.000
WT% OF TOTAL SOLIDS	=	0.000
SAMPLE pH READING	=	0.000

FLUID RHEOLOGY OF THE SAMPLE :

TYPE OF FLUID :

YIELD STRESS (N/m2)	=	0.000
SHEAR STRESS (N/m2)	=	0.000
CONSISTENCY INDEX (Nsec/m2)	=	0.000
FLOW BEHAVIOR INDEX	=	0.000
CRITICAL VELOCITY (m/sec)	=	0.000

Solids Settling Behavior for the [illegible]
Tank 102 [illegible] of sample [illegible]

Time(hrs)	[illegible]		[illegible]	
	Height(cm)	Height change (cm)	Height(cm)	Height change (cm)
0.0	14.5	14.5	14.6	14.8
1.17	14.5	14.5	14.8	14.8
3.17	12.3	14.5	13.0	14.8
5.17	12.0	14.5	12.0	14.8
22.5	12.0	14.5	12.0	14.8

3.20 Congdon, J. W., and Lozier, J. S., 1987, "Inhibition of Washed Sludge with Sodium Nitrite," (Memorandum DPST-87-379 to M. A. Ebra), Savannah River Laboratory, Aiken, South Carolina.

OSR 14-357

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DPST-87-379

TITLE
Inhibition of Washed Sludge with Sodium Nitrite

AUTHOR(S)
J. W. Congdon, J. S. Lozier

TYPE OF DOCUMENT

- ☐ CLASSIFIED DP REPORT
- ☐ UNCLASSIFIED DP REPORT
- ☐ CLASSIFIED LETTER
- ☐ UNCLASSIFIED LETTER
- ☐ CLASSIFIED PAPER
- ☒ UNCLASSIFIED REPORT
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16

TECHNICAL DIVISION
SAVANNAH RIVER LABORATORY

DPST-87-379

Key Words: Waste Tank
Corrosion
Pitting
Nitrite
Inhibitors
Washed Sludge

CC: J. E. Haywood, 703-A
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D. D. Walker, 773-A
R. E. Eibling, 773-A
P. E. Zapp, 773-A
L. F. Landon, 704-T
SRL Records (4), 773-A

April 7, 1987

MEMORANDUM

TO: M. A. EBRA, 773-A

FROM: J. W. CONGDON, 773-A *J. W. Congdon*
J. S. LOZIER, 773-A

INHIBITION OF WASHED SLUDGE WITH SODIUM NITRITE

INTRODUCTION

Washed sludge is an aqueous slurry consisting of a relatively dilute salt solution in equilibrium with several transition metal oxides and hydroxides. This slurry will be produced by in-tank washing of sludge and each batch will be stored for approximately two years in existing carbon steel (ASTM A-537) tanks. Batches of washed sludge will be removed periodically and sent to the DWPF for processing into glass. Washed sludge contains several species (nitrate, sulfate, chloride, and fluoride) which are known to act as pit inducing (aggressive) anions.[1]

Pitting of the waste tanks has been identified as a corrosion concern for washed precipitate[2] which has a composition similar to washed sludge. This prompted concern about the corrosivity of washed sludge. Pitting is most likely to occur in the region just above (0 to 6") the waterline based on the corrosion mechanism described for washed precipitate.[3]

This report describes the results of electrochemical tests used to determine the relationship between the concentration of the aggressive anions in washed sludge and the minimum effective inhibitor concentration. Sodium nitrite was added as the inhibitor because of its compatibility with the DWPF process.[4]

SUMMARY

A minimum of 0.05M nitrite is required to inhibit the washed sludge simulant solution used in this study. When the worst case compositions and safety margins are considered, it is expected that a minimum operating limit of nearly 0.1M nitrite will be specified. The validity of this limit is dependent on the accuracy of the concentrations and solubility splits reported in BDR-90.[5] Sodium nitrite additions to obtain 0.1M nitrite concentrations in washed sludge will necessitate the additional washing of washed precipitate in order to decrease its sodium nitrite inhibitor requirements sufficiently to remain below the sodium limits[4] in the feed to the DWPF.

Nitrate will be the controlling anion in "fresh" washed sludge unless the soluble chloride concentration is about ten times higher than predicted by the solubility splits in BDR-90. Inhibition of "aged" washed sludge will not be a problem unless significant chloride dissolution occurs during storage. It will be very important to monitor the composition of washed sludge during processing and storage.

EXPERIMENTAL

Cyclic potentiodynamic polarization tests were used to determine the pitting behavior of ASTM A-537 carbon steel in various compositions of synthetic washed sludge. The experimental procedure and equipment have been described previously.[6]

The composition of washed sludge simulant was based on data reported in BDR-90. Imbedded in BDR-90 are solubility splits for various species. These splits (Table 1) can have a significant effect on the soluble concentration of several species in washed sludge. For the simulant recipe, it was assumed that nitrate, sulfate, and fluoride were fully soluble. This is 3, 2, and 20 times the respective BDR-90 soluble values, and should adequately represent worst-case for these ions. The BDR-90 solubility value of 2% was used for chloride. All other species were added at the soluble concentrations reported in BDR-90. Several electrochemically important transition metals were added with precipitation allowed to occur in situ.

The various compositions of the test solutions (i.e. nitrite/aggressive anion ratios) were selected by a best guess approach based on the results of previous tests rather than a fixed matrix of compositions. Since the soluble fluoride concentration in washed sludge is very low, the effects of variations in the fluoride concentration were not evaluated in this study, however, it was always present at the maximum expected level. The compositions of the simulant solutions were adjusted by the addition or removal of the appropriate sodium salts.

After each scan was completed, the specimens were cleaned with Clarke's solution[7] and examined with an optical microscope for evidence of pitting and crevice corrosion. Pitting was defined as the presence of corrosion on the exposed portion of the specimen.

RESULTS and DISCUSSION

The effects of the concentration of the primary aggressive anions (nitrate, chloride, and sulfate) in washed sludge on the minimum nitrite concentration required for inhibition are shown in Figures 1, 2, and 3. All species were present at the concentrations specified above, except for the one being varied. The line in each of the plots represents the minimum nitrite concentration required to inhibit pitting as a function of the aggressive anion concentration. A minimum of 0.05M nitrite is required to inhibit the washed sludge simulant used in this study.

All three log-log plots show a region in which the minimum nitrite concentration is independent of the aggressive anion concentration. This behavior has also been reported for washed precipitate[1] and indicates that there are no interaction effects between the aggressive anions.

These results also indicate that nitrate controls the inhibitor requirement in "fresh" washed sludge. If the soluble concentration of chloride increases to >0.002M (which is 10x the concentration predicted in BDR-90), the nitrite requirements will be controlled by the soluble chloride concentration. If chloride concentrations are this high, the required sodium nitrite additions could be sufficiently high to necessitate rewashing of the slurry to lower the total sodium to concentrations acceptable to the DWPF process.[4] At present, there is no information on the dissolution of chloride into washed sludge during storage. Chloride levels in washed sludge will be monitored very closely during processing and storage.

Radiolysis effects during the storage of washed sludge make the slurry less corrosive as nitrate is converted to nitrite. Since there is no tetraphenylborate anion (TPB) in washed sludge, nitrite depletion is not a problem. Nitrite depletion in washed precipitate is apparently related to the volatile decomposition products of TPB.[8]

The results presented in Figure 3 indicate that nearly a ten fold increase in the sulfate concentration is necessary before the nitrite requirements for washed sludge begin to increase. This is important since the concentration of soluble sulfate is difficult to predict for the various stages of sludge washing because of the presence of insoluble calcium sulfate. The sulfate concentration determines the critical nitrite concentration (0.009M) on the nitrite/nitrate plot (Figure 1) based on an extrapolation of the slope of nitrite/sulfate plot to the BDR-90 sulfate concentration (0.00258M). Therefore, the inhibitor requirements for "aged" BDR-90 washed sludge (i.e. nitrate depleted) will be controlled by the sulfate concentration if the sulfate is fully soluble. The data indicates that, if the solubility splits in Table 1 are correct, the inhibitor requirements for the soluble chloride and sulfate in "aged" washed sludge are both ~0.005M nitrite. Hence, an increase in the soluble concentration of either species would increase the inhibitor requirements for the aged slurry. As discussed earlier, the nitrite concentration resulting from the radiolytic conversion of nitrate to nitrite will be more than sufficient to inhibit "aged" washed if the solubility split for chloride is correct in BDR-90.

PROGRAM

Four month coupon tests to demonstrate the effectiveness of nitrite inhibition at selected washed sludge compositions are in progress. Electrochemical tests are in progess to establish the nitrite requirements for partially washed sludge at each stage of processing. Electrochemical tests to establish the nitrite requirements in a worst case composition of washed sludge are planned, if the conservative assumptions in this report do not adequately represent a worst-case solution composition.

REFERENCES

1. J. W. Congdon, DPST-86-803, "Aggressive Anions in Washed Precipitate," November 24, 1986.

2. A. F. Riechman, DPST-86-236, In-Tank Processing: Corrosion Phenomena Due to Storage of Dilute Waste Solutions, January 20, 1986.

3. J. W. Congdon, DPST-86-446, "Corrosion Mechanism of Carbon Steel in Washed Precipitate," May 19, 1986.

4. D. F. Bickford, C. M. Jantzen, DPST-86-546, "Inhibitor Limits for Washed Precipitate Based on Glass Quality and Solubility Limits," October 6, 1986.

5. "Basic Data Report Defense Waste Processing Facility Sludge Plant, DPST-80-1033, Volume 2, Rev. 90, October 30, 1984.

6. J. W. Congdon, DPST-86-457, "Evaluation of Corrosion Inhibitors for Washed Precipitate," May 27, 1986.

7. ASTM Designation: G1-81, "Standard Practices for Preparing, Cleaning, and Evaluating Corrosion Test Specimens," (1981).

8. D. D. Walker and B. S. Johnson, Radiolytically Induced Changes in the Concentration of Nitrate and Nitrite Ions in Potassium Tetraphenylborate Slurries, DPST-86-716, October 14, 1986.

JWC:khs

Table 1. Total Concentration and the Percentage Soluble of Selected Species in Washed Sludge

Species	Total Concentration M	% Soluble
NaOH	0.152	20
Na_2CO_3	0.00148	100
$NaNO_2$	0.0158	100
Total NO_3	0.0630	36
Total Cl	0.0245	1.3
NaF	0.00341	4.5
Na_2SO_4	0.00258	53
$Na_2C_2O_4$	0.0000726	100
Na_2CrO_4	0.0000298	100
Na_2MoO_4	0.00000387	100
Na_2SiO_3	0.0000368	80
Na_3PO_4	0.000188	44

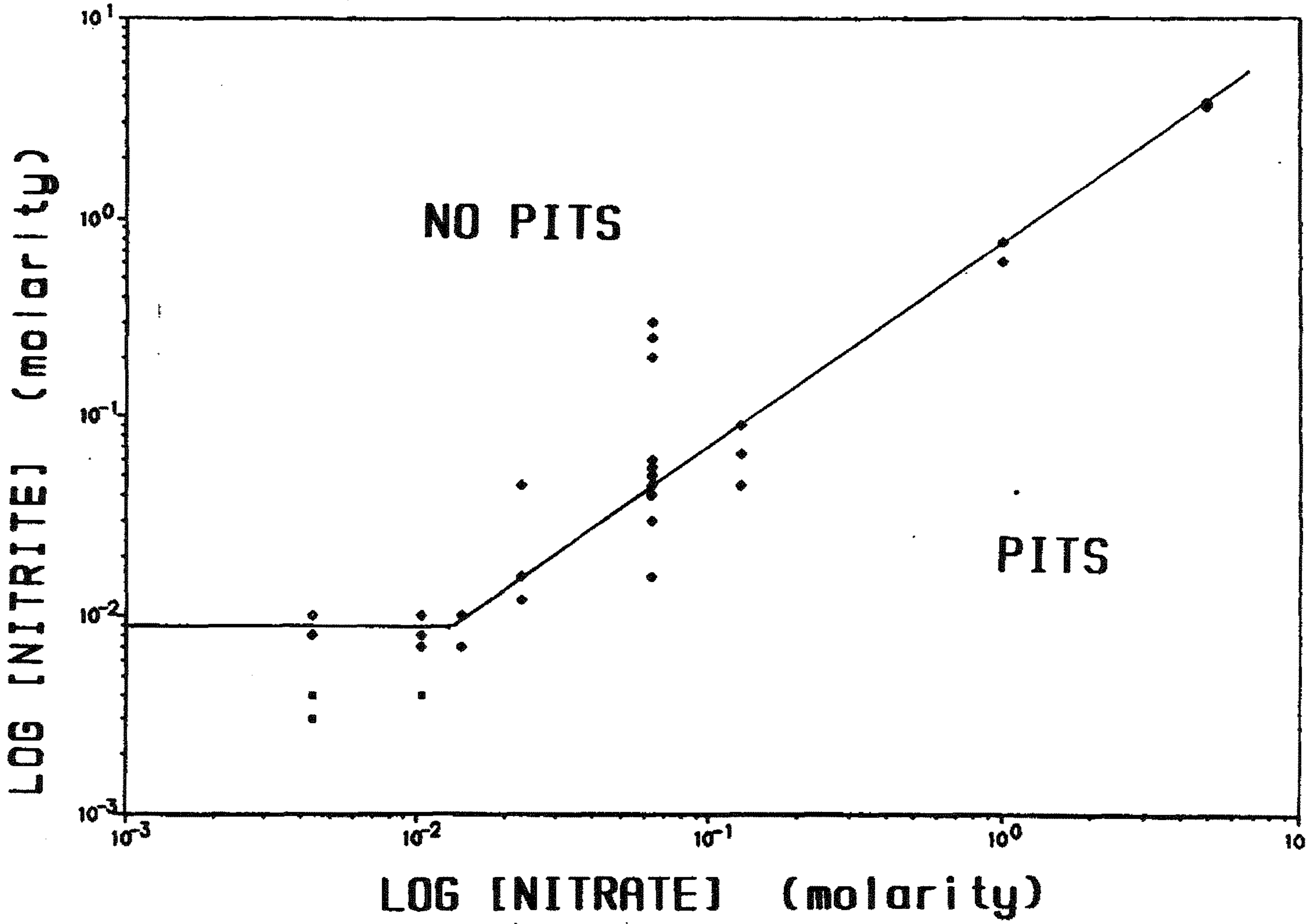

Figure 1: **Effect of Nitrate Concentration on the Minimum Nitrite Concentration Required to Prevent Localized Corrosion of A-537 Carbon Steel in Washed Sludge.**

Key: ◇ No Pits
Occasional Pitting
Pits

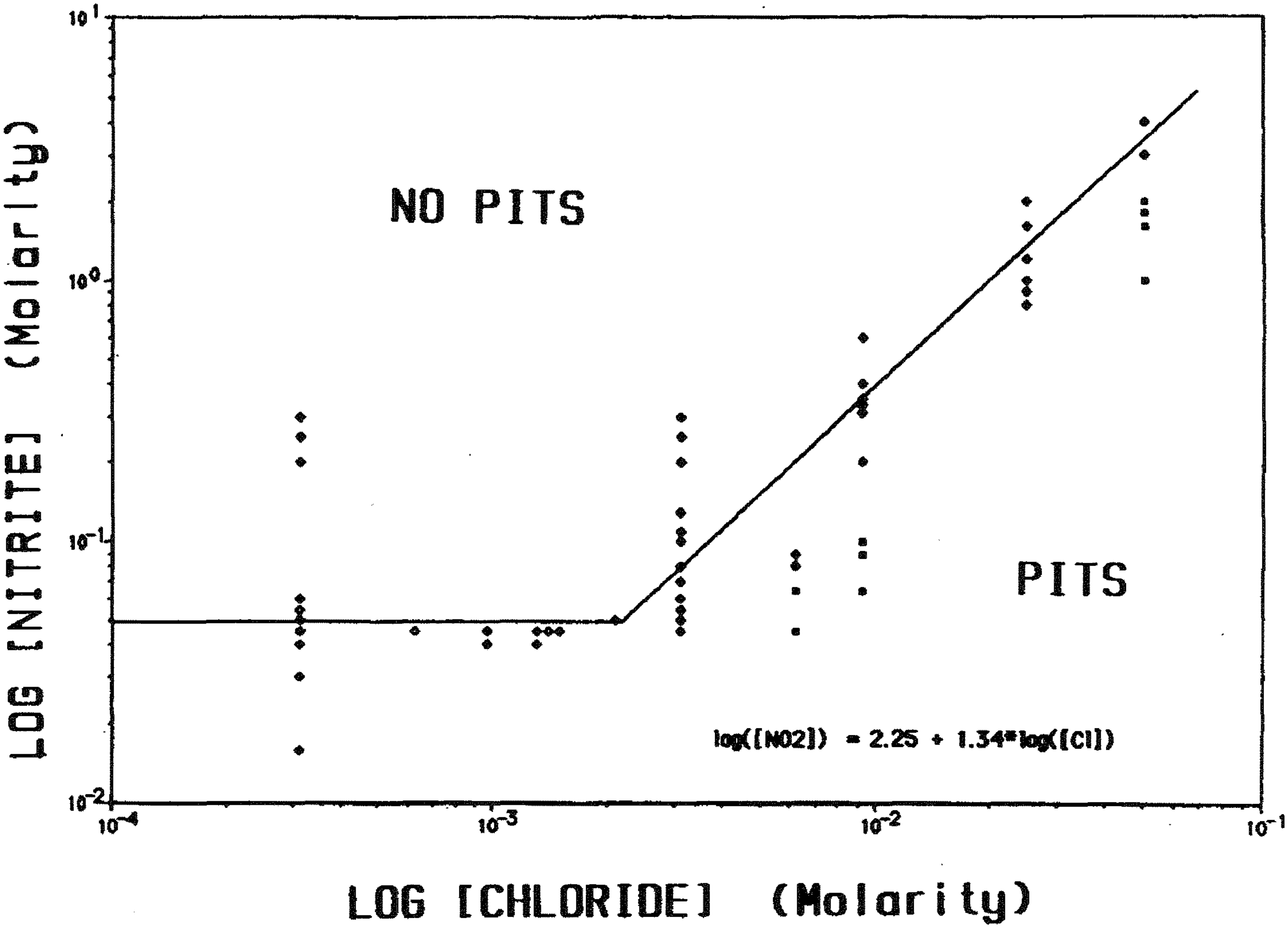

Figure 2: **Effect of Chloride Concentration on the Minimum Nitrite Concentration Required to Prevent Localized Corrosion of A-537 Carbon Steel in Washed Sludge.**

Key: ◇ No Pits
Occasional Pitting
Pits

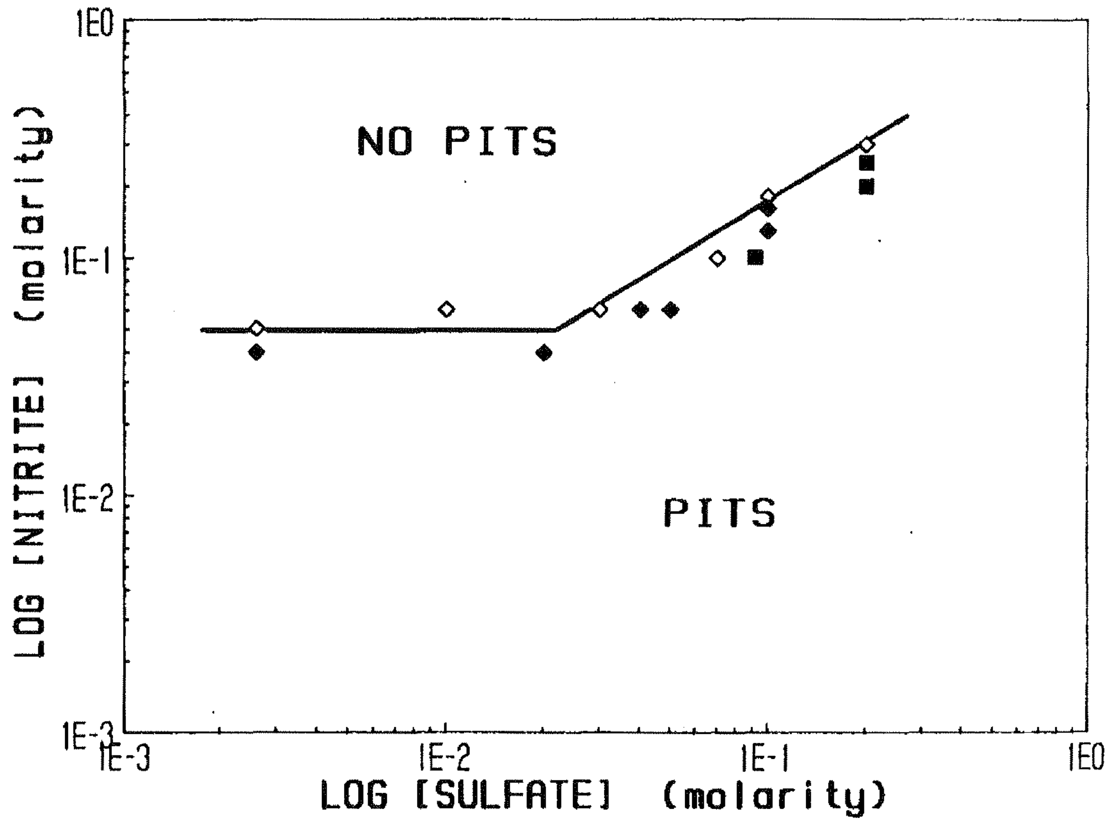

Figure 3: Effect of Sulfate Concentration on the Minimum Nitrite Concentration Required to Prevent Localized Corrosion of A-537 Carbon Steel in Washed Sludge.

Key: ◇ No Pits
◆ Occasional Pitting
■ Pits

3.21 WSRC-TR-94-0250, 1994, Recommended Nitrite Limits for Chloride and Sulfate in ESP Slurries (U), Westinghouse Savannah River Company, Aiken, South Carolina.

OSR 14-357# (Rev 2-2-99)
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Westinghouse Savannah River Company
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Title: RECOMMENDED NITRITE LIMITS FOR CHLORIDE AND SULFATE IN ESP SLURRIES

Key Words (list 3): Corrosion, Pitting, Carbon Steel

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Aiken, SC 29802

MSD-STI-9ALD-TIM-94-0629

August 9, 1999

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WSRC Public Relations Officer
Public Relations Department
Building 705-A

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Document No. WSRC-TR-94-0250

Document Title RECOMMENDED NITRITE LIMITS FOR CHLORIDE AND SULFATE IN ESP SLURRIES

Author P. E. Zapp

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RECOMMENDED NITRITE LIMITS FOR CHLORIDE AND SULFATE IN ESP SLURRIES

by

P. E. Zapp

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

DOE Contract No. **DE-AC09-89SR18035**

687897

WSRC-TR-94-0250

WESTINGHOUSE SAVANNAH RIVER COMPANY
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INTER-OFFICE MEMORANDUM

June 6, 1994

TO: J. E. Marra, 703-H

FROM: P. E. Zapp, 773-A

Approved by:

N. C. Iyer, Manager
Materials Application and Corrosion Technology Group

Technical Reviewer

Authorized Derivative Classifier

RECOMMENDED NITRITE LIMITS FOR CHLORIDE AND SULFATE IN ESP SLURRIES (U)

SUMMARY

Two additional nitrite limits are developed and recommended for Extended Sludge Processing slurries. These limits apply to slurries in which the chloride or sulfate concentrations exceed specified percentages of the nitrate concentration.

DISCUSSION

In a previous report additional nitrite limits were developed and recommended for inclusion in the In-Tank Precipitation (ITP) Operational Safety Requirements.[1] These limits specify nitrite concentrations which prevent pitting corrosion of carbon steel exposed to waste solutions which contain high chloride or sulfate concentrations. Such additional limits cover the conditions in which a specified percentage of the concentration of nitrate, which is normally the principal corrosive anion, is exceeded by the chloride or sulfate concentration. The new limits are based on previously obtained laboratory corrosion data on the corrosivity of simulated washed precipitate solutions. They permit the inhibition of pitting with nitrite additions to the ITP tanks rather than caustic additions to raise the hydroxide level to > 1 M.

Nitrite concentrations based on chloride and sulfate can be developed also for Extended Sludge Processing (ESP) operations. The approach to developing these was identical to that followed for the ITP limits. In previously conducted electrochemical corrosion tests, the nitrite concentration which is required to inhibit pitting was established in a simulated fully washed ESP solution with varied chloride or sulfate levels.[2] The fixed concentrations of the various ions in the simulant were those reported in the "Basic

Data Report Defense Waste Processing Facility Sludge Plant, DPST-80-1033, Vol. 2, Rev. 90", except for the nitrate, sulfate, and fluoride concentrations, which were calculated under the assumption of the complete solubility of these species. This assumption yielded, for example, a nitrate concentration in the simulant solution of 0.063 M, rather than 0.022 M. Pitting susceptibility or immunity was assessed with cyclic potentiodynamic polarization scans on specimens of ASTM A537 Class 1 carbon steel. Testing was conducted at 40°C only.

The tests revealed that, as with the ITP test results, the logarithm of the inhibiting nitrite concentration is independent of the logarithm of the corrosive anion below a certain critical value and then linearly dependent upon it above that value. The general form of the linearly dependent relationship is

$$\log [NO_2^-] = a + b*\log[CA] \qquad (1)$$

where CA stands for any corrosive anion, and a and b are constants, which are dependent upon the composition of the simulant under test.

The equation for nitrite to prevent chloride-induced pitting in the washed sludge is

$$\log [NO_2^-] = 2.25 + 1.34*\log[Cl^-] \qquad (2)$$

obtained at 40°C. Equation 2 applies when the chloride concentration exceeds 3% of the nitrate concentration.

In order to provide a temperature dependence to the nitrite concentration, one can adopt the temperature dependence expressed in the equation developed for the minimum nitrite equation as a function of the nitrate concentration in ESP solutions:

$$[NO_2^-] = 0.025*10^{0.041T}*[NO_3^-]^{0.98} \qquad (3)$$

where T is in °C.[3] Equation 3 was developed from laboratory data obtained at 23, 30, 40, 50, and 60°C, and is applicable over that range only. Equation 3 incorporates the increase in corrosivity with temperature due to nitrate in ESP solutions. With a change in temperature T away from 40°C, the nitrite requirement changes by a factor of $10^{0.041T}/10^{0.041*40}$, or $10^{0.041*(T-40)}$, from the 40°C nitrite level. Based on the thermal activation of corrosion reactions and the relatively small differences between 40°C and temperatures of interest, it is reasonable to apply the same temperature factor to Equation 2. Thus Equation 2 becomes, with the antilogarithmic transformation and the inclusion of the temperature dependence and a safety factor of 1.5,

$$[NO_2^-] = 1.5 * 10^{0.041*(T-40)} * 10^{(2.25 + 1.34*\log[Cl^-])} \qquad (4)$$

The equation for the minimum nitrite concentration required to inhibit pitting caused by sulfate is

$$\log [NO_2^-] = -0.0675 + 0.835*\log[SO_4^{=}] \qquad (5)$$

Equation 5 applies when the sulfate concentration exceeds 30% of the nitrate concentration. After the antilogarithmic transformation, the same temperature dependence and safety factor may be introduced to the nitrite-sulfate relationship to give

$$[NO_2^-] = 1.5 * 10^{0.041*(T-40)} * 10^{(0.0675 + 0.835*\log[SO_4^=])} \quad (6)$$

It has been shown that corrosive anions act independently, not additively.[4] Pitting corrosion is prevented, when the highest nitrite concentration required by any corrosive anion is present in the waste. Thus the minimum nitrite limit is the highest of the three nitrite concentrations calculated from the nitrate (see Reference 3), chloride, or sulfate concentration.

RECOMMENDED ESP PROCESS REQUIREMENT LIMITS

Equations 4 and 6 may be inserted as additional limits in the Requirements for Corrosion Control of Waste Tank Contents in the ESP Process Requirements. The new limits may take the form

Applicability	Parameter	Minimum	Maximum	Units
$[NO_3^-] \le 1.0$ Molar and $[OH^-] < 1.0$ Molar and $[Cl^-] > 0.03\ [NO_3^-]$	$[NO_2^-]$	A	-	Molar
	Temperature	-	60	°C
	pH	10.3		pH units

where $A = 1.5 * 10^{0.041*(T-40)} * 10^{(2.25 + 1.34*\log[Cl^-])}$

Applicability	Parameter	Minimum	Maximum	Units
$[NO_3^-] \le 1.0$ Molar and $[OH^-] < 1.0$ Molar and $[SO_4^=] > 0.3\ [NO_3^-]$	$[NO_2^-]$	B	-	Molar
	Temperature	-	60	°C
	pH	10.3		pH units

where $B = 1.5 * 10^{0.041*(T-40)} * 10^{(0.0675 + 0.835*\log[SO_4^=])}$

For these limits the pH has been changed to 10.3, so that the limits are valid at any ESP dilution.

REFERENCES

1. P. E. Zapp, "Effect of Chloride and Sulfate on Nitrite Requirements for ITP (U)," WSRC-TR-94-0217, May 5, 1994.

2. J. W. Congdon and J. S. Lozier, "Inhibition of Washed Sludge with Sodium Nitrite," DPST-87-379, April 7 1987.

3. P. E. Zapp, "Effect of Temperature on the Nitrite Requirement to Inhibit Washed Sludge (U)," WSRC-TR-90-292, September 18, 1990.

4. J. W. Congdon, "Inhibition of Nuclear Waste Solutions Containing Multiple Aggressive Anions," Materials Performance 22, 34 (1988).

4.0 Supporting Documentation for RPP-ASMT-53793, Section 4.1.8, Tank AY-102 Ultrasonic Testing

The primary wall UT measurements for Tank AY-102 from FY2007 were reviewed by the Level III NDE to look for the amount of un-recorded pitting in the tank. These pits became a concern when the chemistry evaluation of the Tank AY-102 showed the presence of historic waste composition that could have led to pitting. The UT protocol for recording the presence of pits could have masked the presence of pits caused by these historic waste compositions. The data from FY2007 re-evaluated was to look for pits at a depth of greater than 40 mils and to see whether the lower levels of the tank (especially the bottom knuckle) had an increased pit population.

During the evaluation of the chemistry in Tank AY-102, the current composition of the waste doesn't show a propensity for corrosion. However, since the current corrosion control limits were adopted in 1984, there may have been waste in the tank that would show a propensity for corrosion. If a layer of this waste exists in the tank, the addition of higher heat waste in 1998 may have led to conditions in which corrosion could have occurred. There is uncertainty as to the presence of this layer because the core sampling system is kept from sampling the very bottom of the tank because of concerns of the drill string damaging the primary tank.

The discussion of this potential layer is found in Chemistry, Section 4.1.4. From the Chemistry Summary Section 4.1.4.5 on page 4-26 of RPP-ASMT-53793:

> *Although there were opportunities for corrosion in the early operation of the tank, there are no definite indications of a high propensity for corrosion in Tank AY-102 because of its operating history. One scenario that should be considered is that remnants of incompletely inhibited nitrate-rich interstitial liquids that were present in the low temperature solids layer in Interval 2 remained at the bottom of the tank after 20 years of storage. It is conceivable that pitting and SCC occurred on the bottom of the tank when the tank temperature increased significantly after the addition of solid waste from Tank C-106 in 1999.*
>
> *However, the concern remains that the cores have not sampled the waste at the actual bottom of the tank or detected elements of its lateral heterogeneity. As discussed above, the interstitial liquid at the bottom of the tank may have retained interstitial liquids with nitrate ion that was deposited in Interval 2. The solids that deposited in Interval 2 traversed at least three different supernatant layers. The first and third supernatant layers, through which the solids traveled, had low concentrations of nitrite ion and a low nitrite ion/nitrate ion concentration. The supernatant layer that was present for the most of Interval 2 had about 2 M hydroxide ion and nitrite ion with about 3 M nitrate ion. It is very difficult to judge the composition of the interstitial liquid that existed at the bottom of the tank 15 years later in 1999 when it experienced the large increase in temperature. However, it is well established that pitting and SCC occur much more readily at higher temperatures, and the possibility that pitting and SCC occurred as a consequence of the addition of the hot waste cannot be dismissed on the basis of the information that is now available. Any remaining tensile stresses from bulging in the Tank AY-102 bottom*

liner following stress relieving during construction would have also increased the propensity for SCC initiation.

The presence of un-recorded pits is due to the reporting of pits starting at 25 percent of the wall thickness. The value is half the action level of the 50 percent wall thickness developed by the DOE Tank Structural Integrity Panel. To further capture the presence of pits, WRPS used a ten percent criterion to identify un-reportable pits. The concern was raised the protocol could mask the presence of pits below this lower level and should this population show an increase with depth it could be an indication that the historic waste could have led to a reduced integrity of the tank.

The discussion of the UT results is found in Section 4.1.8. From the Comparison from Section 4.1.8.3 for the UT of Tank AY-102 on page 4-44:

Of the 23 areas of greater than ten percent wall reduction found in FY2007, 18 were identified as non-reportable pits. In the FY2007 inspection, the Level III NDE inspector reported pitting on plates 3, 4, and 5 whereas the FY1999 inspector did not. In FY1999, Level III NDE inspector reported "laminations detected throughout plate" for Plate 3 with inspector's notes suggesting potential existence of pitting. The distinction between laminations and the presence of pitting could be attributed to equipment resolution and wall contact of the UT system. In FY2007, the Level III NDE only reported non-reportable pits as plate minima, but his notes indicated the presence of other non-reportable pits.

As such, WRPS contacted the Level III NDE inspector to review scans at a constant 40 mils off-set from the local average of the plate. In principle this review would have been conducted at other off-sets, but the initial review showed no increase in the pit population with depth so these additional reviews weren't conducted.

Though the Level III NDE looked at over 70 scans to come to his conclusion about the absence of an increase in the pitting population only nine of those scans are presented here as examples. The tables list the sample scans. The scans are from Riser 88 and Riser 89.

Riser 88 Ultrasonic Testing Scans from Fiscal Year 2007

Scan Number	Location	Nominal Thickness of the Plate (inches)	Comment
1	Plate 4	0.500	Moderate pitting
2	Plate 4	0.500	Moderate pitting
3	Plate 5	0.875	Light pitting
4	Plate 5	0.875	Light pitting

Riser 89 Ultrasonic Testing Scans from Fiscal Year 2007

Scan Number	Location	Nominal Thickness of the Plate (inches)	Comment
1	Plate 4	0.500	Light pitting
2	Plate 5	0.875	Moderate pitting
3	Plate 5	0.875	Moderate pitting
4	Plate 5	0.875	Light pitting
5	Knuckle	0.875	Light pitting

The determination of a pit or general thinning is determined by the Level III NDE, but as a general guide for these scans the color pixels represent the average thickness, the pits, and the raised areas on the plate. The average thickness of the plate is reflected the gray and light purple coloration. Pits are indicated by dark purple pixels on the scans. Raised areas are shown by green, red, and yellow pixels. The causes for raised areas may be due to the presence of material not removed in cleaning of the scanning surface or lift off of the transducer from the surface.

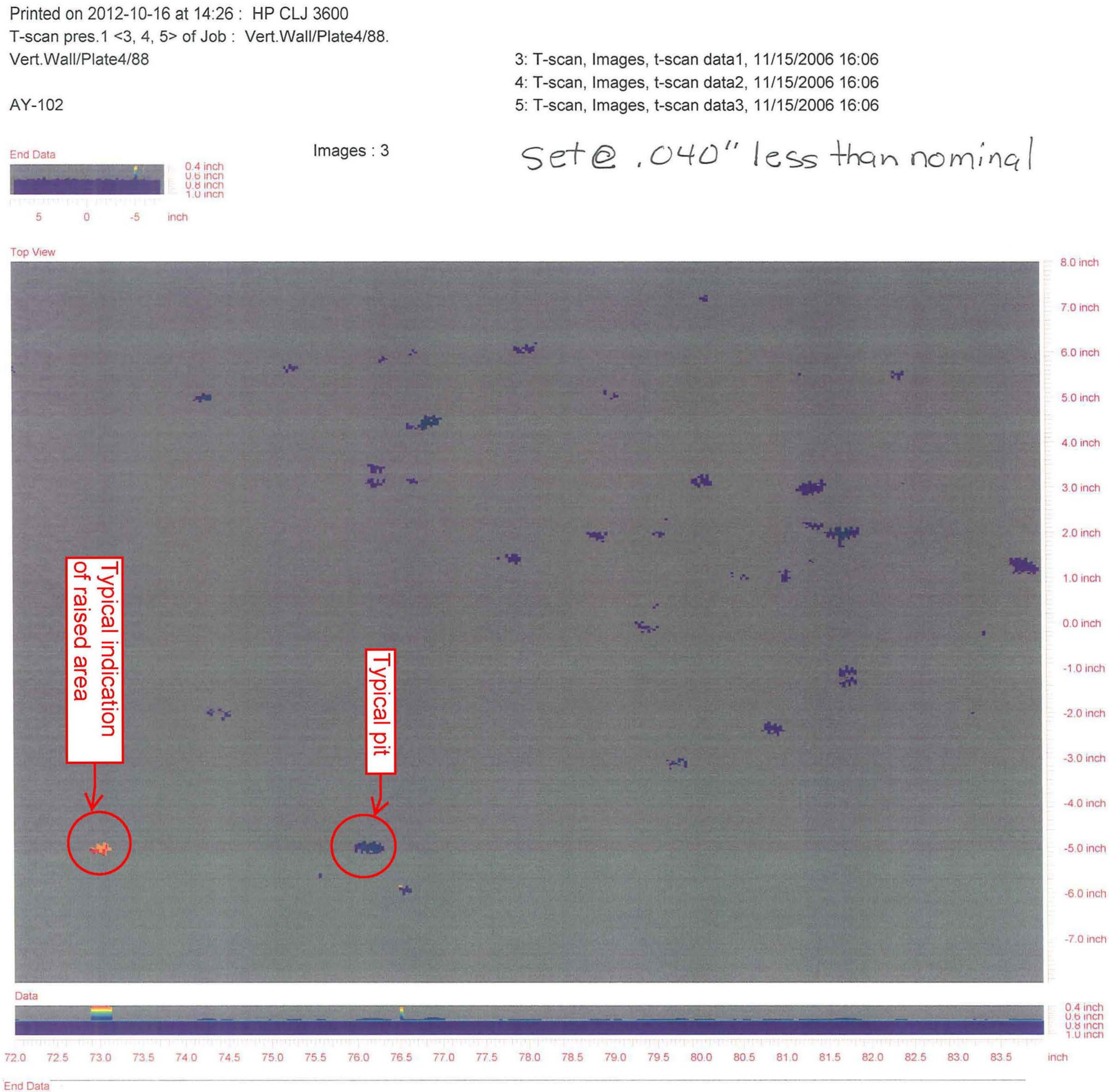

Figure 4-1. Scan 1 from Riser 88
Plate 4, 0.500 inch nominal thickness at 40 mils off-set from plate local average

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Vert.Wall/2nd/Plate4/88
jsp
AY-102-2

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Images : 3

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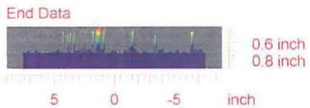

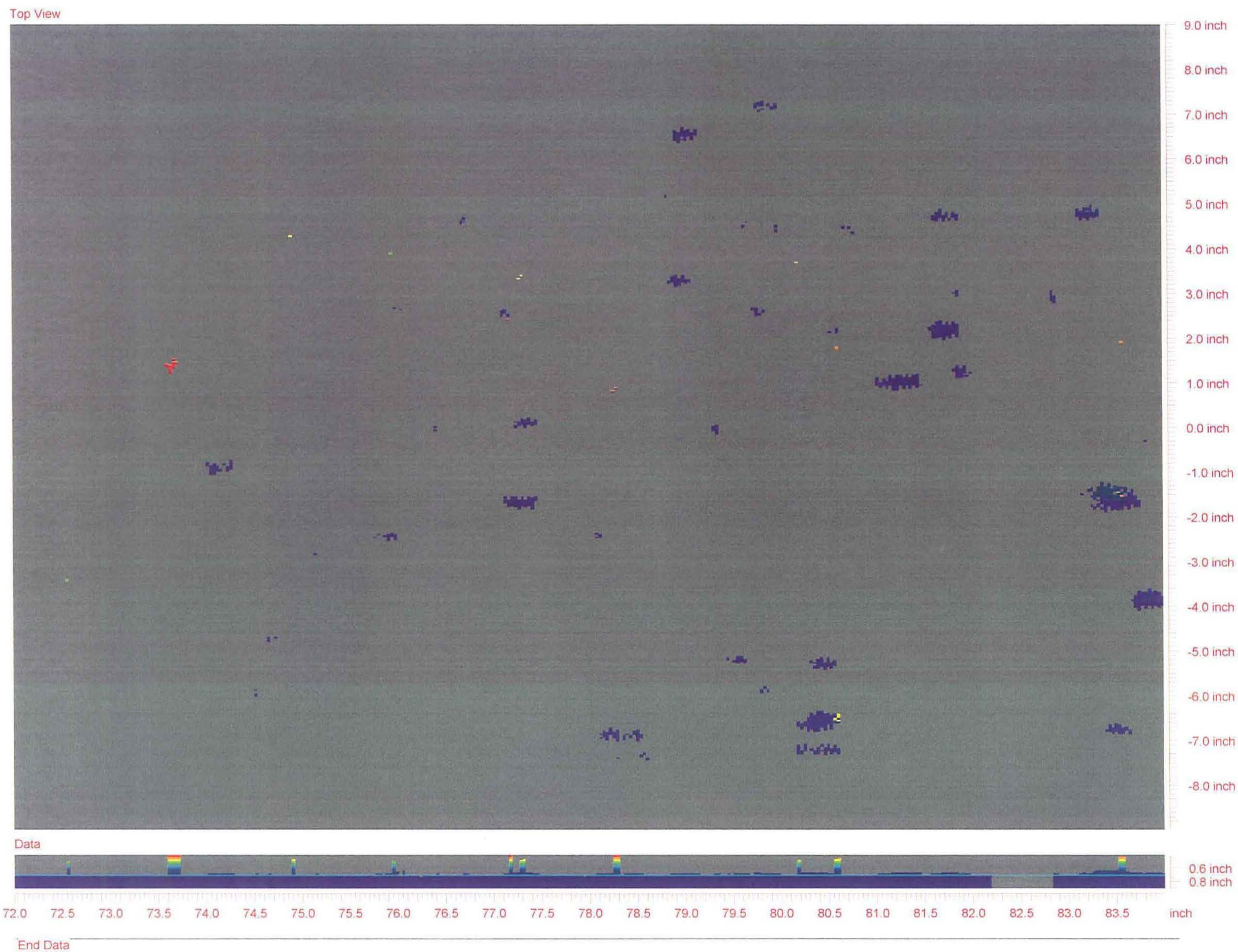

Figure 4-2. Scan 2 from Riser 88
Plate 4, 0.500 inch nominal thickness at 40 mils off-set from plate local average

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AY-102-2

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Images : 3 4

set @ .040" less than nominal

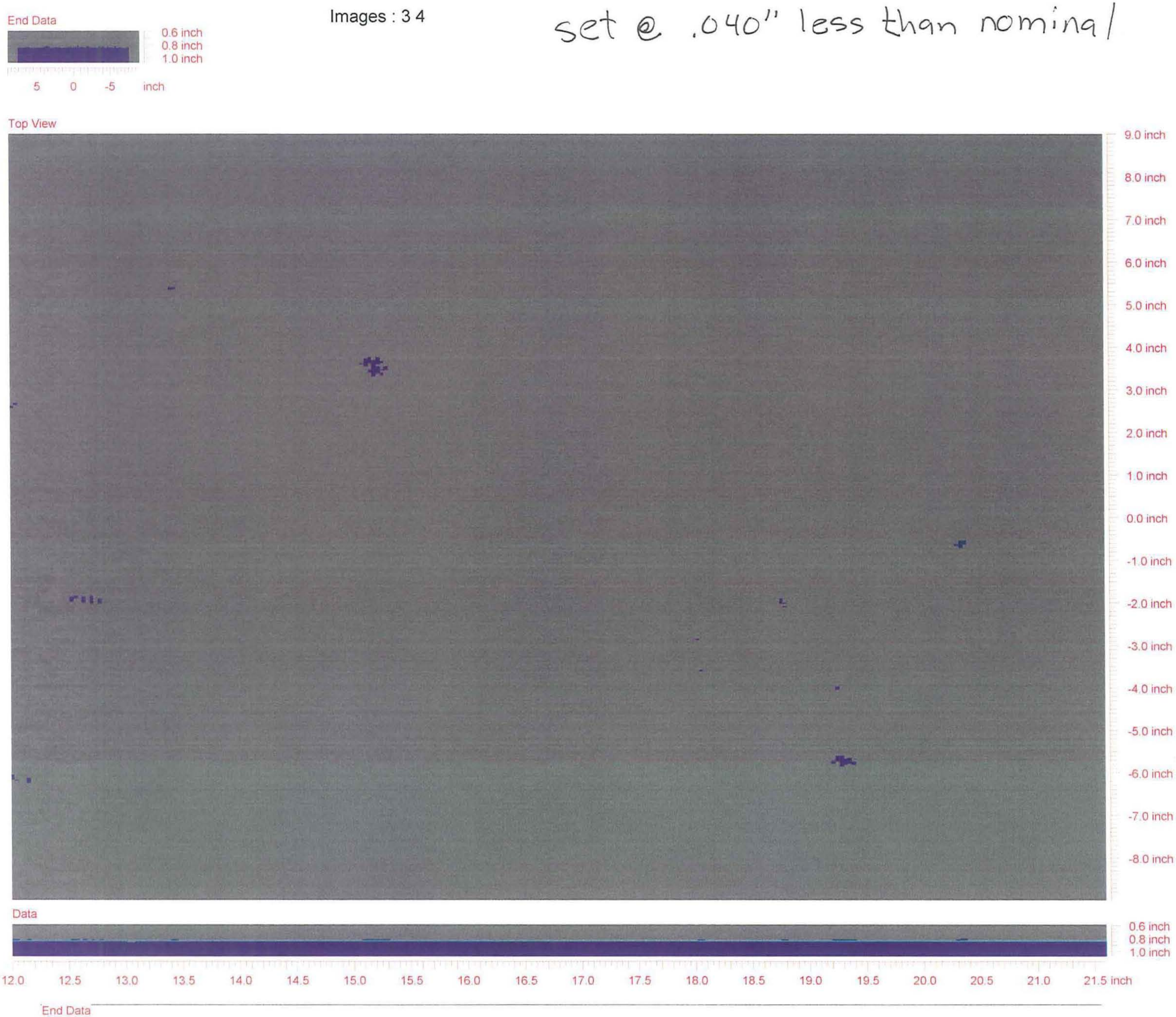

Figure 4-3. Scan 3 from Riser 88
Plate 5, 0.875 inch nominal thickness at 40 mils off-set from plate local average

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Images : 3 4

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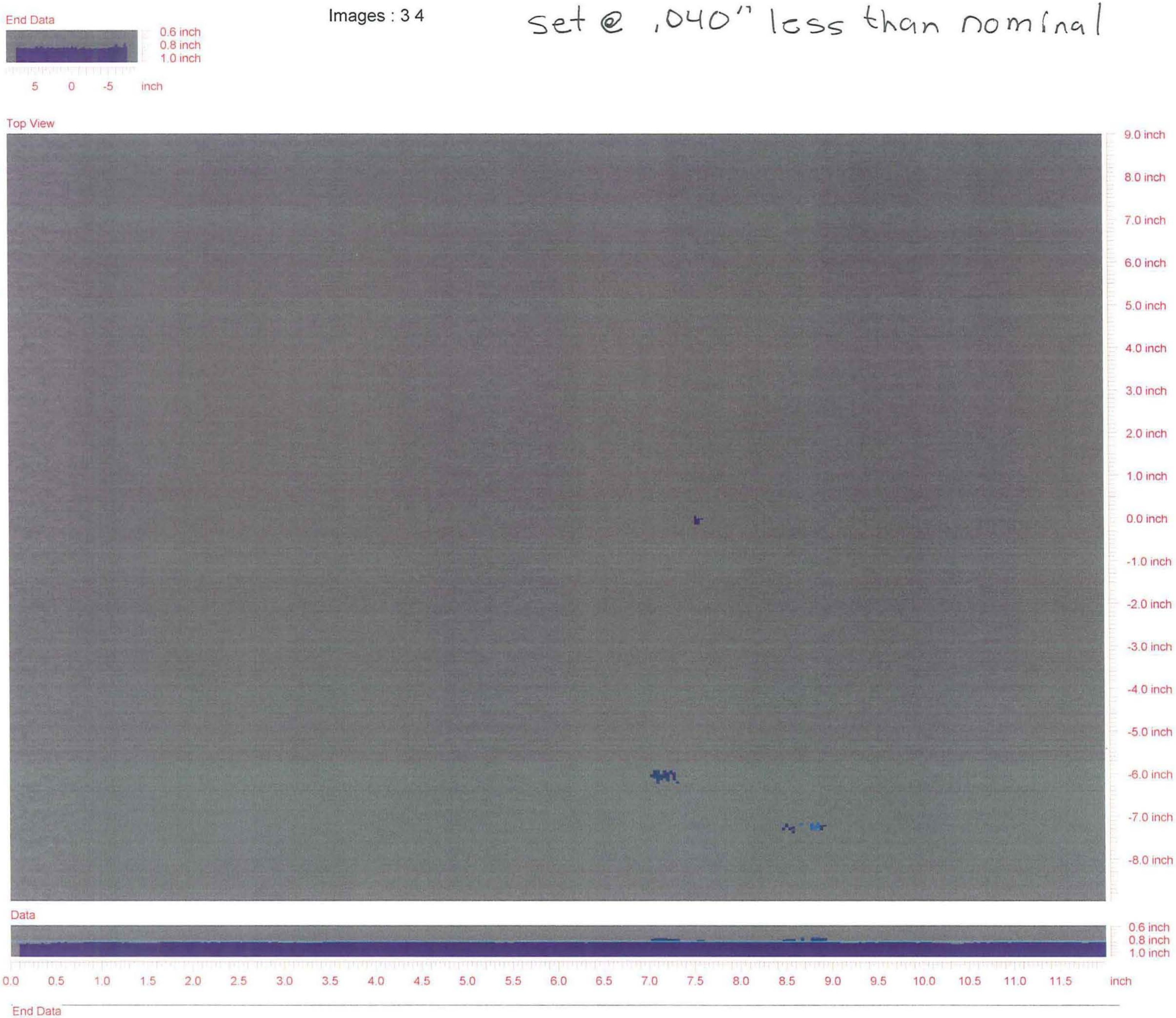

Figure 4-4. Scan 4 from Riser 88
Plate 5, 0.875 inch nominal thickness at 40 mils off-set from plate local average

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Vert.Wall/2nd/Plate/89
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ay-102

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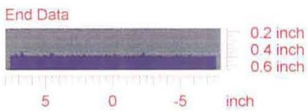

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Set @ .040" less than nominal (.500")

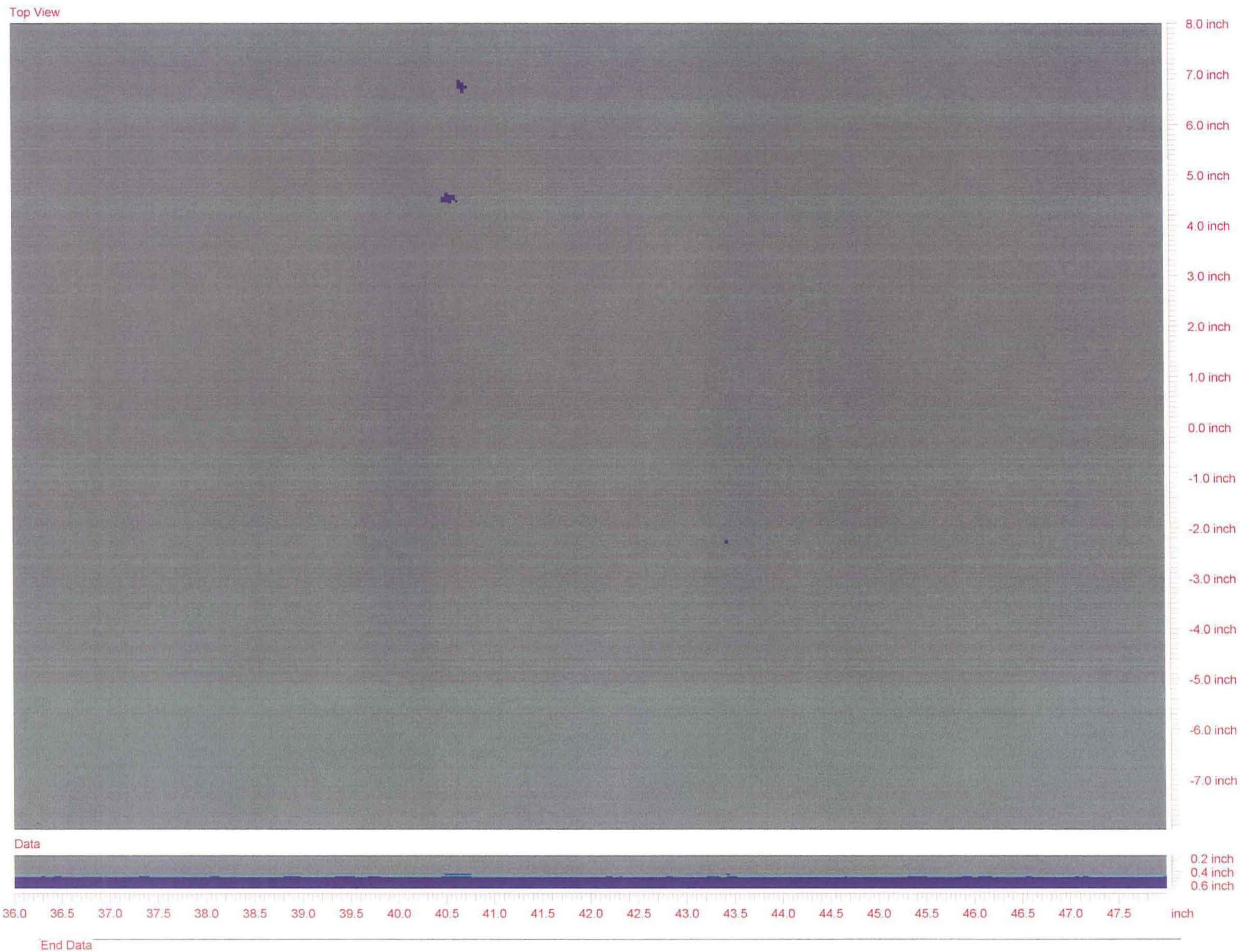

Figure 4-5. Scan 1 from Riser 89 Plate 3, 0.500 inch nominal thickness at 40 mils off-set from plate local average

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Vert.Wall/Plate
WDP
102-AY
riser 89

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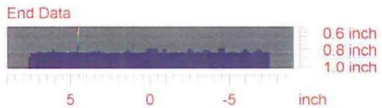
Images : 3



set @ .040" less than nominal (.875")

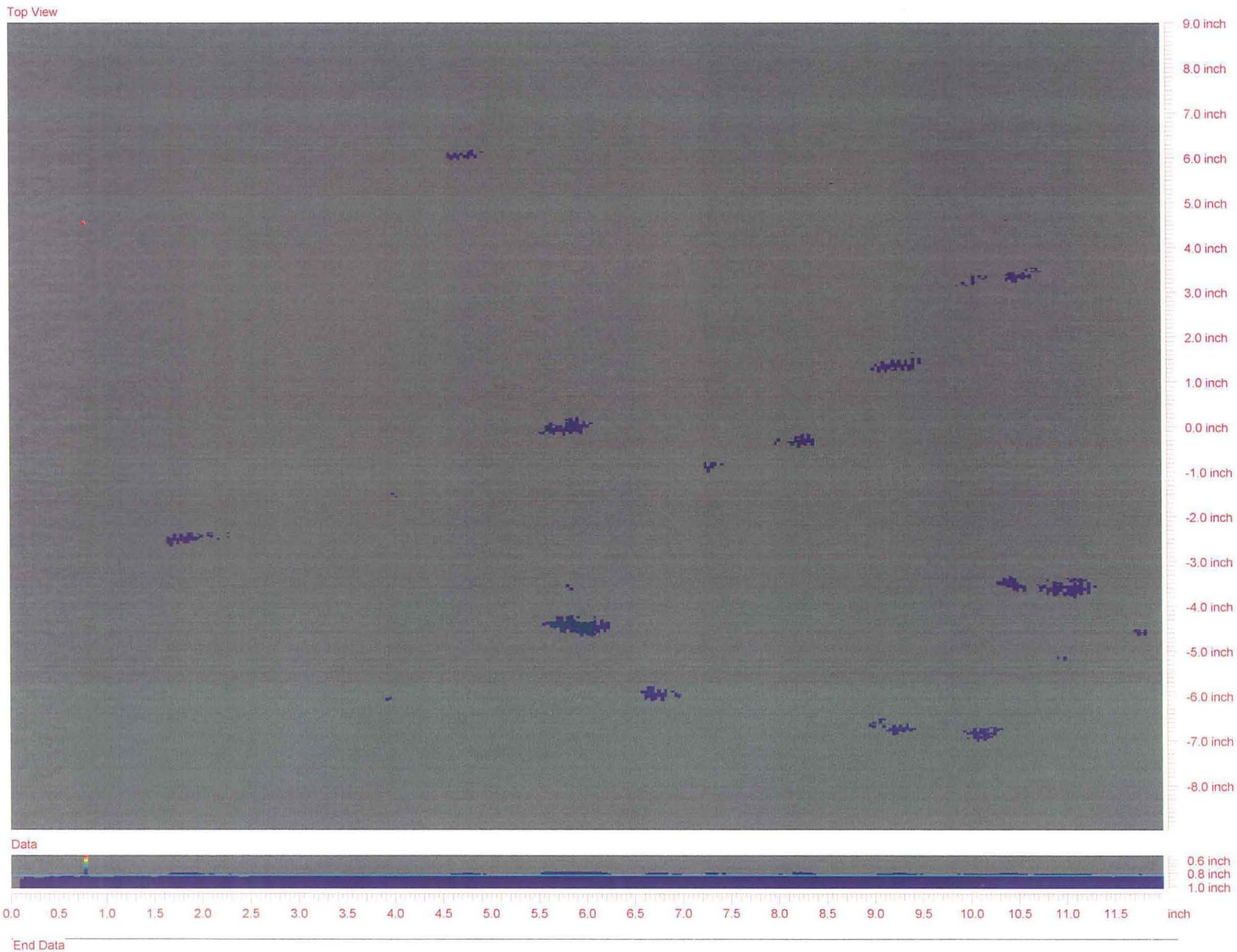


Figure 4-6. Scan 2 from Riser 89
Plate 5, 0.875 inch nominal thickness at 40 mils off-set from plate local average

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WDP
102-AY
riser 89

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Images : 3

Sct @ .040" less than nominal (.875")

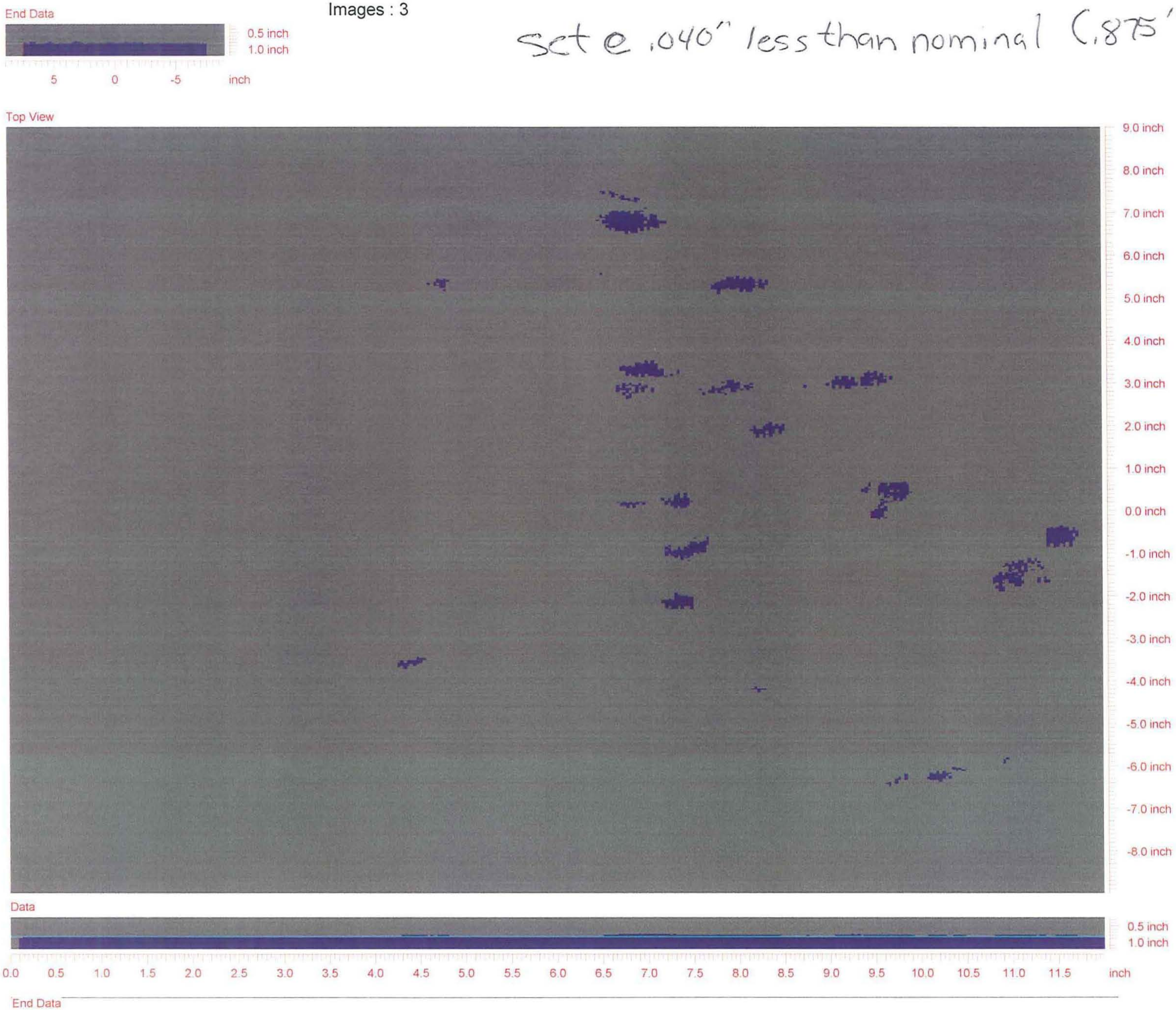


Figure 4-7. Scan 3 from Riser 89
Plate 5, 0.875 inch nominal thickness at 40 mils off-set from plate local average

Printed on 2012-10-16 at 15:50 : HP CLJ 3600
T-scan pres.1 <3, 4, 5> of Job : Vert.Wall/2nd/Plate5/89.
Vert.Wall/Plate
WDP
102-AY
riser 89

3: T-scan, Images, t-scan data1, 10/23/2006 18:41
4: T-scan, Images, t-scan data2, 10/23/2006 18:41
5: T-scan, Images, t-scan data3, 10/23/2006 18:41

Images : 3

set @ .040" less than nominal (.875")

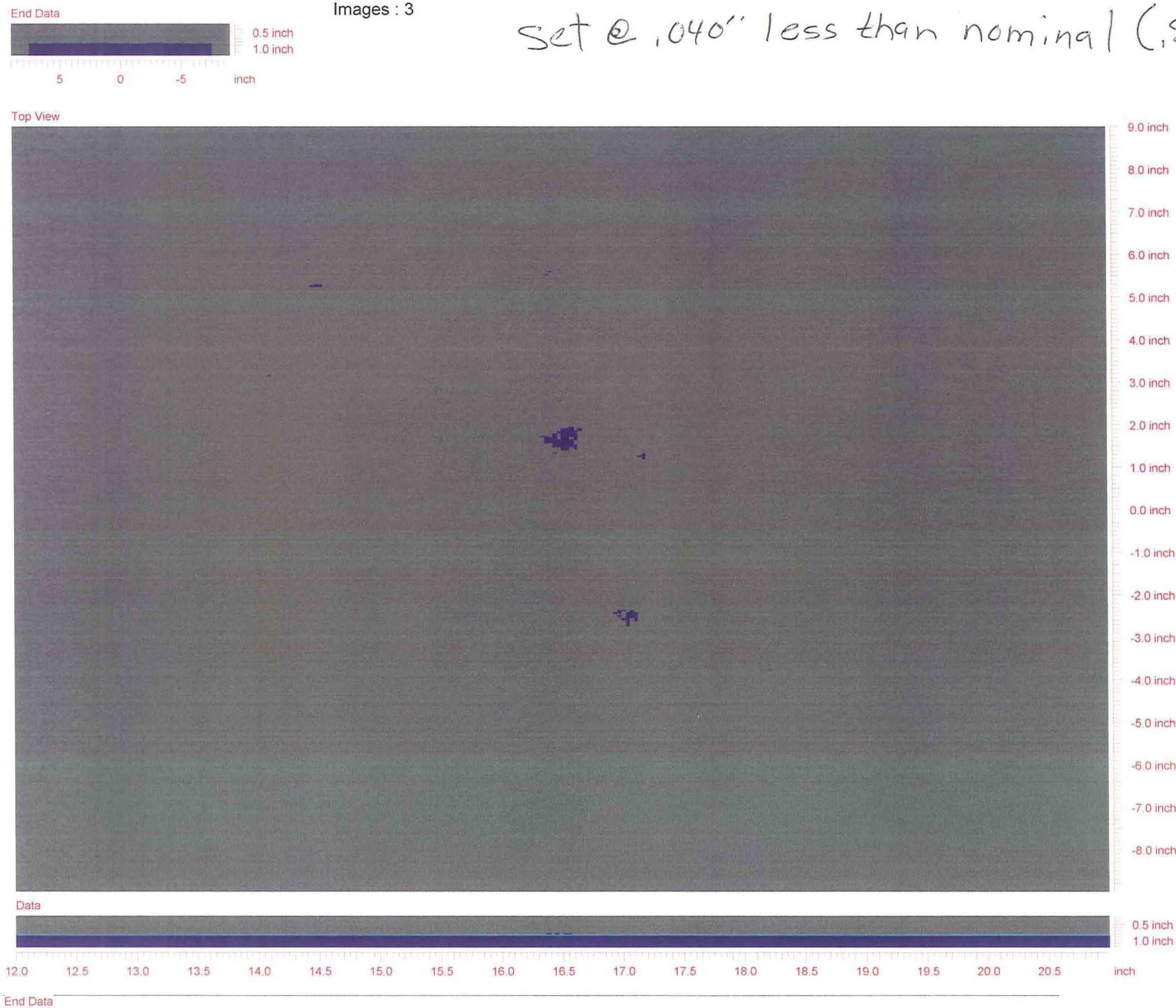


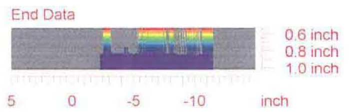
Figure 4-8. Scan 4 from Riser 89
Plate 5, 0.875 inch nominal thickness at 40 mils off-set from plate local average

Printed on 2012-10-17 at 15:17 : HP CLJ 3600
T-scan pres.1 <1, 2, 3> of Job : Knuckle.
Knuckle
WHN/LAS
AY-102
Riser#89

1: T-scan, Images, t-scan data1, 11/9/2006 08:33
2: T-scan, Images, t-scan data2, 11/9/2006 08:33
3: T-scan, Images, t-scan data3, 11/9/2006 08:33

Images : 3 4

set @ .040" less than nominal (.875")



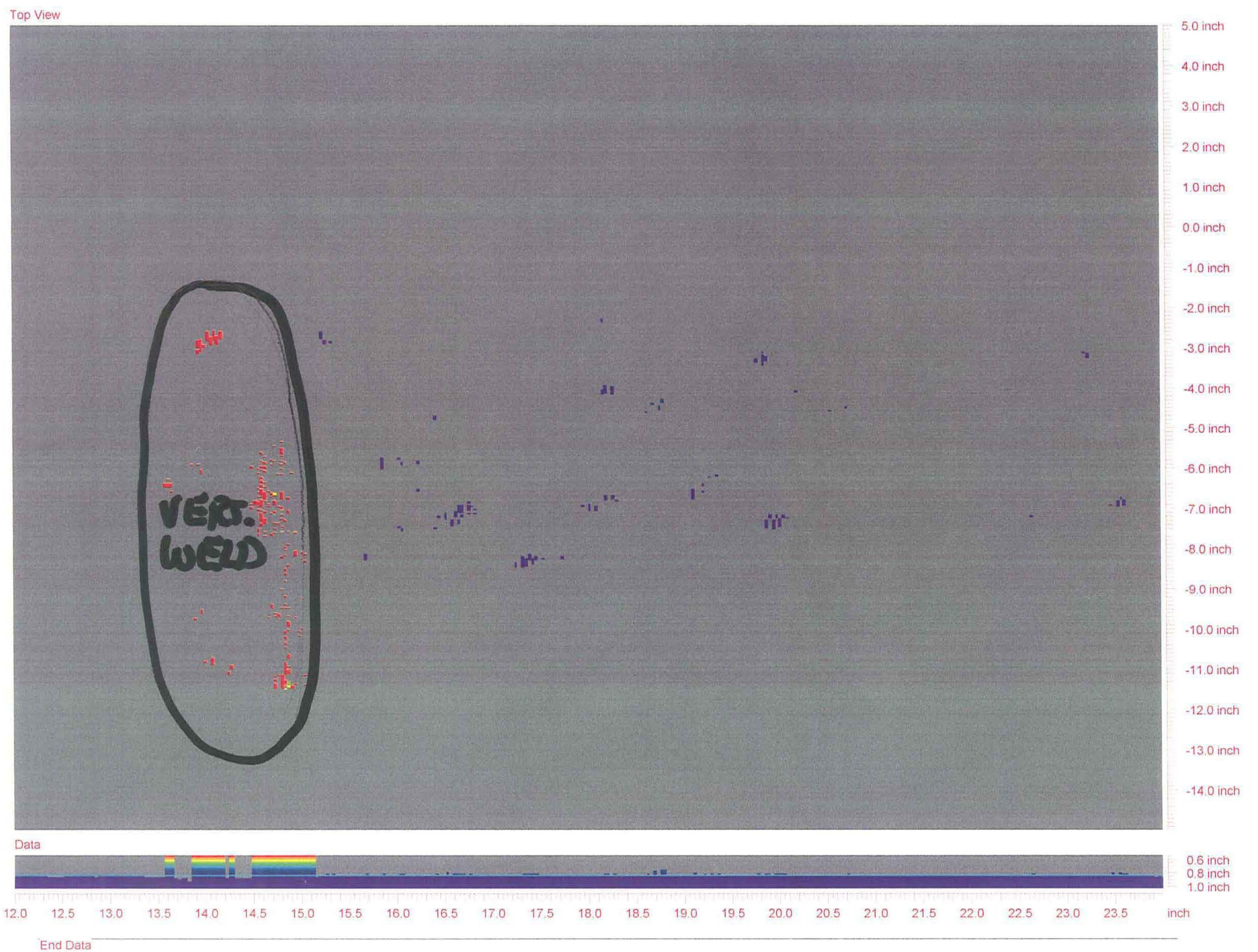


Figure 4-9. Scan 5 from Riser 89
Knuckle, 0.875 inch nominal thickness at 40 mils off-set from plate local average

5.0 Preliminary Annulus Sample Results for RPP-ASMT-53793, Section 4.2.7, Samples 2012

5.1 Riser 90- August 2012 Sample

Harlow, Donald G

From: Venetz, Theodore J
Sent: Tuesday, September 25, 2012 4:04 PM
To: Rosenkrance, Chelsea L
Subject: FW: AY102 sample update

From: Boomer, Kayle D
Sent: Monday, August 13, 2012 2:46 PM
To: Venetz, Theodore J; Engeman, Jason K
Subject: FW: AY102 sample update

From: Rice, Andrew D
Sent: Monday, August 13, 2012 2:01 PM
To: McKinney, Steve G; Washenfelder, Dennis J; Boomer, Kayle D; Levy, Gregery
Cc: Renberger, Duane L; Prilucik, John R; Johnson, Jo M; Ritenour, Gerald P; Hansen, Daniel R; Watts, Heather D; Anderson, Brian P; Noyes, Gary W
Subject: RE: AY102 sample update

Appended below are the preliminary results for the AY-102 Annulus sample collected and delivered to the 222-S laboratory on Friday, 8/10/2012.
These results represent the amount of each nuclide that could be acid leached from one portion of the duct tape sample.

Nuclide	Result each (µCi)	MDA (µCi)	Comments
Cs-137	3.9E+00	9.8E-04	Gamma spectroscopy
Sr-90	1.0E-01	4.1E-03	Separation and beta count
Pu-239/240	4.1E-05	2.1E-05	Separation and alpha spectroscopy
Am-241	1.6E-04	8.3E-06	Separation and alpha spectroscopy

No isotopes of curium were detected.

It should be observed that the Pu/Am results are near the detection limit, and therefore will lack precision. It may be possible to improve these results by analyzing a larger aliquot of digest.

Please note that this is preliminary data and could change upon further review.

Let me know if you have any questions.

Andy Rice
Radiochemistry Manager 222-S
509.372.2057
509.551.8401

From: McKinney, Steve G
Sent: Saturday, August 11, 2012 12:07 PM
To: Washenfelder, Dennis J; Boomer, Kayle D
Cc: Renberger, Duane L; Prilucik, John R; Johnson, Jo M; Rice, Andrew D; Ritenour, Gerald P
Subject: AY102 sample update

Just a heads up on where ATL is – Andy Rice will send out a more detailed summary later, once he is out of the lab. The AY102 annulus sample was broken down this morning. Based on appearance, it was decided to remove the double-sided tape along with the sample and not try to scrape sample off the tape (ATL took photographs). The tape and sample were removed from the weight and was then divided into four sections. The section with the least amount of plastic adhering to the tape was chosen for digest. This section was digested (chemist noted slight fizzing upon addition of acid) and by appearance, all sample material dissolved off the tape. GEA prep will be completed today, radiochemical separations and counting are scheduled for tomorrow and tomorrow night. We expect data, as planned, by Monday. Added observation – there was a towel in with the sample that appeared to have been used to wipe down the cable as the sample was withdrawn through the riser. This towel also was contaminated but at this time, nothing has been done with it.

Thanks.

Harlow, Donald G

From:	Venetz, Theodore J
Sent:	Tuesday, September 25, 2012 2:25 PM
To:	Rosenkrance, Chelsea L
Subject:	FW: AY102 sample update
Attachments:	AY102 Residual Samples Grp#20121249 006.jpg; AY102 Residual Samples Grp# 20121249 001.jpg; AY102 Residual Samples Grp#20121249 002.jpg; AY102 Residual Samples Grp#20121249 003.jpg; AY102 Residual Samples Grp#20121249 004.jpg; AY102 Residual Samples Grp#20121249 005.jpg; AY102 Residual Samples Grp# 20121249 007.jpg

---

From: Boomer, Kayle D
Sent: Monday, August 13, 2012 7:34 AM
To: Venetz, Theodore J
Subject: FW: AY102 sample update

From: Rice, Andrew D
Sent: Saturday, August 11, 2012 1:29 PM
To: McKinney, Steve G; Washenfelder, Dennis J; Boomer, Kayle D
Cc: Renberger, Duane L; Prilucik, John R; Johnson, Jo M; Ritenour, Gerald P; Hansen, Daniel R
Subject: RE: AY102 sample update

Steve did a good job of summarizing what happened, I will add the photos and a few details. The photos will put you in email jail, but I wanted the detail to remain.

A masslin-type cloth was included with the "weight and tape" sample. This cloth was contaminated and was saved for future analysis, if desired.

The tape did a great job of trapping the particulate matter, so it was decided to digest the tape itself. Most of the particulates appeared to be rust, with a few interestingly colored flecks interspersed.

Once we had removed the tape from the weight, the tape was cut into 4 sections. Based on appearance and dose rates, the tape surrounding the steel weight was fairly homogeneous, so the section analyzed should be reasonably representative of the whole. The other sections have been saved for future analysis, if needed.

Duct tape is not an ideal analytical substrate, so the digest was performed so as to minimize possible matrix effects from the tape while removing as much contamination as possible. This appeared to be successful.

Separations and counting will occur Sunday, we plan on providing preliminary results by Monday, 8/13.

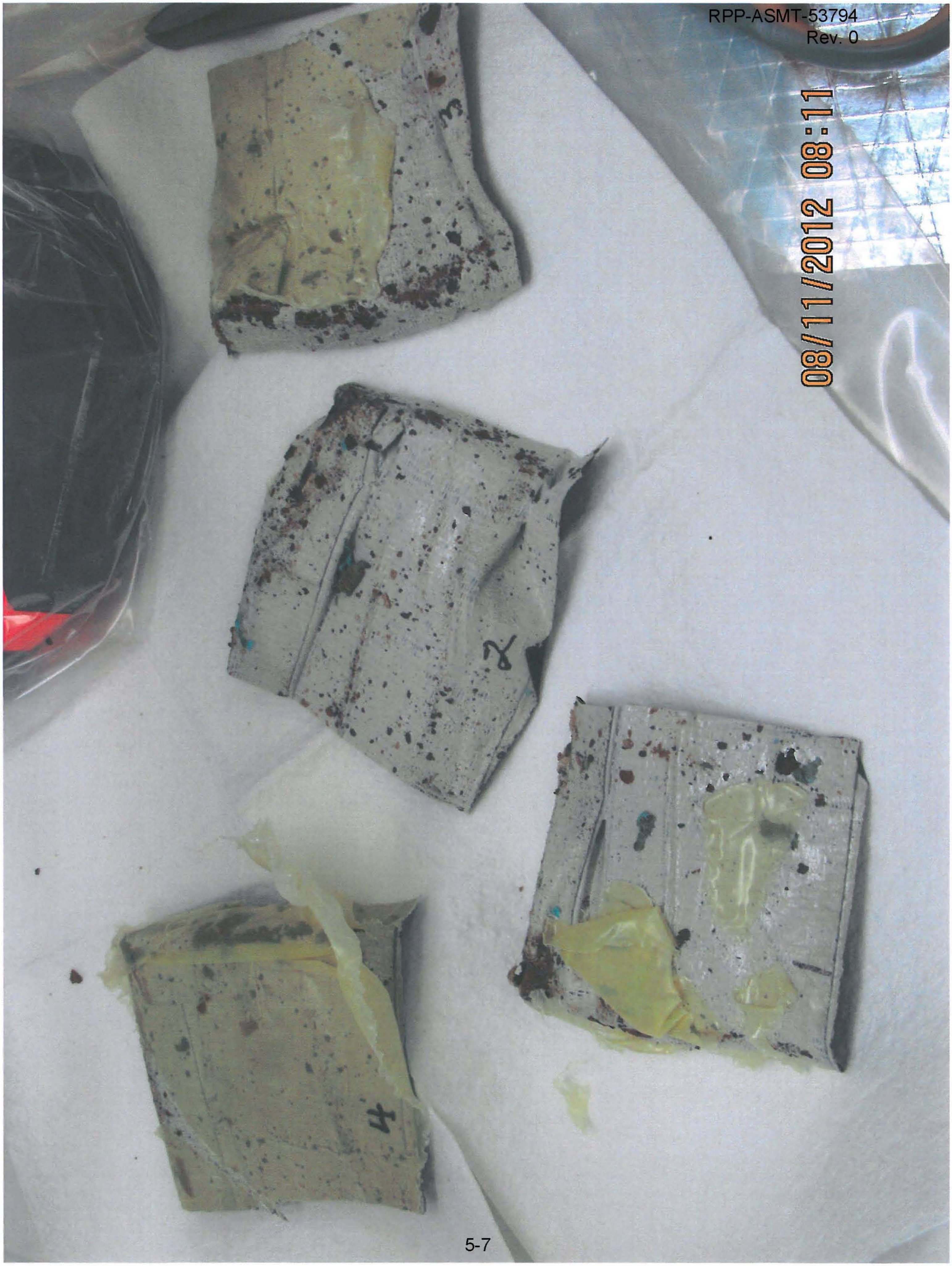
Let me know if I can be of additional assistance.

Andy

From: McKinney, Steve G
Sent: Saturday, August 11, 2012 12:07 PM
To: Washenfelder, Dennis J; Boomer, Kayle D
Cc: Renberger, Duane L; Prilucik, John R; Johnson, Jo M; Rice, Andrew D; Ritenour, Gerald P
Subject: AY102 sample update

Just a heads up on where ATL is – Andy Rice will send out a more detailed summary later, once he is out of the lab. The AY102 annulus sample was broken down this morning. Based on appearance, it was decided to remove the double-sided tape along with the sample and not try to scrape sample off the tape (ATL took photographs). The tape and sample were removed from the weight and was then divided into four sections. The section with the least amount of plastic adhering to the tape was chosen for digest. This section was digested (chemist noted slight fizzing upon addition of acid) and by appearance, all sample material dissolved off the tape. GEA prep will be completed today, radiochemical separations and counting are scheduled for tomorrow and tomorrow night. We expect data, as planned, by Monday. Added observation – there was a towel in with the sample that appeared to have been used to wipe down the cable as the sample was withdrawn through the riser. This towel also was contaminated but at this time, nothing has been done with it.

Thanks.


08/11/2012 08:11
3
2
4

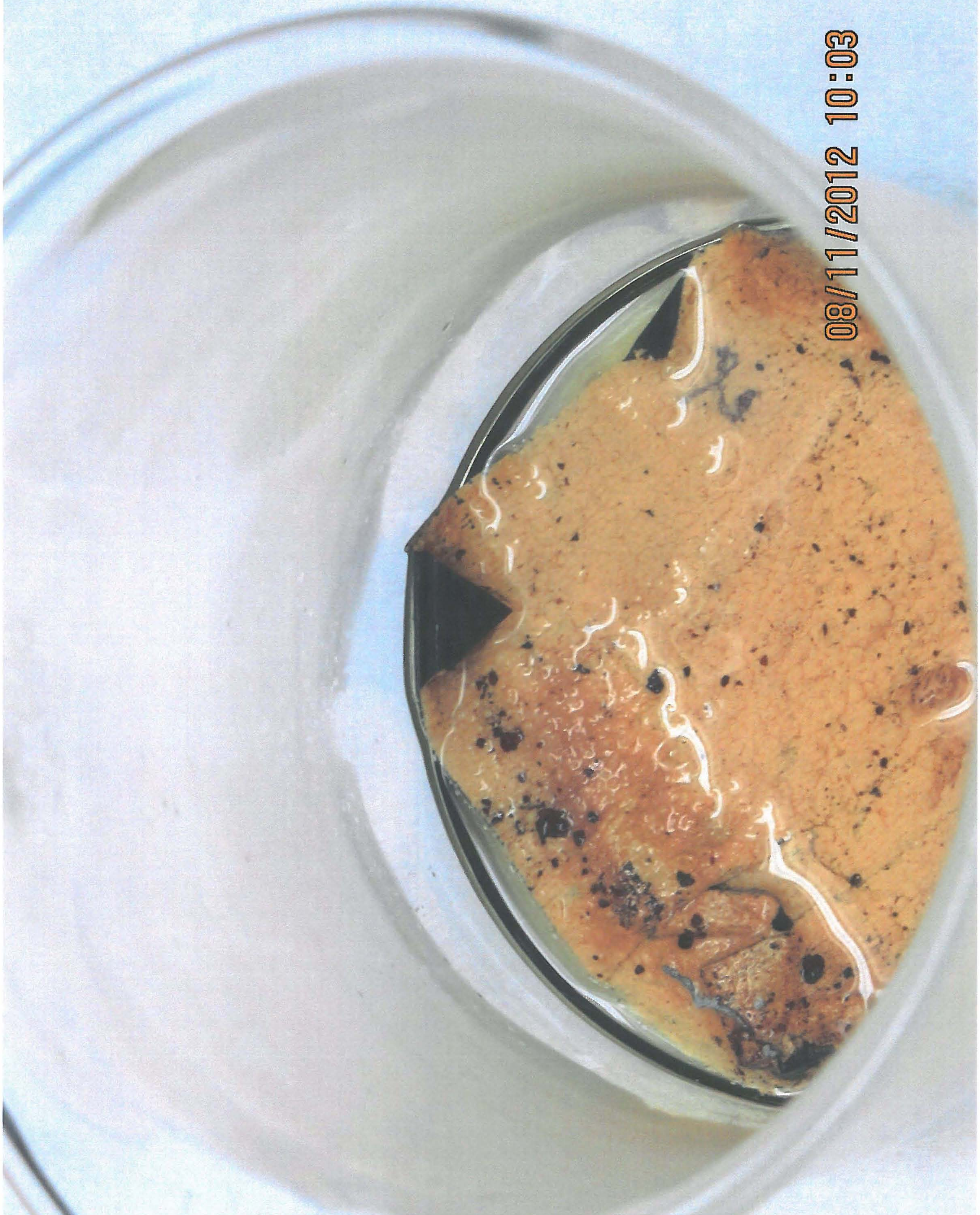

08/11/2012 07:23


08/11/2012 07:29


08/11/2012 07:30


08/11/2012 08:06


08/11/2012 08:07
4
3


08/11/2012 10:03

Harlow, Donald G

From: Venetz, Theodore J
Sent: Tuesday, September 25, 2012 2:37 PM
To: Rosenkrance, Chelsea L
Subject: FW: Optical and scanning electron microscope examination of AY102 residues

---

From: Rasmussen, Juergen H
Sent: Tuesday, September 25, 2012 2:35 PM
To: Venetz, Theodore J
Subject: FW: Optical and scanning electron microscope examination of AY102 residues

Juergen Rasmussen
Washington River Protection Solutions,
contractor to the United States Department of Energy

From: McKinney, Steve G
Sent: Tuesday, August 14, 2012 3:28 PM
To: Renberger, Duane L; Sams, Terry L; Rasmussen, Juergen H; Washenfelder, Dennis J; Boomer, Kayle D
Cc: Patten, Elester; Wilkinson, Robert E
Subject: FW: Optical and scanning electron microscope examination of AY102 residues

---

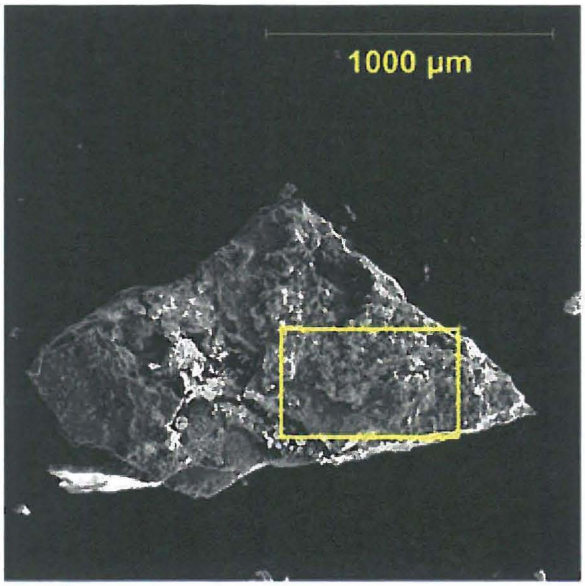
From: Cooke, Gary
Sent: Tuesday, August 14, 2012 3:11 PM
To: McKinney, Steve G
Cc: Johnson, Jo M; Seidel, Cary M; Prilucik, John R
Subject: Optical and scanning electron microscope examination of AY102 residues

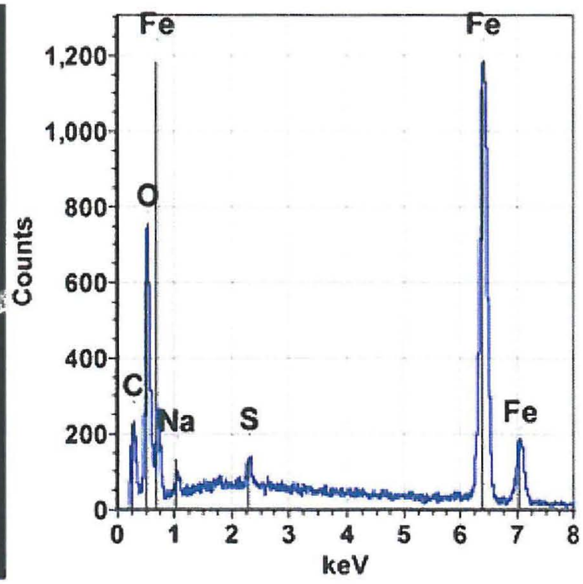
Steve:

We examined the particulate recovered from three samples from the Tank 241-AY-102. The samples consisted of particulate adhering to duct tape which had been placed in clear yellow plastic bags. The samples were identified as:
AY102Annulus-1-1 (S12R000485)
AY102Annulus-1-3 (S12R000487)
AY102Annulus-1-4 (S12R000488)

The three samples were examined and individual particles were removed and placed on an adhesive tab on an SEM specimen mount. The selected particulate was examined first on a binocular microscope and then carbon coated and examined on the SEM. The SEM images, below are paired, with the image on the left with the area or spot examined by the energy dispersive x-ray (EDS) detector marked by the yellow cross or box, and the EDS spectrum on the right.

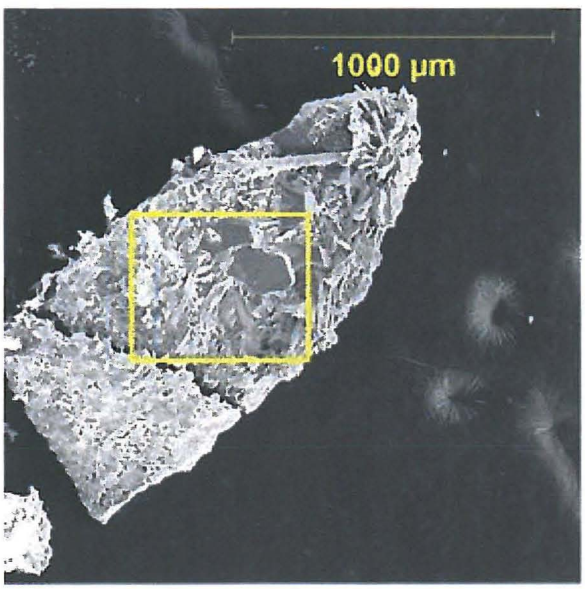
The particulate appears to be dominated by rust. Only a few examples of the rust were examined and found to be composed primarily of iron and oxygen, as expected:

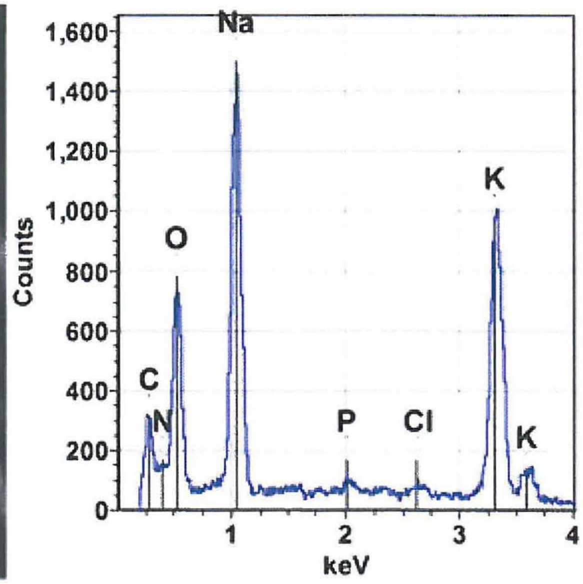




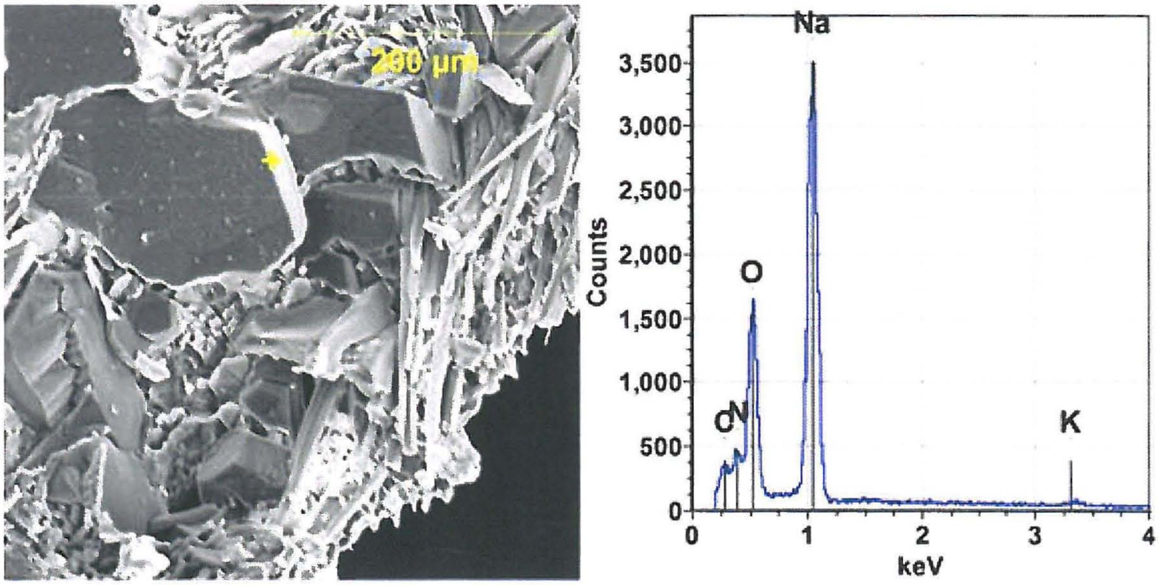
The scattered blue particulate appears to be some type of paint. The EDS signature indicates a kaolinite mineral is the filler in the paint and there are cellulose fibers present as well.

The remainder of the particulate is mostly light gray to amber colored aggregates of fine-grained crystalline material. Several of these particles were examined. The chemistry was fairly uniform, with sodium, potassium, carbon, oxygen, nitrogen, phosphorous and chlorine identified in the EDS spectra:

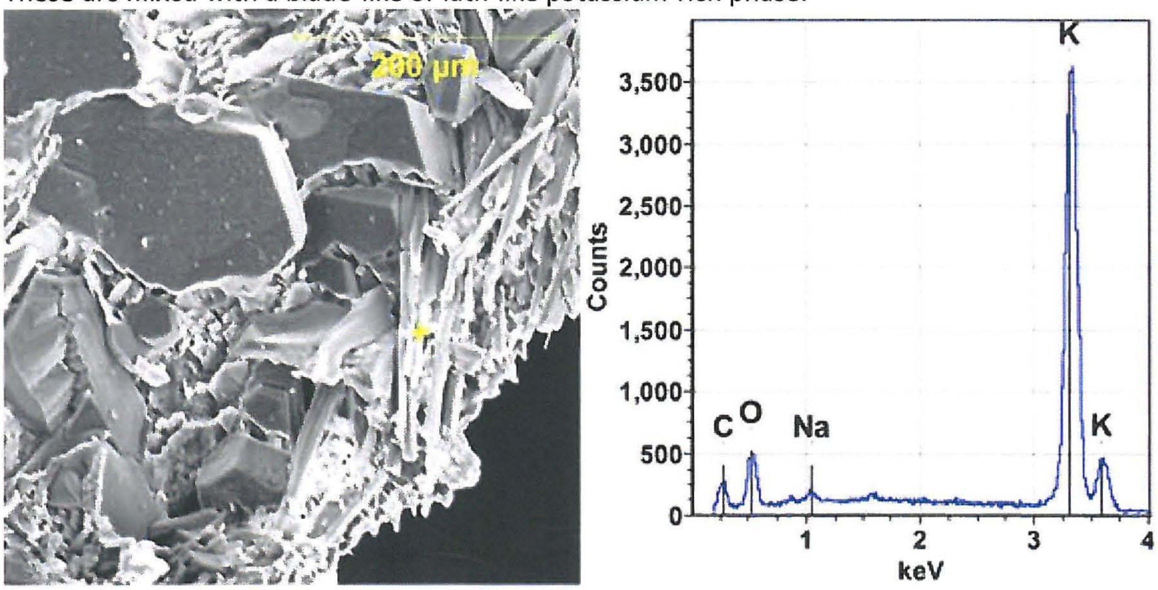




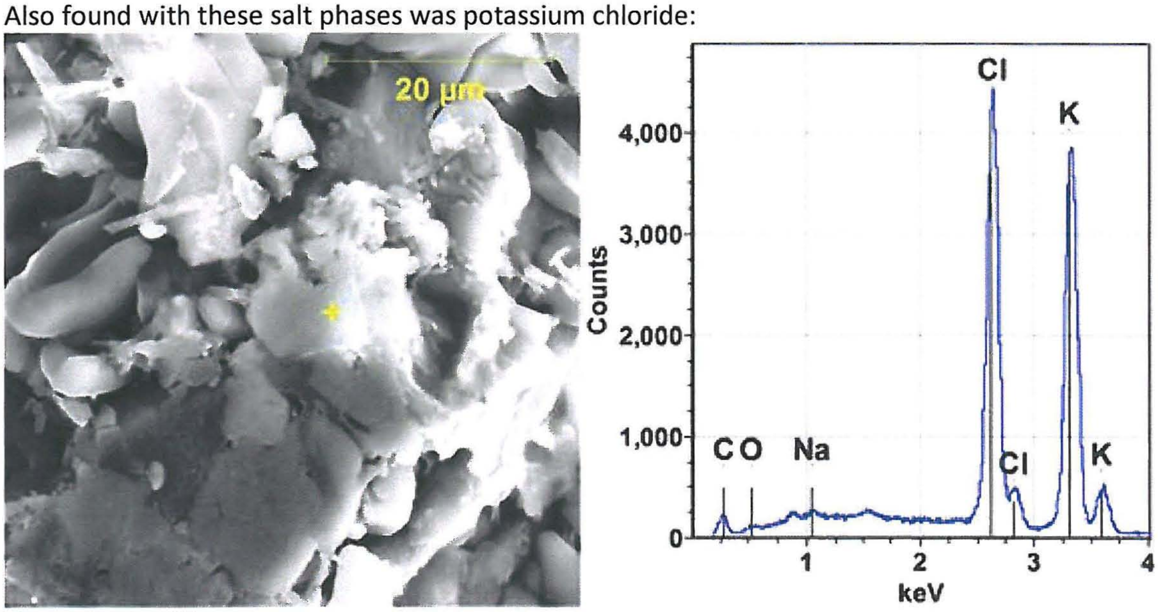
The largest crystals are blocky, equant crystals of sodium nitrate (Nitratine):



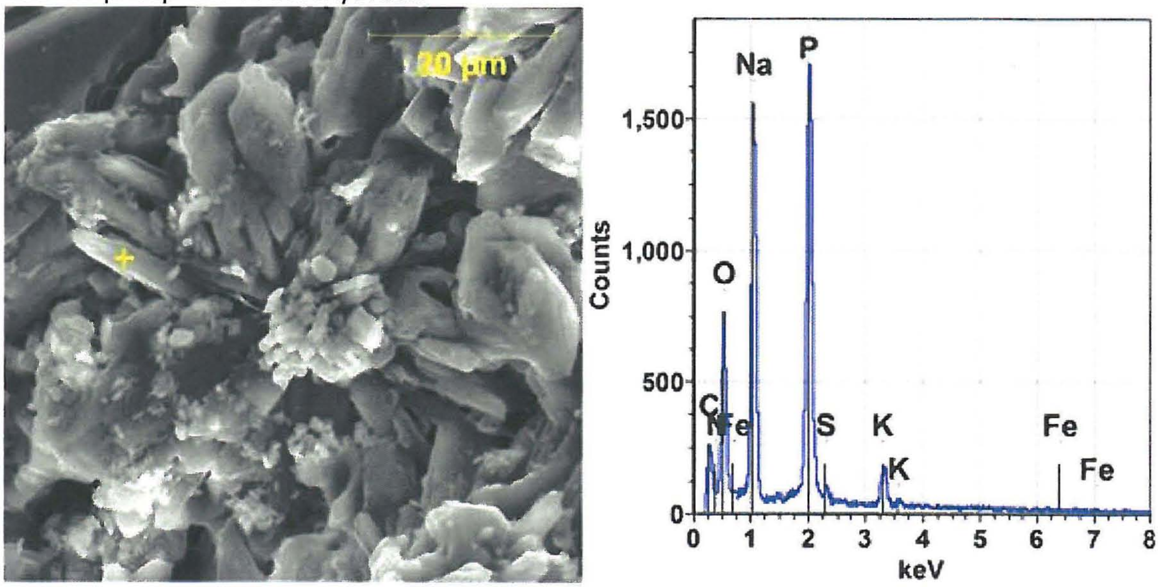
These are mixed with a blade-like or lath-like potassium-rich phase:



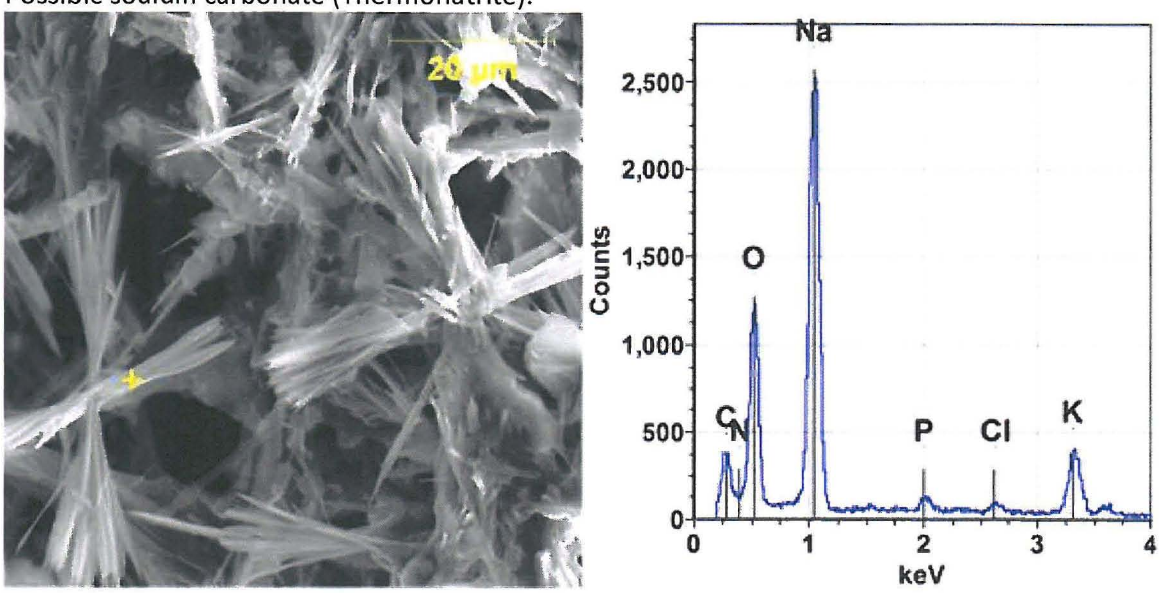
Also found with these salt phases was potassium chloride:



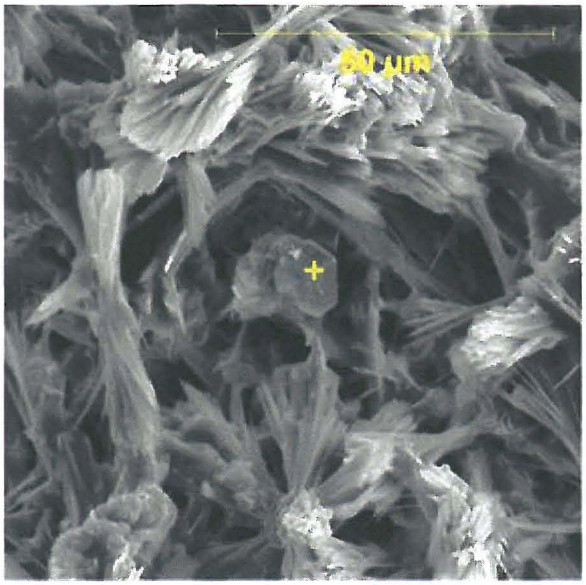
Sodium phosphate dodecahydrate:

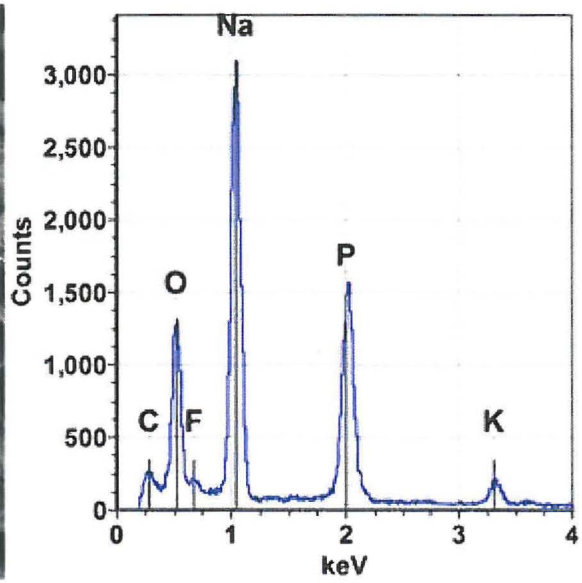


Possible sodium carbonate (Thermonatrite):



and a trace amount of sodium fluoride phosphate hydrate (Kogarkoite):





The sodium phases listed above are all water soluble phases that have been identified in tank waste. The source of the potassium is uncertain. Potassium is generally rare in tank waste.

Please pass this on to whoever needs to see it. If you have any questions, please let me know.

Gary A. Cooke
gary_cooke@rl.gov (509) 373-2154 Cell: (509) 845-3988
Washington River Protection Solutions, contractor to the United States Department of Energy

5.2 Riser 83- September 2012 Sample

Venetz, Theodore J

From: Harrington, Stephanie J
Sent: Wednesday, October 24, 2012 4:11 PM
To: Rosenkrance, Chelsea L; Sams, Terry L; Washenfelder, Dennis J; Kirch, Nicholas W (Nick); Venetz, Theodore J; Boomer, Kayle D
Cc: Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Reynolds, Jacob G
Subject: FW: Interim Results for AY102 Annulus - TIC/TOC (ANU1) and ICP (ANU3A)

Importance: High

Please find the preliminary results below for the TIC/TOC analyses on the sample from near riser 83 (the floor sample) as well as the ICP metals analysis results for the second air duct sample taken on Oct. 17th near riser 90.

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

AY102 Annulus TIC-TOC 2AY-12-A...

AY102 Annulus ICP 2AY-12-ANU3A...

From: Bushaw, Ruth A
Sent: Wednesday, October 24, 2012 3:54 PM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; McKinney, Steve G; Cooke, Gary
Subject: Interim Results for AY102 Annulus - TIC/TOC (ANU1) and ICP (ANU3A)
Importance: High

Stephanie,

The attached spreadsheets provide the interim results for the TIC/TOC analysis requested for sample 2AY-12-ANU1 and the ICP results for sample 2AY-12-ANU3A.

For the TIC/TOC analysis, the spike recovery for the TIC was 207% but the amount of spike added was much less than 25% of the concentration in the sample, so no qualifier flags or reanalyses were required.

For the ICP analysis, there was no preparation standard because the digest that was requested was originally just for radchem, so no standard was prepared. Also, we forgot to run the preparation blank associated with this sample, the chemist is going to ask the technician if maybe it had been consumed with the radchem analyses and wasn't available. If it was just overlooked, I asked them to run that and rerun the sample to see if some of the instrument QC issues will not be present in the rerun.

Recall that there was also insufficient sample material to digest a duplicate sample portion or a spike. The analytical batch also contained solid samples from the recent AN101/C104 sampling event, and one of those samples was used for the sample QC. I'm reluctant to include that QC with this report because the sample matrix isn't quite the same.

As I stated in my previous email with ICP results, the digest methods that we have available at 222-S lab are not appropriate for digesting silicon. Therefore, it's likely that the LCS and spike recovery, if prepared for this sample, might have failed low, as they did with the SW846 Method 3050B prep that was used to digest the previous AY102 Annulus sample. I will discuss in the narrative that the silicon result might not be very accurate. Note that silicon was detected in the instrument blanks. For two of the blanks, the silicon was > EQL and >5% of the sample result, so I added a "B" flag. Since these were instrument blanks, I'm expecting that the reanalysis might be better. Silicon also failed high on the low level standard (LLS). Since the result in the sample was at approximately the same level as the LLS, this could indicate a high bias. This failure does not require a reanalysis, but since we are going to rerun anyway, the LLS might meet the requirement on the rerun.

Remember that these results have not been fully reviewed and may change, especially since we plan to rerun the ICP.
Thanks,

Ruth A. Bushaw
Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

24-oct-2012 15:11:08
INTERIM
AY102 Annulus
Data Summary of All Results

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
83	2AY-12-ANU1	Grab Sample (Total)	S12T021101		TIC	Total inorganic carbon	ug/g	98.8	<7.00	4.20E+04	4.42E+04	4.31E+04	5.10	207	200	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021101		TOC	Total organic carbon	ug/g	94.7	<20.0	1.39E+03	1.61E+03	1.50E+03	14.7	92.4	572	n/a	J

NA = Not Analyzed, ND = Not Detected
J - Estimated

Harlow, Donald G

From: Boomer, Kayle D
Sent: Tuesday, September 25, 2012 4:20 PM
To: Girardot, Crystal L; Harlow, Donald G; Rosenkrance, Chelsea L; Engeman, Jason K
Subject: FW: Off-riser Sampling System Image

From: Harrington, Stephanie J
Sent: Tuesday, September 25, 2012 4:16 PM
To: Boomer, Kayle D; Venetz, Theodore J
Subject: Off-riser Sampling System Image

Thank you,

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

Harlow, Donald G

From: Boomer, Kayle D
Sent: Tuesday, October 16, 2012 12:26 PM
To: 'Leon M.Stock' (stock1777@comcast.net); Rosenkrance, Chelsea L
Cc: Washenfelder, Dennis J; Engeman, Jason K; Venetz, Theodore J; Harlow, Donald G
Subject: FW: Additional Information for 2AY-12-ANU1 White Material

Importance: High

From: Harrington, Stephanie J
Sent: Tuesday, October 16, 2012 12:24 PM
To: Boomer, Kayle D; Sams, Terry L
Cc: Powell, William J (Bill)
Subject: FW: Additional Information for 2AY-12-ANU1 White Material
Importance: High

Kayle,

Is this good enough information for the annulus sample in terms of pH for the sample from the material near riser 83? I can make sure this gets into the report, but it will be qualitative, not quantitative. I will find out more for the TIC/TOC you were wanting for the remaining material in archive. It shouldn't be a problem as there is still the 1 gram of material in archive to work with.

Thank you,

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Bushaw, Ruth A
Sent: Tuesday, October 16, 2012 12:14 PM
To: Harrington, Stephanie J
Cc: McKinney, Steve G; Cooke, Gary
Subject: Additional Information for 2AY-12-ANU1 White Material
Importance: High

Stephanie,

I asked Gary Cooke if he would do a quick check for the pH of the white material from AY102 Annulus riser 83 sample 2AY-12-ANU1.

He said that he estimated that he used < 1 mg of sample with a couple of drops of water and the pH was ~11 using pH test paper. He said that Hanford soils would give a pH around 8.5 – 9. The only thing that he could think of that would give a pH that high would be tank waste.

He also wanted me to let you know that he is ready to put the new samples on the scope to get better pictures and run the solid phase tests that you requested.

Thanks,

Ruth A. Bushaw

Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

Harlow, Donald G

From:	Harrington, Stephanie J
Sent:	Wednesday, October 10, 2012 12:06 PM
To:	Rosenkrance, Chelsea L; Sams, Terry L; Washenfelder, Dennis J; Kirch, Nicholas W (Nick); Powell, William J (Bill); Venetz, Theodore J
Cc:	Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Reynolds, Jacob G
Subject:	FW: UPDATE: AY102 Annulus 10-Working Day Interim Report

All,

Please find the 10 –working day interim report attached. Please note the following disclaimer from the laboratory:

"Note that these results are identified as interim because they have not been fully reviewed and, therefore, are potentially subject to change upon final review. If any result changes, I will identify that in the final report."

Thank you,
Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Bushaw, Ruth A
Sent: Wednesday, October 10, 2012 11:58 AM
To: Bushaw, Ruth A; Harrington, Stephanie J
Cc: Bushaw, Thomas H; McKinney, Steve G; Hansen, Daniel R; Prilucik, John R; Johnson, Jo M
Subject: UPDATE: AY102 Annulus 10-Working Day Interim Report

I forgot to rerun the DSR to show the "B" flag on the formate result. Here is the new report.

AY102 Annulus
Riser 83 IC_IC...

Thanks,
Ruth A. Bushaw
Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy 222-S Laboratory
373-4314

From: Bushaw, Ruth A
Sent: Wednesday, October 10, 2012 11:47 AM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; McKinney, Steve G; Hansen, Daniel R; Prilucik, John R; Johnson, Jo M
Subject: AY102 Annulus 10-Working Day Interim Report
Importance: High

Stephanie,

The attached file contains the interim results for the IC and ICP analyses for sample 2AY-12-ANU1. Note that 12-CCN-24 indicates that Sr-90 results are also required for this 10-Working Day report, but those results were already provided to you in the 7-Working Day report.

Here is a brief discussion of the QC:

1. Following the fusion digest, it was noted that there was a very small amount of fine black solids in the bottom of the bottle.
2. Following the acid digest, the digestate was described as clear with no solids remaining.
3. The RPD for Fe from the fusion digest is 74.9%. No qualifier flag was required because the sample result is less than the quantitation limit. Recall that this sample had small black flecks of solid that were attracted to a magnet, so it's not surprising to have a high RPD for Fe.
4. A number of analytes were detected in the preparation blanks.
    a. For the fusion digest, Al, Na, and Si were detected in the preparation blank, but the concentration was below the quantitation limit and the QAPP does not require comparison to the sample result or a qualifier flag. The QAPP does not require reanalysis of blanks if the results are below the quantitation limit.
    b. For the acid digest, Ca, Fe, and Si were detected in the preparation blank. The results for Ca and Fe were below the quantitation limit, so no qualifier flag or reanalysis was required. The Si preparation blank result was above the quantitation limit; but Si was not detected in the sample, so no qualifier flag was required and no reanalysis was performed. This is a good example of the typical inconsistent results that the laboratory obtains for Si.
    c. For the water digest, formate, nitrite, sulfate, and nitrate were detected in the preparation blank. Results for all analytes, except formate, were below the quantitation limit and no qualifier flags or reanalysis were required. For formate, the blank result is greater than 5% of the sample result and a "B" flag was applied. Since this is not a required analyte, no repreparation or reanalysis is required.
5. The LCS (prep standard) for Si in the acid digest had a very low recovery; 49%. This digest method, SW-846 Method 3050B, is not an appropriate digest for Si analysis. The laboratory currently does not have an appropriate digest for Si analysis. Note that no Si was detected in the sample using this digest, and an "a" flag was applied to the sample result to indicate the failed LCS recovery. No repreparation and reanalysis was requested because of the limited sample size and because the laboratory does not expect to obtain a better result using this same digestion method.

<< File: AY102 Annulus Riser 83 IC & ICP Interim Results.xlsx >>

Note that these results are identified as interim because they have not been fully reviewed and, therefore, are potentially subject to change upon final review. If any result changes, I will identify that in the final report.

Thanks,

Ruth A. Bushaw

Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

10-oct-2012 11:54:06
INTERIM
AY102 Annulus
Data Summary of All Results

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7429-90-5	Aluminum	ug/g	97.4	1.69E+03	9.95E+03	9.17E+03	9.56E+03	8.15	102	429	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7440-70-2	Calcium	ug/g	98.8	<5.72E+03	<5.72E+03	<5.88E+03	n/a	n/a	96.5	5.72E+03	n/a	U
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7440-47-3	Chromium	ug/g	97.8	<71.5	334	272	303	20.3	98.8	71.5	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7439-89-6	Iron	ug/g	99.0	<715	2.40E+03	5.28E+03	3.84E+03	74.9	99.1	715	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7439-95-4	Magnesium	ug/g	96.5	<143	<143	<147	n/a	n/a	101	143	n/a	U
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7440-23-5	Sodium	ug/g	95.9	6.02E+03	2.76E+05	2.70E+05	2.73E+05	2.12	100	2.86E+03	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7723-14-0	Phosphorus	ug/g	94.1	<214	653	635	644	2.73	96.6	214	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	7440-21-3	Silicon	ug/g	95.4	503	1.32E+03	<3.67E+02	n/a	n/a	97.2	357	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7429-90-5	Aluminum	ug/g	95.2	<6.00E-03	9.42E+03	9.14E+03	9.28E+03	2.99	103	27.5	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7440-70-2	Calcium	ug/g	95.9	0.118	<366	<356	n/a	n/a	98.7	366	n/a	U
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7440-47-3	Chromium	ug/g	94.4	<1.00E-03	251	241	246	4.08	99.8	4.58	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7439-89-6	Iron	ug/g	95.4	0.0102	2.16E+03	2.24E+03	2.20E+03	3.62	100	45.8	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7440-09-7	Potassium	ug/g	91.3	<0.0200	4.01E+04	3.79E+04	3.90E+04	5.48	97.8	91.5	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7439-95-4	Magnesium	ug/g	92.7	<2.00E-03	<9.15	<8.89	n/a	n/a	101	9.15	n/a	U
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7439-96-5	Manganese	ug/g	94.6	<1.00E-03	15.3	13.1	14.2	15.1	100	4.58	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7440-23-5	Sodium	ug/g	93.8	<0.0400	2.94E+05	2.88E+05	2.91E+05	2.02	90.6	183	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7723-14-0	Phosphorus	ug/g	84.0	<3.00E-03	878	864	871	1.60	96.9	13.7	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7440-21-3	Silicon	ug/g	49.0	0.0518	<22.9	<22.2	n/a	n/a	96.8	22.9	n/a	Ua
83	2AY-12-ANU1	Grab Sample (Total)	S12T021143	A	7440-31-5	Tin	ug/g	98.7	<3.00E-03	60.3	62.5	61.4	3.46	101	13.7	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	16984-48-8	Fluoride	ug/g	103	<1.61E-03	859	861	860	0.208	106	55.9	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	12311-97-6	Formate	ug/g	112	0.331	1.33E+03	1.32E+03	1.32E+03	0.665	101	469	n/a	JB
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	16887-00-6	Chloride	ug/g	101	<9.98E-03	1.45E+03	1.40E+03	1.43E+03	3.32	100	179	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	14797-65-0	Nitrite	ug/g	103	0.138	6.01E+04	5.73E+04	5.87E+04	4.80	103	782	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	14808-79-8	Sulfate	ug/g	102	0.0330	1.04E+03	1.01E+03	1.02E+03	2.17	101	514	n/a	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	14797-55-8	Nitrate	ug/g	102	0.0970	1.84E+05	1.77E+05	1.81E+05	3.91	98.7	704	n/a	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021144	W	14265-44-2	Phosphate	ug/g	98.6	<0.0167	2.16E+03	2.13E+03	2.14E+03	1.10	99.1	224	n/a	J

NA = Not Analyzed, ND = Not Detected
b - MS/MSD Outside Range
J - Estimated
a - LCS Outside Range
U - Less Than Detection Limit

Harlow, Donald G

From: Harrington, Stephanie J
Sent: Wednesday, October 10, 2012 12:09 PM
To: Rosenkrance, Chelsea L; Sams, Terry L; Washenfelder, Dennis J; Kirch, Nicholas W (Nick); Powell, William J (Bill); Venetz, Theodore J
Cc: Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Reynolds, Jacob G
Subject: FW: AY102 Annulus 10-Working Day Interim Report - SPC Data

All,

The solids SPC data is attached.

Thank you,
Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: McKinney, Steve G
Sent: Wednesday, October 10, 2012 11:51 AM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; Hansen, Daniel R; Prilucik, John R; Johnson, Jo M; Bushaw, Ruth A; Pestovich, John A; Cooke, Gary; Huber, Heinz J
Subject: RE: AY102 Annulus 10-Working Day Interim Report

AY-102AnnulusS...

..and here is the SPC data...

Thanks.

From: Bushaw, Ruth A
Sent: Wednesday, October 10, 2012 11:47 AM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; McKinney, Steve G; Hansen, Daniel R; Prilucik, John R; Johnson, Jo M
Subject: AY102 Annulus 10-Working Day Interim Report
Importance: High

Stephanie,

The attached file contains the interim results for the IC and ICP analyses for sample 2AY-12-ANU1. Note that 12-CCN-24 indicates that Sr-90 results are also required for this 10-Working Day report, but those results were already provided to you in the 7-Working Day report.

Here is a brief discussion of the QC:

1. Following the fusion digest, it was noted that there was a very small amount of fine black solids in the bottom of the bottle.
2. Following the acid digest, the digestate was described as clear with no solids remaining.
3. The RPD for Fe from the fusion digest is 74.9%. No qualifier flag was required because the sample result is less than the quantitation limit. Recall that this sample had small black flecks of solid that were attracted to a magnet, so it's not surprising to have a high RPD for Fe.
4. A number of analytes were detected in the preparation blanks.
    a. For the fusion digest, Al, Na, and Si were detected in the preparation blank, but the concentration was below the quantitation limit and the QAPP does not require comparison to the sample result or a qualifier flag. The QAPP does not require reanalysis of blanks if the results are below the quantitation limit.
    b. For the acid digest, Ca, Fe, and Si were detected in the preparation blank. The results for Ca and Fe were below the quantitation limit, so no qualifier flag or reanalysis was required. The Si preparation blank result was above the quantitation limit; but Si was not detected in the sample, so no qualifier flag was required and no reanalysis was performed. This is a good example of the typical inconsistent results that the laboratory obtains for Si.
    c. For the water digest, formate, nitrite, sulfate, and nitrate were detected in the preparation blank. Results for all analytes, except formate, were below the quantitation limit and no qualifier flags or reanalysis were required. For formate, the blank result is greater than 5% of the sample result and a "B" flag was applied. Since this is not a required analyte, no repreparation or reanalysis is required.
5. The LCS (prep standard) for Si in the acid digest had a very low recovery; 49%. This digest method, SW-846 Method 3050B, is not an appropriate digest for Si analysis. The laboratory currently does not have an appropriate digest for Si analysis. Note that no Si was detected in the sample using this digest, and an "a" flag was applied to the sample result to indicate the failed LCS recovery. No repreparation and reanalysis was requested because of the limited sample size and because the laboratory does not expect to obtain a better result using this same digestion method.

<< File: AY102 Annulus Riser 83 IC & ICP Interim Results.xlsx >>

Note that these results are identified as interim because they have not been fully reviewed and, therefore, are potentially subject to change upon final review. If any result changes, I will identify that in the final report.

Thanks,

Ruth A. Bushaw

Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

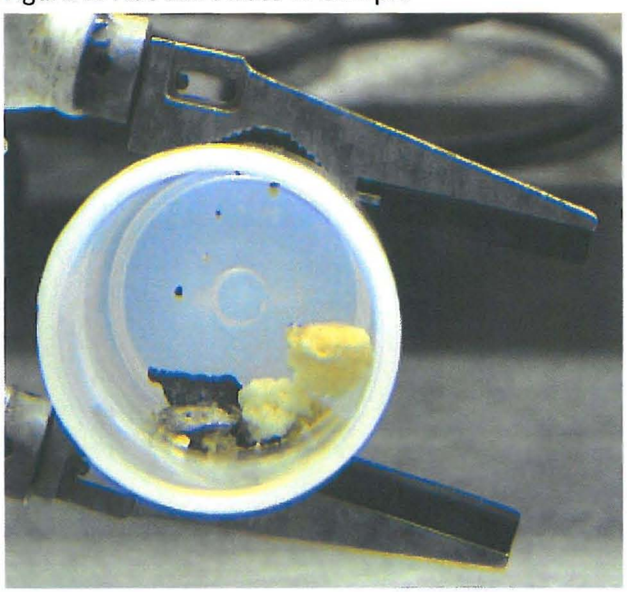
SPC Analysis of AY-102 Annulus Space Sample received 09-27-2012

The Special Analytical Studies Group at the 222-S Laboratory examined the particulate recovered from the floor of the annulus space in Tank 241-AY-102 and delivered to the 222-S Laboratory on September 27th, 2012 (Field sample ID 2AY-12-ANU1). The purpose of this analysis was to perform solid phase characterization (SPC) to determine the compounds present in the material as requested in RPP-PLAN-53352. It was expected that identifying the compounds in the sample could elucidate the source of the material.

The analyses that were conducted included scanning electron microscopy (SEM), X-ray Diffraction (XRD) and polarized light microscopy (PLM). The SEM analysis was conducted by Gary A. Cooke using procedure ATS-LT-161-100. XRD analysis was performed by John A. Pestovich utilizing procedure ATS-LT-507-101. PLM analysis was done by Dr. Heinz J. Huber under procedure ATS-LT-519-107.

The sample received from Tank Farms consisted of a mixture of light and dark particulate. The majority of the dark particulate was contained in a single, intact piece in the form of a thin sheet of material (Figure 1). This material was tested with a magnet and was found to be slightly attracted by it.

Figure 1: Hot Cell Photo of Sample



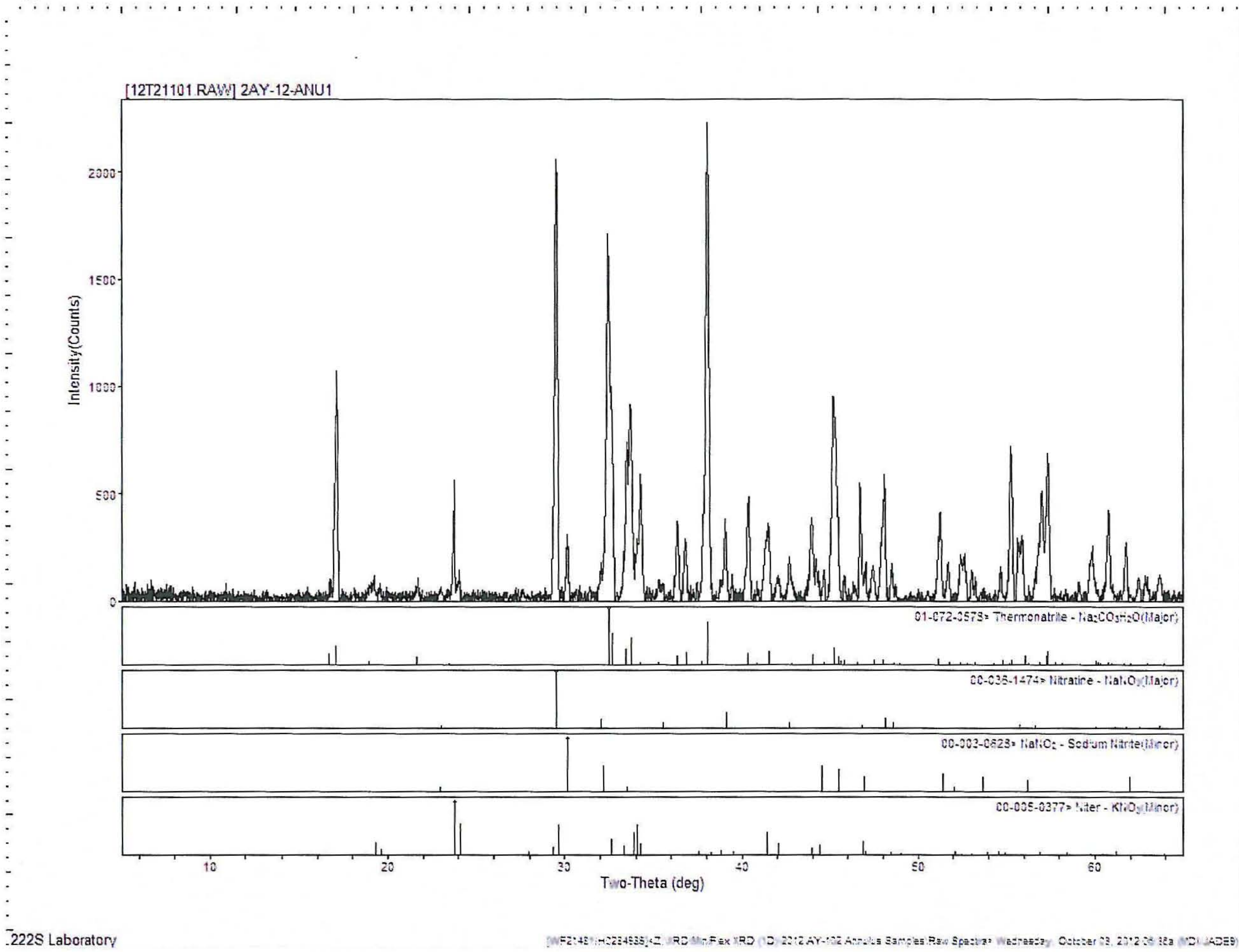
The material was split in the 11A Hot Cells into two fractions. The white salt-like crystalline portion of the sample was identified as Sample S12T021101 (renumbered S12R000514 for solid phase characterization (SPC)). The large dark piece which showed an attraction to a magnet was separated and identified as sample S12R000516. The characterization change notice 12-CCN-24 was issued to describe changes in the analytical scheme that resulted from the limited amount of sample material that was available.

Both subsamples were crushed in a mortar and pestle in the hot cells. During crushing, the white chunks became noticeably moister, either through release of pore water or bound water, or through deliquescence. Water was not used in subsequent sample preparation steps, to avoid altering water-soluble compounds.

All SEM images shown below are secondary electron images (SEI) paired with an energy dispersive x-ray spectrum (EDS) of the area marked with the **+** in the photo, unless otherwise noted.

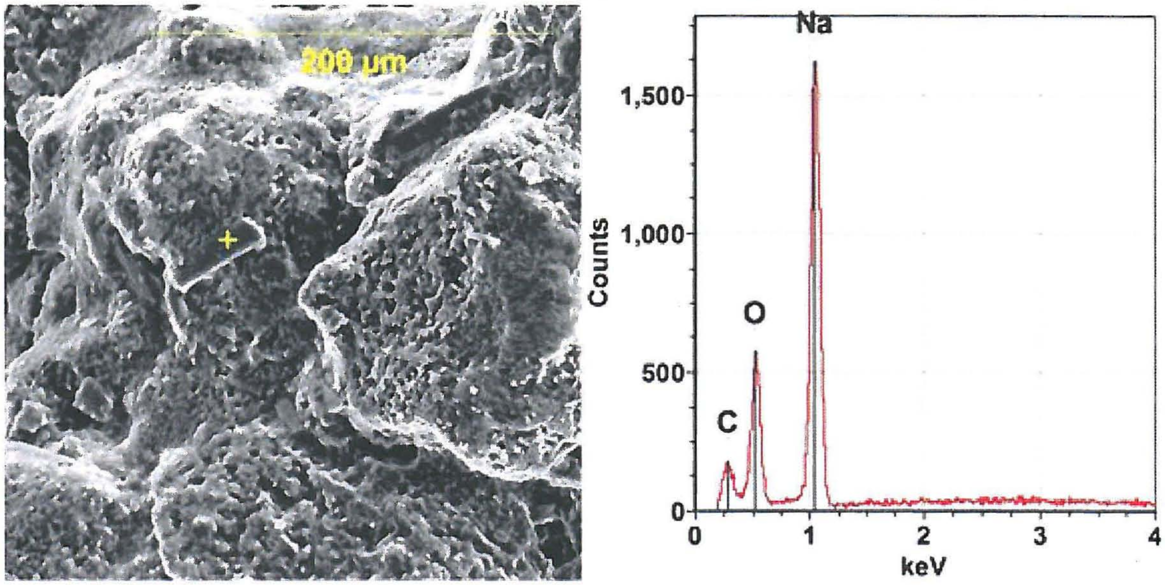
<u>Sample S12R000514 (S12T021101 – 2AY-12-ANU1, White particulate)</u>. The major phases of the sample were identified by XRD analysis as Thermonatrite [$Na_2CO_3 \cdot (H_2O)$] and Nitratine [$NaNO_3$]. Sodium Nitrite [$NaNO_2$] and Niter (KNO_3) were identified as minor phases. The XRD pattern, along with the stick diagrams for the phases that were identified is presented in Figure 2.

Figure 2. XRD Pattern and Matching Phases for Sample S12R000514



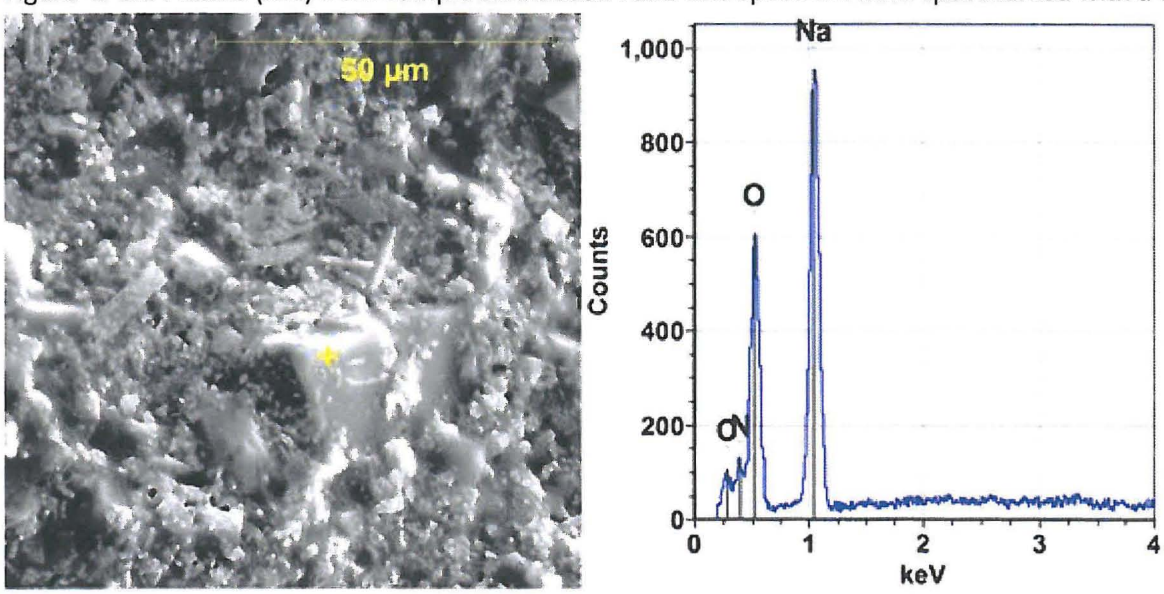
The SEM analysis confirms the presence of the Thermonatrite and the nitrate/nitrite phases. Thermonatrite was the dominant phase (Figure 3).

Figure 3. SEI Picture (left) from Sample S12R000514 and EDS spectrum from spot marked with a cross.



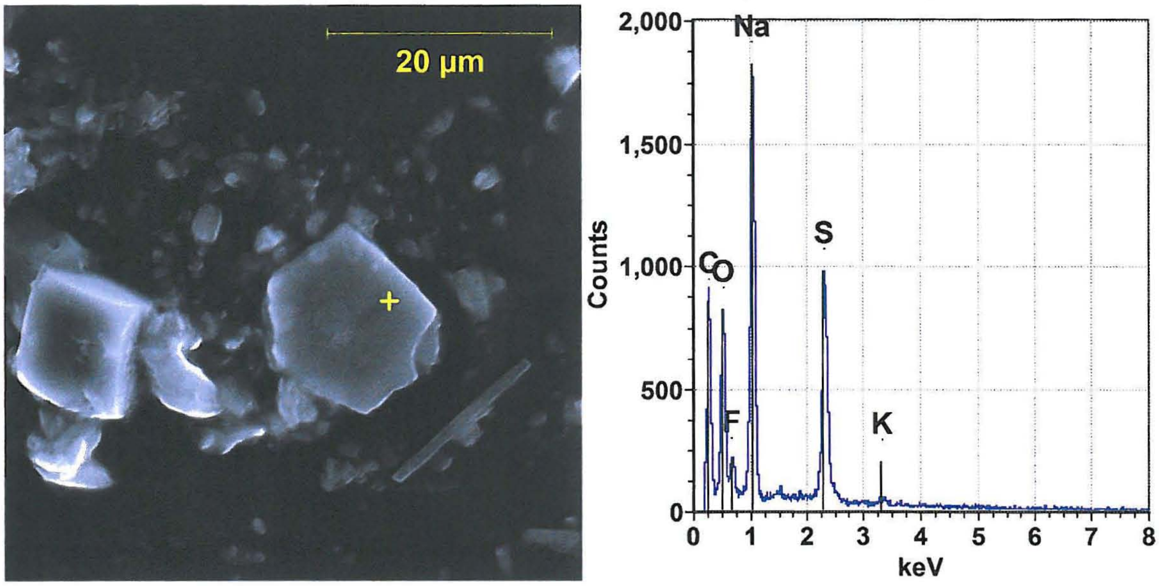
It is difficult for the SEM to distinguish the sodium nitrate from the nitrite, although one or both of these phases are certainly present (Figure 4). The EDS detection for nitrogen, in the presence of the carbon coating, is very poor.

Figure 4. SEI Picture (left) from Sample S12R000514 and EDS spectrum from spot marked with a cross.



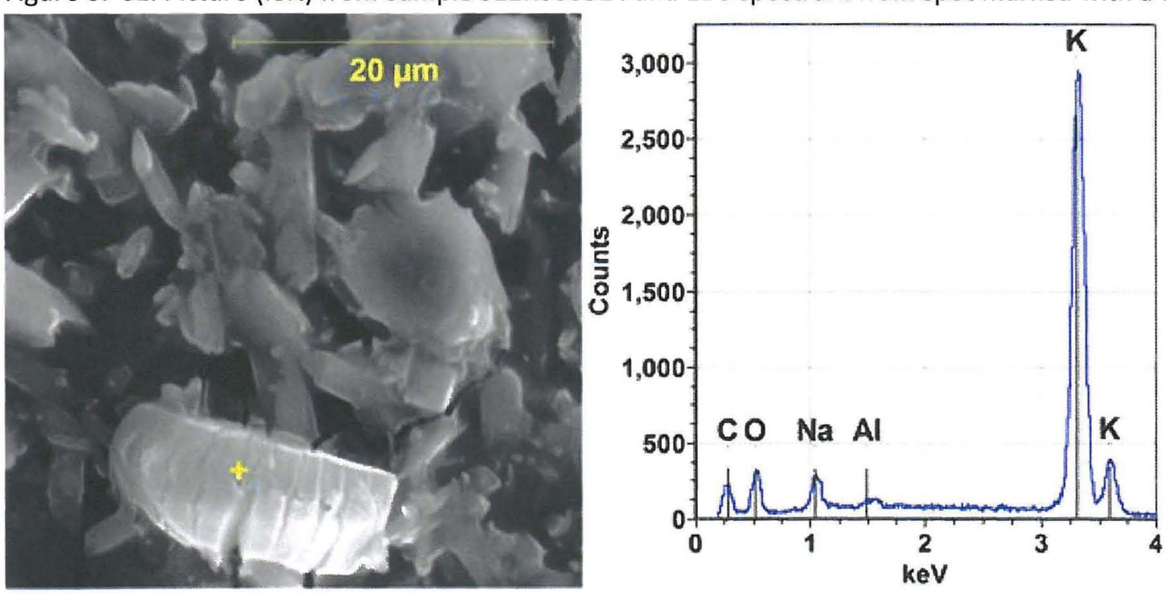
A trace of amount of Sodium Fluoride Sulfate (Kogarkoite, Na_3FSO_4) was also observed in the SEM analysis of this sample (Figure 5).

Figure 5. SEI Picture (left) from Sample S12R000514 and EDS spectrum from spot marked with a cross.



The SEM analysis indicates that the remaining material in the white particulate is one or more potassium salt (Figure 6).

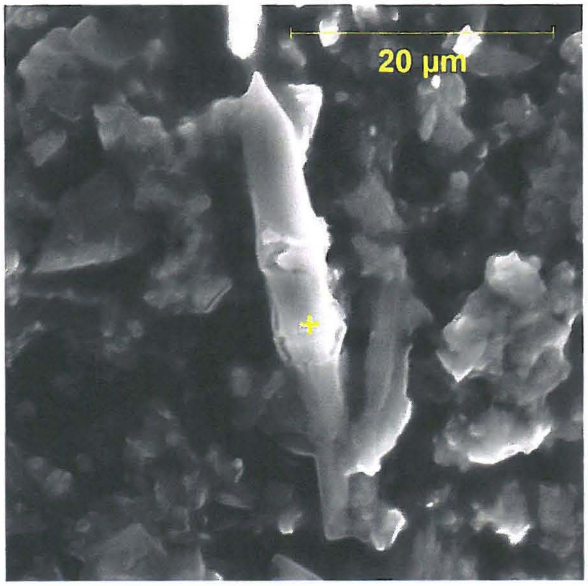
Figure 6. SEI Picture (left) from Sample S12R000514 and EDS spectrum from spot marked with a cross.

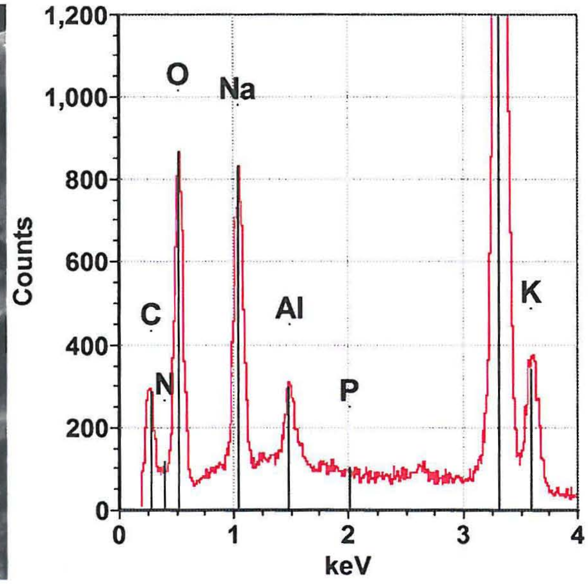


The primary potassium-bearing phase is identified as potassium nitrate using XRD analysis. Detection of nitrogen can be very difficult on the carbon-coated specimens that are examined on the SEM. The nitrogen content of the sodium nitrate/nitrite is 16 to 20% by weight, yet the nitrogen peak is barely visible in the sodium nitrate/nitrite in Figure 4. For the heavier cation in the potassium nitrate, the nitrogen content falls below 14%, making detection with the EDS detector that much harder.

The largest nitrogen peak associated with the potassium-rich phase is shown in Figure 7.

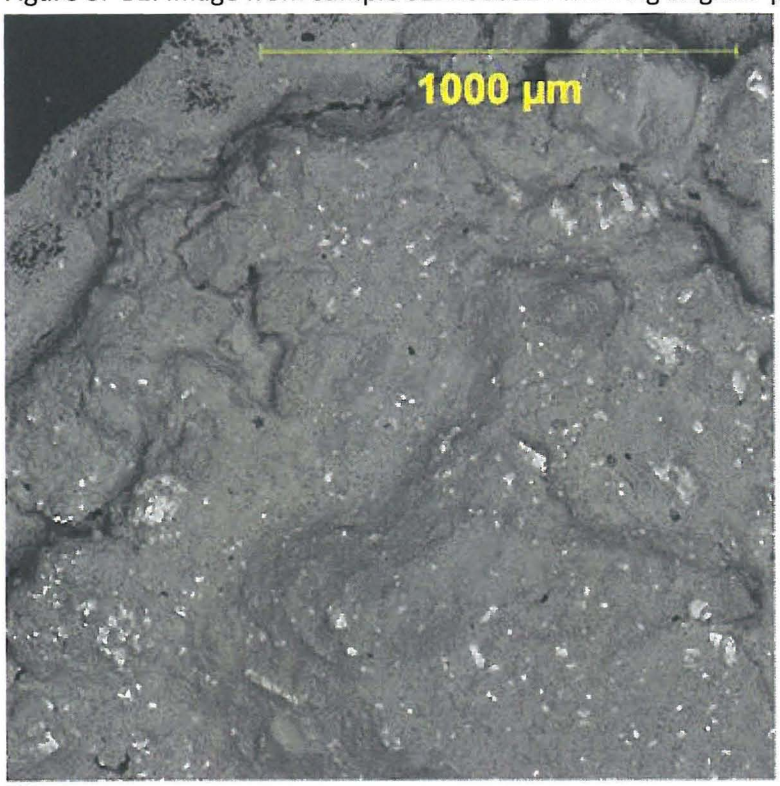
Figure 7. SEI Picture (left) from Sample S12R000514 and EDS spectrum from spot marked with a cross.





The potassium-bearing phase can be made to stand out in the SEM backscatter electron image (BEI). It is distinctly brighter than the sodium-bearing phases. The potassium-bearing phase appears to comprise about 5-10% of the sample by volume (Figure 8).

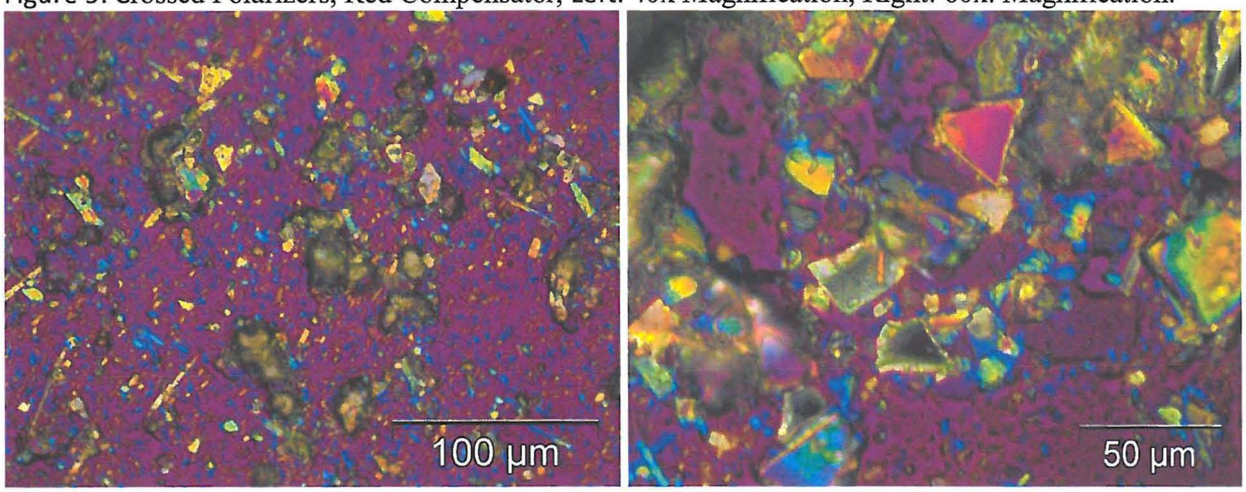
Figure 8. BEI Image from Sample S12R000514 showing brighter potassium-bearing phase(s).



Trace amounts of a uranium-rich particulate were also observed in this sample. A single particle of potassium-rich particulate was observed that contained a significant amount of the element: ruthenium. The sodium phosphate and potassium chloride particulate that were observed on the earlier sample (See attachment B in RPP-53434) were not observed in this current sample.

Polarized light microscopy (PLM) generally confirmed the SEM and XRD observations. Sodium carbonate and sodium nitrate dominate the PLM specimen; trace amounts of sodium oxalate were also observed (Figure 9, Left). An unknown triangular phase with high birefringence (Figure 9, Right) was found on several occasions.

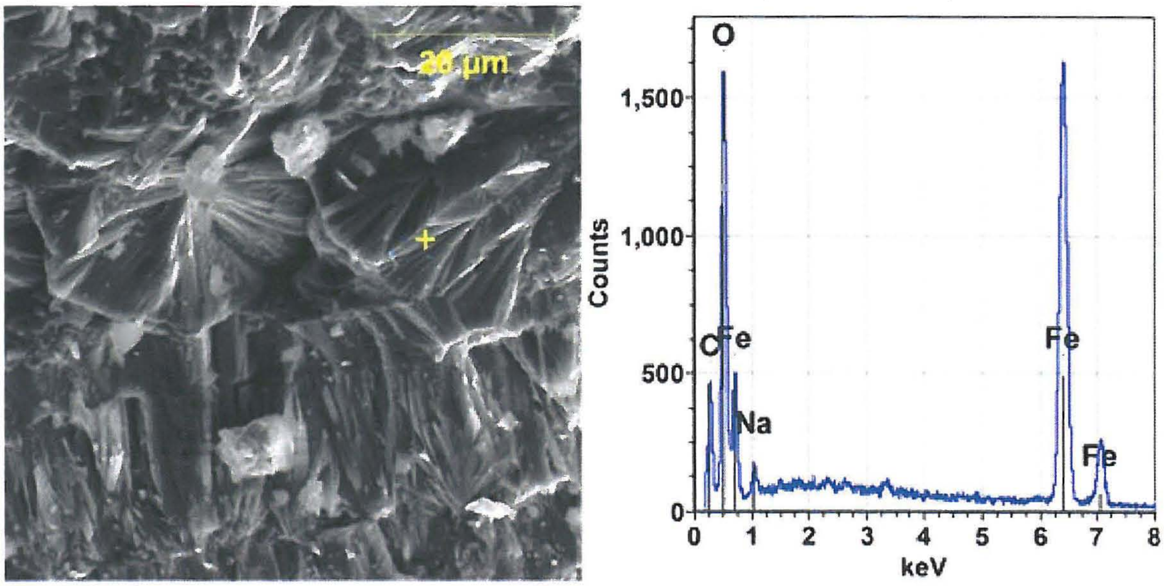
Figure 9. Crossed Polarizers, Red Compensator, Left: 40x Magnification, Right: 60x. Magnification.



Sample S12R000516 (2AY-12-ANU1-Dark Metallic material).

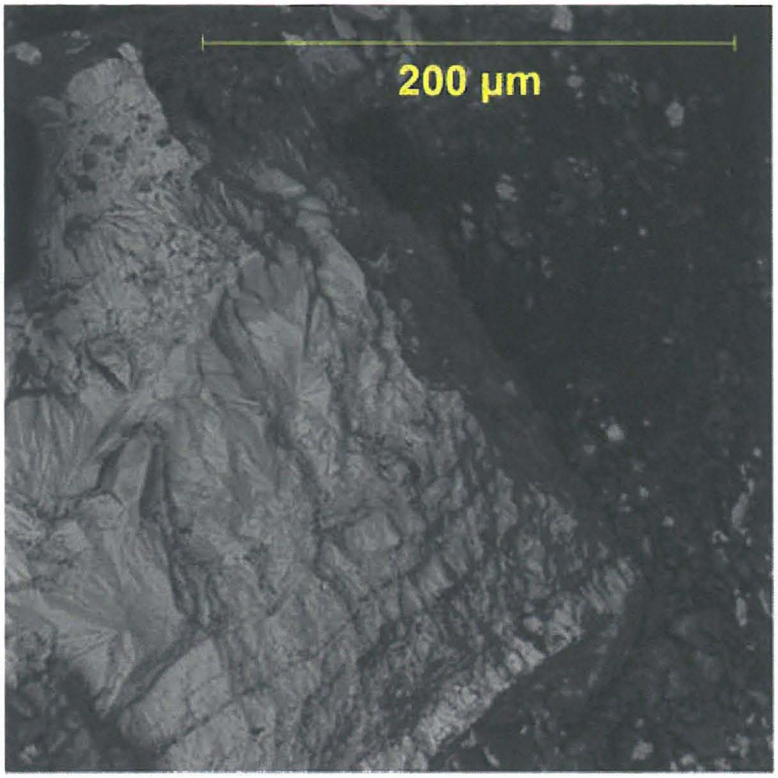
The XRD analysis of this material revealed that the presumed iron-bearing, partially magnetic phase is not crystalline. The only crystalline peaks observed were of the same sodium-bearing phases found in S12R000514. However, the intensity (and therefore concentration) of these sodium phases is about a tenth as large as in sample S12R000514. SEM analysis confirmed that the sodium and potassium salts were present in this sample as well. However, the bulk of the sample is an iron oxide (Figure 10). PLM analysis revealed a mixture of the sodium salts and a fine-grained opaque material.

Figure 10. SEI Picture (left) from Sample S12R000516 and EDS spectrum from spot marked with a cross.



The iron-rich particulate in this sample appears layered, parallel to the long axis of the larger particles, as shown in Figure 11, a BEI image.

Figure 11. BEI Image from Sample S12R000516 Showing Evidence of Layering.



The chemistry, magnetic attraction and morphology of the dark material are consistent with mill scale, or a mixture of mill scale and corrosion.

Discussion

The sodium phases identified in these samples are all water soluble phases that have been identified in tank waste. The presence of soluble potassium salts is notable. Potassium is generally rare in tank waste.

However, a review of the BBI for the current supernatant liquid in Tank AY-102 (RPP-RPT-44630, Rev. 3) reveals high potassium concentrations in the current supernatant (96000 ug/g Na versus 24281 ug/g K, mass ratio 3.95). RPP-RPT-44630 states:

"In December 2006, most of the supernatant was transferred to tanks 241-AN-106 and 241-AW-102. The tank was refilled with supernatant from tank 241-AP-101 in January 2007."

Prior to this transfer, the liquid supernatant that was to be moved from AP-101 to AY-102 was examined as part of a study examining the effects of mixing the AP-101 supernatant with AY-102 solids or residual supernatant (7S110-RWW-04-029, October 14, 2004). The AP-101 supernatant composite used in that study contained 133000 ug/ml sodium, 31000 ug/ml potassium and a mass ratio of about 4.3. This is consistent with the current BBI value for AY-102 supernatant.

The evaporation study conducted with the AP-101 supernatant in 7S110-RWW-04-029 only reduced the volume by 25%. The solids that formed on evaporation were dominated by sodium fluoride (NaF) and sodium oxalate ($Na_2C_2O_4$). If the solids currently found in the AY-102 annulus are derived from this supernatant, they precipitated out during the later stages of evaporation. Solids that precipitated earlier would be expected to have more fluoride bearing salts.

If you have any questions, please contact Gary A. Cooke (509) 373-2154.

Harlow, Donald G

From:	Harrington, Stephanie J
Sent:	Friday, October 05, 2012 1:15 PM
To:	Rosenkrance, Chelsea L; Sams, Terry L; Washenfelder, Dennis J; Kirch, Nicholas W (Nick); Powell, William J (Bill); Venetz, Theodore J
Cc:	Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Reynolds, Jacob G
Subject:	FW: AY102 Annulus ATL 7-Working Day Report
Importance:	High

Please see the 7-Working day report for the preliminary AY-102 annulus sample analyses below.

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Bushaw, Ruth A
Sent: Friday, October 05, 2012 12:38 PM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; Hansen, Daniel R; Prilucik, John R; Johnson, Jo M
Subject: AY102 Annulus ATL 7-Working Day Report
Importance: High

Stephanie,

We placed a high priority on the AY102 Annulus project and were able to expedite the analyses. At this time, I am able to provide you chemist-reviewed results for both the GEA and Sr-90 analyses. Note that these results are identified as interim because they have not been fully reviewed and, therefore, are potentially subject to change upon final review. If any result changes, I will identify that in the final report.

I sent a message yesterday discussing the RPD > 20% for the Sr-90 results. Upon further evaluation, it was determined that the results are below the mean difference confidence level. Therefore, the reported results are acceptable per our QAPP and HASQARD, with no data flag required for the high RPD.

AY102 Annulus
Interim GEA and ....

Thanks,
Ruth A. Bushaw
Project Coordinator
Advanced Technologies and Laboratories International, Inc.

Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

05-oct-2012 10:52:29
INTERIM
AY102 Annulus
Data Summary of All Results

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	10198-40-0	Cobalt-60	uCi/g	98.5	<0.0161	<0.0194	<0.0107	n/a	n/a	n/a	0.0194	n/a	U
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	10045-97-3	Cesium-137	uCi/g	104	<0.0192	92.7	89.2	90.9	3.89	n/a	0.0951	0.21	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	14331-83-0	Actinium-228	uCi/g	n/a	<0.0637	0.0618	<0.0433	n/a	n/a	n/a	0.0567	30.34	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	SR-89/90	Strontium-89/90	uCi/g	104	<4.75E-03	0.105	0.135	0.120	24.7	n/a	4.76E-03	12.902	

NA = Not Analyzed, ND = Not Detected
U - Less Than Detection Limit

Girardot, Crystal L

From: Venetz, Theodore J
Sent: Tuesday, November 06, 2012 3:04 PM
To: Girardot, Crystal L
Subject: FW: Preliminary SPC of AY-102 Residual Solids sample received 09-27-2012 at 222-S

From: Cooke, Gary
Sent: Thursday, October 04, 2012 6:26 AM
To: Washenfelder, Dennis J; Rosenkrance, Chelsea L
Cc: Seidel, Cary M; McKinney, Steve G; Venetz, Theodore J; Harrington, Stephanie J
Subject: FW: Preliminary SPC of AY-102 Residual Solids sample received 09-27-2012 at 222-S

Mr. McKinney sent this out earlier this week. It is the preliminary results from the latest sample.

We have some additional information on the Potassium-bearing salt(s) that suggest at least some of it is Potassium Nitrate (KNO3), the mineral Niter.

Gary

From: McKinney, Steve G
Sent: Tuesday, October 02, 2012 12:30 PM
To: Harrington, Stephanie J; Kirch, Nicholas W (Nick); Nguyen, Duc M; Rasmussen, Juergen H; Templeton, Andrew M; Reynolds, Jacob G; Sams, Terry L; Boomer, Kayle D; Washenfelder, Dennis J; Powell, William J (Bill)
Cc: Johnson, Jo M; Prilucik, John R
Subject: FW: Preliminary SPC of AY-102 Residual Solids sample received 09-27-2012 at 222-S

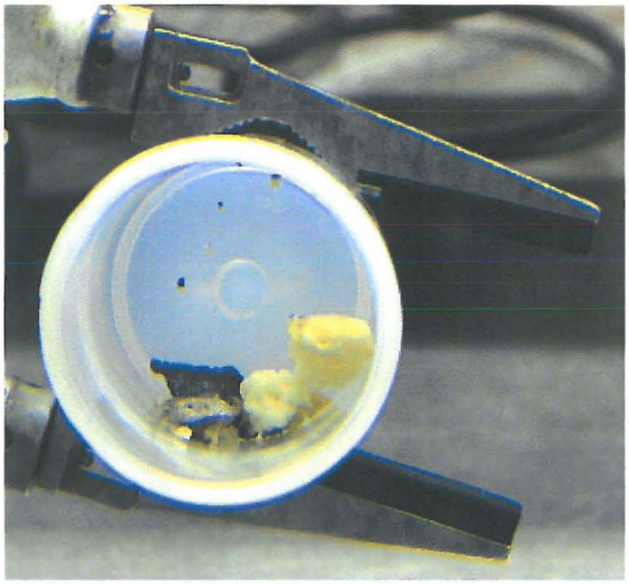
See below.

Thanks.

From: Cooke, Gary
Sent: Tuesday, October 02, 2012 11:53 AM
To: McKinney, Steve G
Subject: Preliminary SPC of AY-102 Residual Solids sample received 09-27-2012 at 222-S

Mr. Pestovich and I have completed our examination of the AY-102 Residual Solids sample that was delivered to the 222-S Laboratory on September 27, 2012. The material was split in the 11A Hot Cells into two fractions. The white salt-like crystalline portion of the sample was identified as Sample S12T021101 (renumbered S12R000514 for solid phase characterization (SPC)). A large dark chunk which showed an attraction to a magnet was separated and identified as sample S12R000516.

Hot Cell Photo:

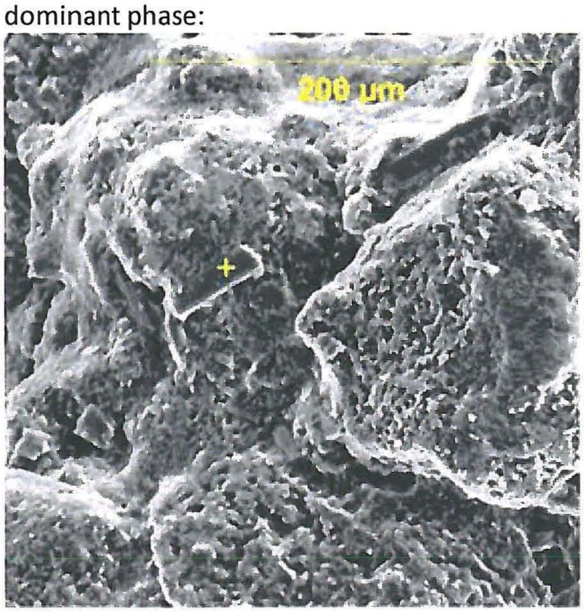


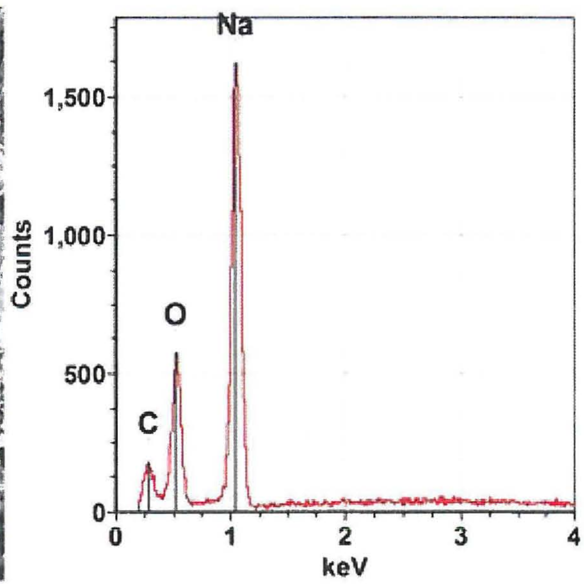
Both subsamples were crushed in a mortar and pestle in the hot cells. During crushing, the white chunks became noticeably moister, either through release of pore water or bound water, or through deliquescence.

Samples were prepared for XRD and SEM analysis using standard procedures ATS-LT-507-101 and ATS- LT-161-100, respectively. Water was not used in the sample preparation steps, to avoid altering water-soluble compounds. All SEM images shown below are secondary electron images (SEI) paired with an energy dispersive x-ray spectrum (EDS) of the area marked with the **+** in the photo, unless otherwise noted.

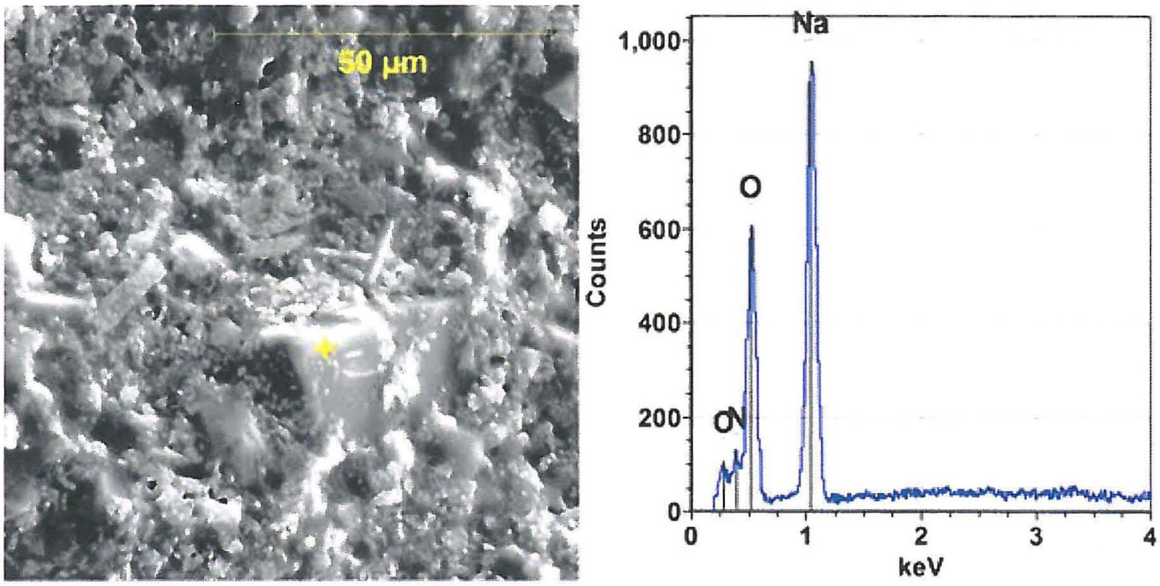
S12R000514 (S12T021101 – 2AY-12-ANU1, White particulate). The major phases of the sample were identified by XRD analysis as Thermonatrite [$Na_2CO_3 \cdot (H_2O)$] and Nitratine [$NaNO_3$]. Sodium Nitrite [$NaNO_2$] was identified as a minor phase. At least one minor/trace phase remains unidentified in the diffraction pattern.

The SEM analysis confirms the presence of the Thermonatrite and the nitrate/nitrite phases. Thermonatrite was the dominant phase:

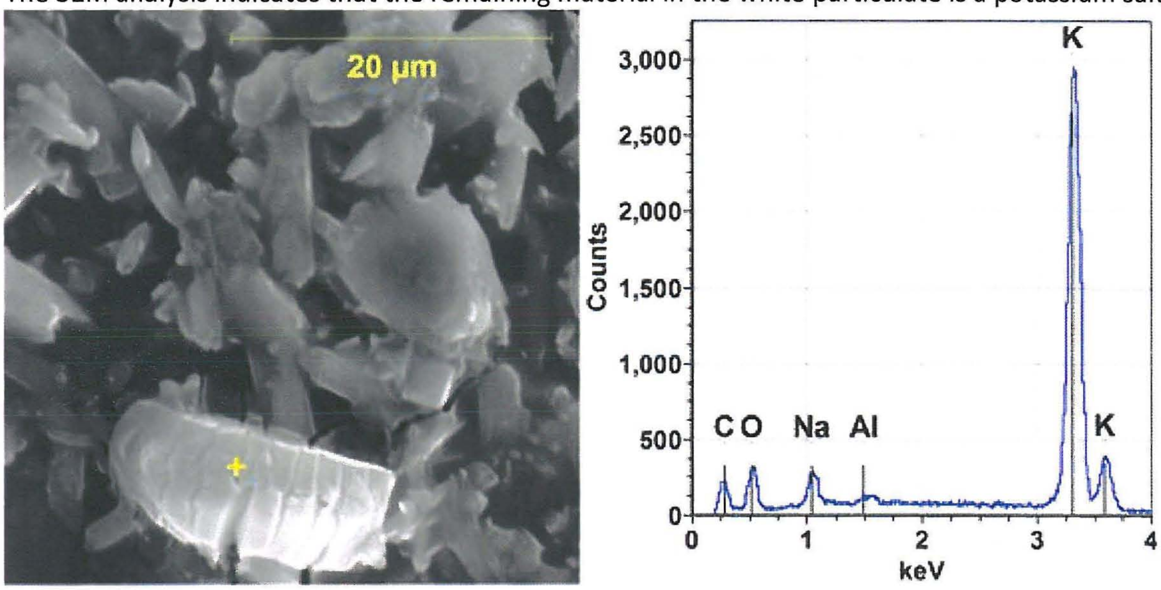




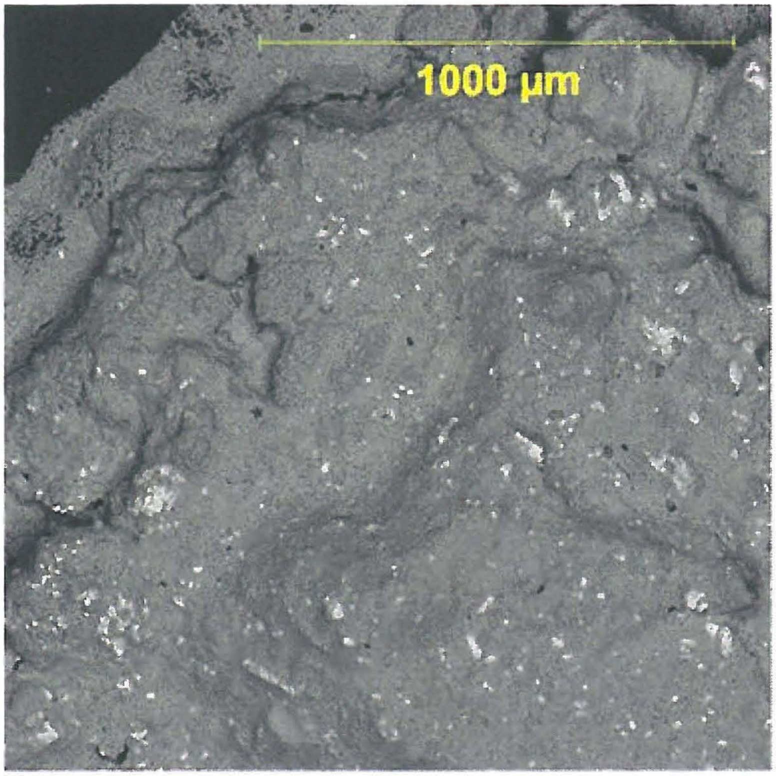
It is difficult for the SEM to distinguish the sodium nitrate from the nitrite, although one or both of these phases is certainly present:



The SEM analysis indicates that the remaining material in the white particulate is a potassium salt:



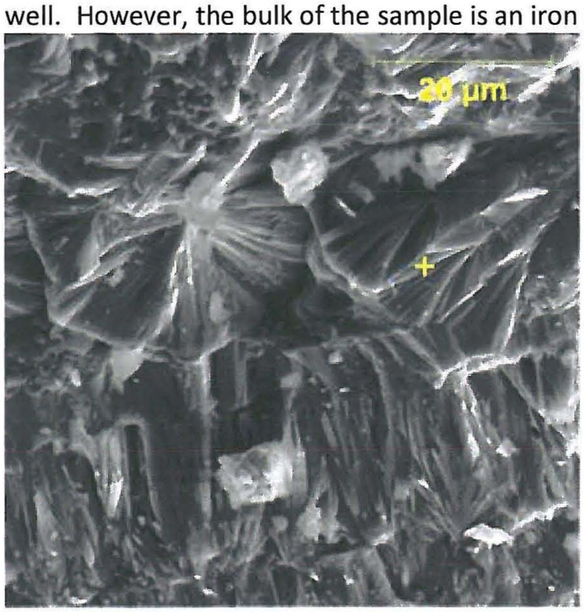
This phase is probably a hydrated potassium carbonate. It has not been identified in the XRD pattern, although there are peaks in the pattern that could not be attributed to the sodium phases mentioned above. The potassium-bearing phase can be made to stand out in the SEM backscatter electron image (BEI). It is distinctly brighter than the sodium-bearing phases. The potassium-bearing phase appears to comprise about 5-10% of the sample by volume:

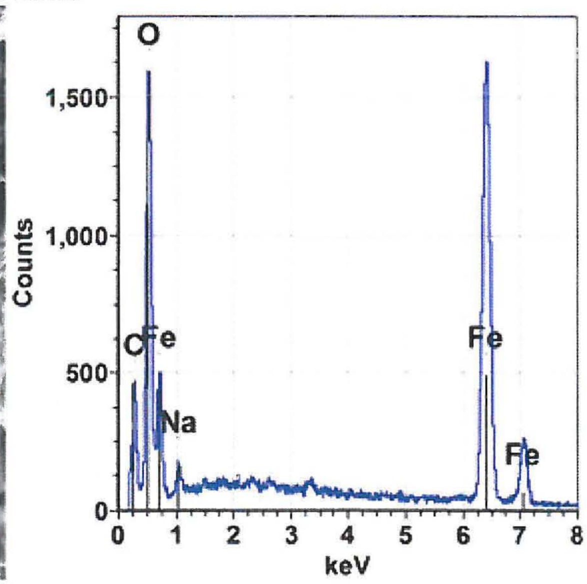


Trace amounts of a uranium-rich particulate were also observed in this sample. A single particle of potassium-rich particulate was observed that contained a significant amount of the element: ruthenium. The sodium phosphate and potassium chloride particulate that were observed on the earlier sample (See attachment B in RPP-53434) were not observed in this current sample.

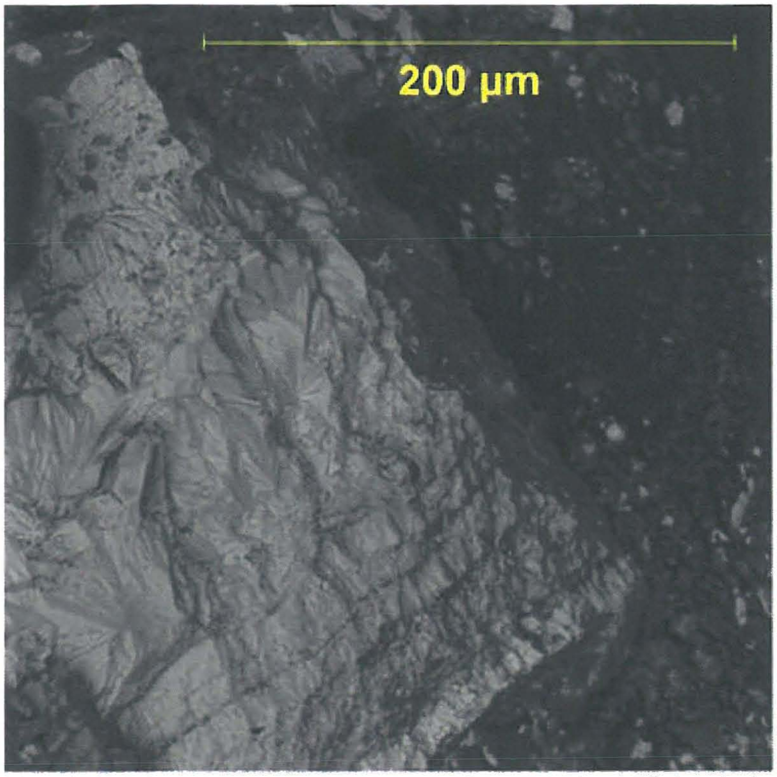
S12R000516 (2AY-12-ANU1-Dark Metallic material).

The XRD analysis of this material revealed that the presumed iron-bearing, partially magnetic phase is not crystalline. The only crystalline peaks observed were of the same sodium-bearing phases found in S12R000514. However, the intensity (and therefore concentration) of these sodium phases is about a tenth as large as in sample S12R000514. SEM analysis confirmed that the sodium and potassium salts were present in this sample as well. However, the bulk of the sample is an iron oxide:





The iron-rich particulate in this sample appears layered, parallel to the long axis of the larger particles, as shown in this BEI image:



The chemistry, magnetic attraction and morphology of the dark material are consistent with mill scale, or a mixture of mill scale and corrosion.

We are scheduling the PLM examination of these samples for tomorrow, and we will report those results when they are available.

Please forward this email to those you feel should see it. If you or anyone you share this with have any questions please let me know.

Gary A. Cooke

gary_cooke@rl.gov (509) 373-2154 Cell: (509) 845-3988

Washington River Protection Solutions, contractor to the United States Department of Energy

Harlow, Donald G

From: Venetz, Theodore J
Sent: Monday, October 01, 2012 10:58 AM
To: Rosenkrance, Chelsea L
Subject: FW: AY102 Annulus Update for Requested Analyses

From: Bushaw, Ruth A
Sent: Monday, October 01, 2012 10:49 AM
To: Venetz, Theodore J; Harrington, Stephanie J
Subject: RE: AY102 Annulus Update for Requested Analyses

The archive of the white material was only 0.9 g. Because of the sticky consistency of that material after they ground it in the mortar, I don't think that we will be able to recover the entire 0.9 g for analysis.

Thanks,
Ruth A. Bushaw
Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy 222-S Laboratory
373-4314

From: Venetz, Theodore J
Sent: Monday, October 01, 2012 8:20 AM
To: Bushaw, Ruth A
Subject: RE: AY102 Annulus Update for Requested Analyses

That would be it, requires less sample than I would have thought. Do you know how much archive was salvaged.
Ted

From: Bushaw, Ruth A
Sent: Monday, October 01, 2012 8:18 AM
To: Venetz, Theodore J
Cc: Harrington, Stephanie J
Subject: RE: AY102 Annulus Update for Requested Analyses

Ted,

If by "quantitative identification of carbonate" you mean that you would like us to run the TIC/TOC analysis (TIC would be carbonate and bicarbonate), we would need about 0.75 g (if none is lost on the spatula when taking the aliquots).

Thanks,

Ruth A. Bushaw

Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy 222-S Laboratory
373-4314

From: Venetz, Theodore J
Sent: Monday, October 01, 2012 7:25 AM
To: Bushaw, Ruth A
Cc: Harrington, Stephanie J
Subject: RE: AY102 Annulus Update for Requested Analyses

Ruth,
Thanks,
Do you know how much of the sample they were actually able to retain as the archive.

Also, if we wanted quantitative identification of carbonate, how much sample would that take. I think we will get some qualitative identification from Gary Cooke, if it is there.

Ted

From: Bushaw, Ruth A
Sent: Thursday, September 27, 2012 5:08 PM
To: Harrington, Stephanie J
Cc: Cooke, Gary; McKinney, Steve G; Venetz, Theodore J
Subject: AY102 Annulus Update for Requested Analyses
Importance: High

Stephanie,

The attached file contains my updated breakdown diagram based on what we discussed back in 11A today.

<< File: AY102 Annulus SBD.pdf >>

As you know, we loaded out 3.2 g of the white material and about 0.6 g of the black material.
Here is my understanding of our new requirements for analysis:

1. Gary Cooke will take aliquots for SEM, PLM, and XRD analysis from our vial containing 3.2 g – he expects to only need 0.3 – 0.5 g
2. ATL will prep a sample and duplicate (~0.5 g ea) by fusion digest for ICP, GEA, and Sr-90 analysis (therefore ~ 1 g used)
3. ATL will prep a sample and duplicate (~0.25 g ea) by acid digest for ICP analysis (therefore ~ 0.5 g used)
4. ATL will prep a sample and duplicate (~0.25 g ea) by water digest for IC analysis (therefore ~ 0.5 g used)
5. Gary Cooke received ~ 0.6 g of the black material for SEM, PLM, and XRD analysis

Since we are limited in the amount of sample we have available, and the customer would like to have some material held in archive for potential future testing, please provide a CCN to indicate the following:

> Due to limited sample material, preparation and analysis of predigestion spikes for the acid and water digests are not required. Since ratios of results of a small number of major expected constituents will be used for determination of the presence of tank material in the annulus, possible minor losses of constituents during digestion, that would be monitored by a predigestion spike, are not expected to affect the use of the data. Post digestion spikes should be analyzed to monitor instrument performance.

In addition, the laboratory is directed to NOT perform the following analyses for sample 2AY-12-ANU1, due to insufficient sample material:

- pH
- TGA
- TIC/TOC
- Ammonium

For the Format II report, the interim results for GEA, PLM, SEM, and XRD will be transmitted via electronic mail within 7 working days after receipt of sample 2AY-12-ANU1. Results for ICP, IC, and Sr-90 will be transmitted within 10 working days.

Thanks,

Ruth A. Bushaw

Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

5.3 Riser 90- October 2012 Samples

Venetz, Theodore J

From:	Cooke, Gary
Sent:	Tuesday, October 30, 2012 1:30 PM
To:	McKinney, Steve G; Harrington, Stephanie J; Sams, Terry L; Reynolds, Jacob G; Boomer, Kayle D; Venetz, Theodore J
Cc:	Bushaw, Ruth A; Seidel, Cary M; Pestovich, John A; Huber, Heinz J; Page, Jason S; Herting, Daniel L
Subject:	RE: Solid Phase Characterization of 2AY-12-ANU-3A and 2AY-12-ANU-5A

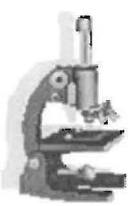
One unfortunate typo found, bottom of page six:
the floor sample (2AY-12-ANU-3A)

should be:
the floor sample (2AY-12-ANU-1)

Gary

From: Cooke, Gary
Sent: Tuesday, October 30, 2012 12:48 PM
To: McKinney, Steve G; Harrington, Stephanie J; Sams, Terry L; Reynolds, Jacob G; Boomer, Kayle D; Venetz, Theodore J
Cc: Bushaw, Ruth A; Seidel, Cary M; Pestovich, John A; Huber, Heinz J; Page, Jason S; Herting, Daniel L
Subject: Solid Phase Characterization of 2AY-12-ANU-3A and 2AY-12-ANU-5A

See attached.

GARY A. COOKE

gary_cooke@rl.gov **(509) 373-2154 Cell: (509) 845-3988**
Washington River Protection Solutions, contractor to the United States Department of Energy

Harlow, Donald G

From: Harrington, Stephanie J
Sent: Tuesday, October 30, 2012 1:07 PM
To: Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Washenfelder, Dennis J; Girardot, Crystal L; Rosenkrance, Chelsea L
Subject: FW: Solid Phase Characterization of 2AY-12-ANU-3A and 2AY-12-ANU-5A
Attachments: Samples12-ANU-3A5A.doc

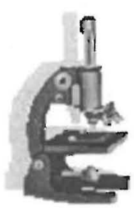
See attached write-up for the solid phase characterization of the last AY-102 annulus samples from the air duct (3A) and mound (5A).

Thank you,
Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Cooke, Gary
Sent: Tuesday, October 30, 2012 12:48 PM
To: McKinney, Steve G; Harrington, Stephanie J; Sams, Terry L; Reynolds, Jacob G; Boomer, Kayle D; Venetz, Theodore J
Cc: Bushaw, Ruth A; Seidel, Cary M; Pestovich, John A; Huber, Heinz J; Page, Jason S; Herting, Daniel L
Subject: Solid Phase Characterization of 2AY-12-ANU-3A and 2AY-12-ANU-5A

See attached.



Gary A. Cooke
gary_cooke@rl.gov (509) 373-2154 Cell: (509) 845-3988
Washington River Protection Solutions, contractor to the United States Department of Energy

Solid Phase Characterization of Samples 2AY-12-ANU-3A and 2AY-12-ANU-5A.

This document reports on our solid phase characterization (SPC) of two samples: samples 2AY-12-ANU-3A and sample 2AY-12-ANU-5A, received at the 222-S laboratory on October 17, 2012. The SPC analyses consist of x-ray diffraction (XRD), scanning electron microscopy (SEM) equipped with an energy dispersive spectrometer (EDS) and polarized light microscopy (PLM).

The analysis of samples using this instrumentation is conducted in accordance with the following procedures:

ATS-LT-161-100, 222-S "Laboratory Sample Preparation and Operating Procedure for Scanning Electron Microscopes" and ATS-LT-161-101, 222-S "Laboratory Technology Procedure for the FEI Quanta 600 Scanning Electron Microscope" are employed for SEM analysis. For XRD analysis ATS-LT-507-101, "222-S Laboratory X-Ray Diffractometry (XRD)" details the analysis steps. The PLM analysis is conducted in accordance with ATS-LT-519-107, "222-S Laboratory Polarized Light Microscopy".

Prior to sub-sampling, all the sample material was poured into a 2 inch diameter Petri dish. Macro photographs and photomicrographs were taken of this material. Figures 1 and 2 show a representative macro photograph and photomicrograph for the two samples. Both samples appear to be mixtures of light colored aggregates along with dark reddish brown material that is assumed to be a mix of rust and mill scale. Sample 2AY-12-ANU-3A is mostly composed of light colored particulate while sample 2AY-12-ANU-5A consists primarily of rust and scale.

Figure 1. Optical Images of 2AY-12-ANU-3A. Petri Dish is 2 Inches in Diameter.

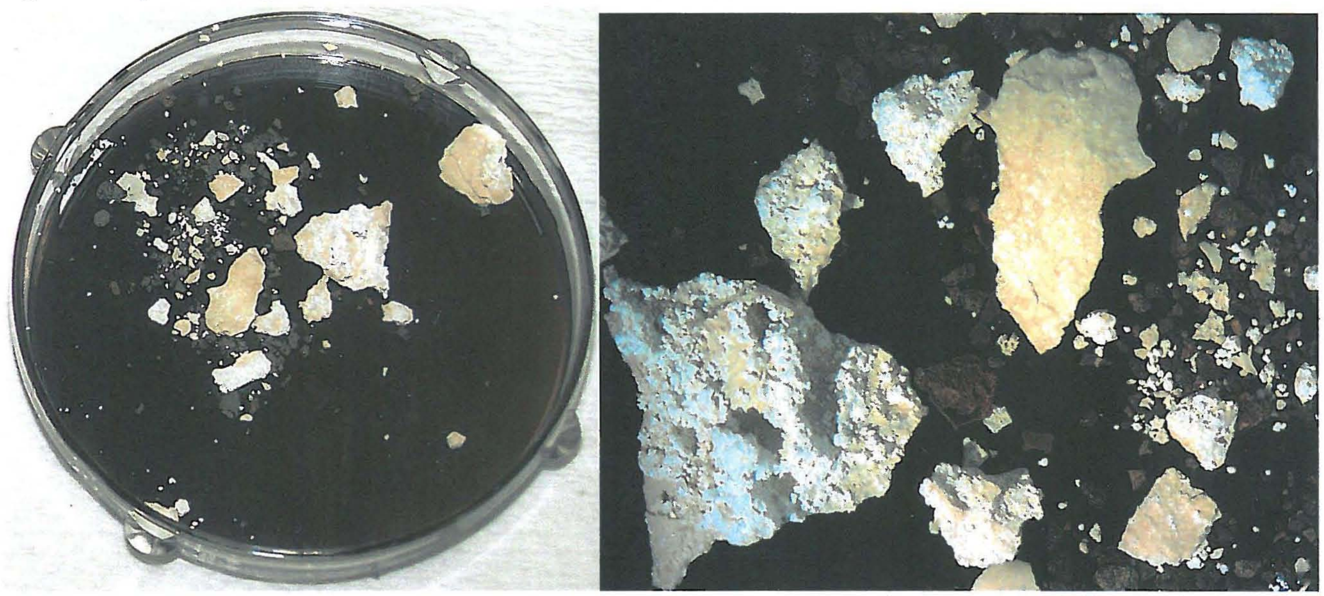
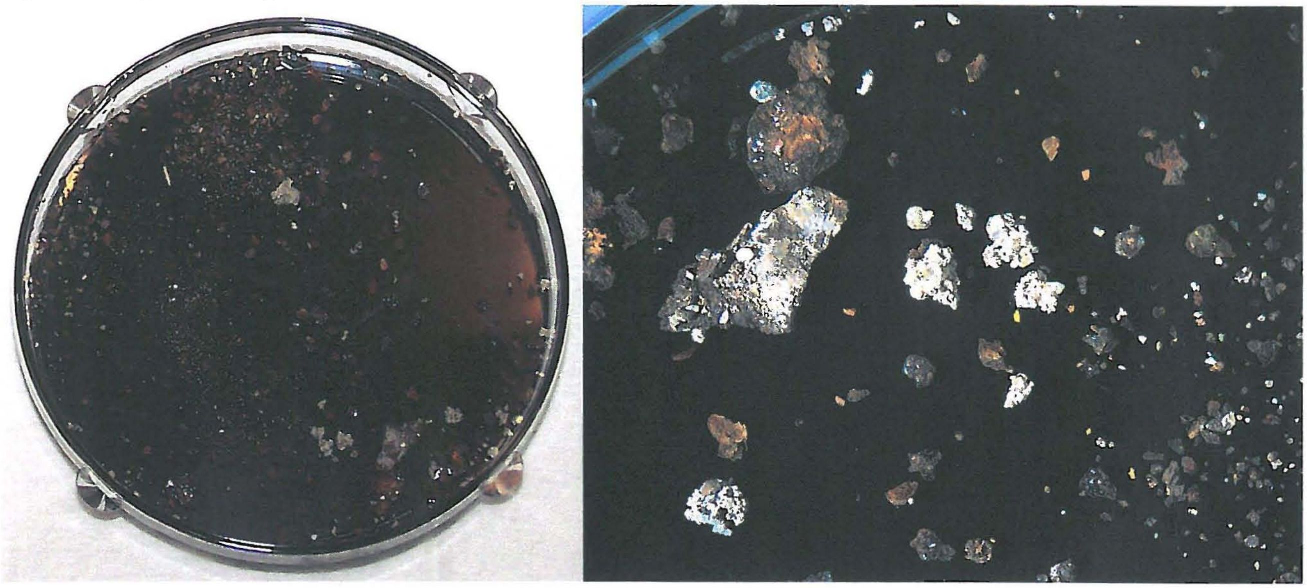


Figure 2. Optical Images of 2AY-12-ANU-5A. Petri Dish is 2 Inches in Diameter.



Close-up optical images of some of the white particulate in both samples show that they consist primarily of aggregates of smaller particles. In the case of the 2AY-12-ANU-3A sample, these appear to be aggregates of salt crystals, either botryoidal (Figure 3), lath- or blade-like (Figure 4) or glassy and vesicular (Figure 5). These appear to be at least two different salt crystals. The glassy vesicular surface appears to have been at the surface of the "cascade" and to have crystallized in the presence of gas bubbles.

Figure 3. Aggregate of Salt Crystals showing Botryoidal Morphology from Sample 2AY-12-ANU-3A.

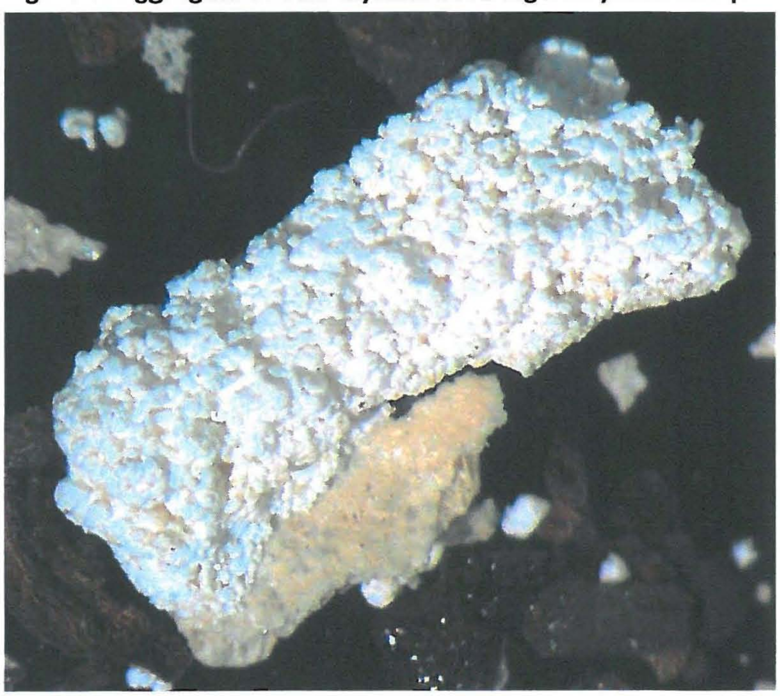


Figure 4. Aggregate of Salt Crystals showing Blade- or Lath-like Morphology from Sample 2AY-12-ANU-3A.

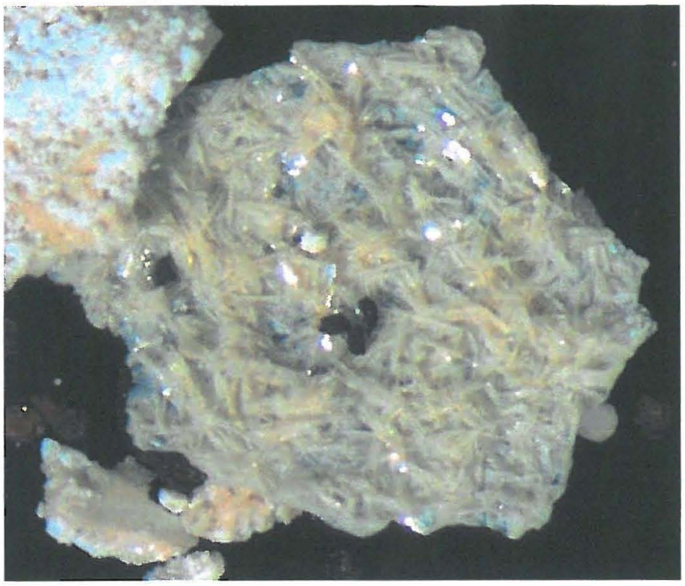
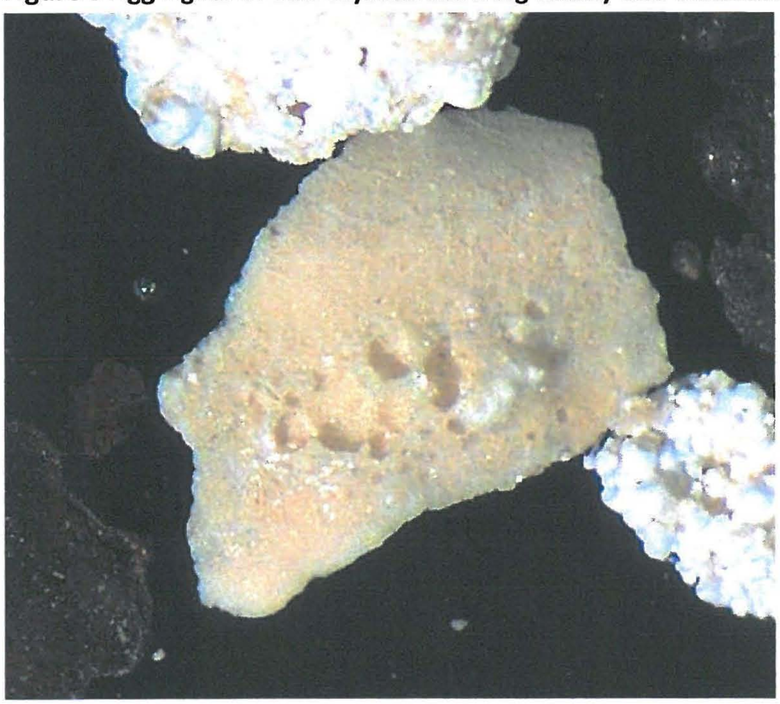
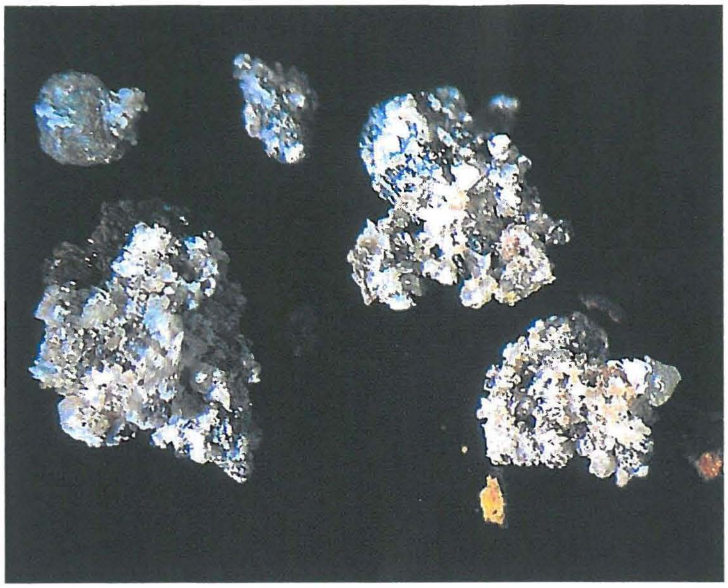


Figure 5 Aggregate of Salt Crystals showing Glassy and Vesicular Morphology from Sample 2AY-12-ANU-3A.



The light colored particulate in sample 2AY-12-ANU-5A was much rarer than in 2AY-12-ANU3A. They appear to be aggregates of darker material cemented by white salt (Figure 6).

Figure 6. Figure 5 Aggregate of Light and Dark Colored Particulate from Sample 2AY-12-ANU-5A.



Samples were prepared for SEM, XRD and PLM by crushing the entire sample (2AY-12-ANU-5A)

SPC of Sample 2AY-12-ANU-3A

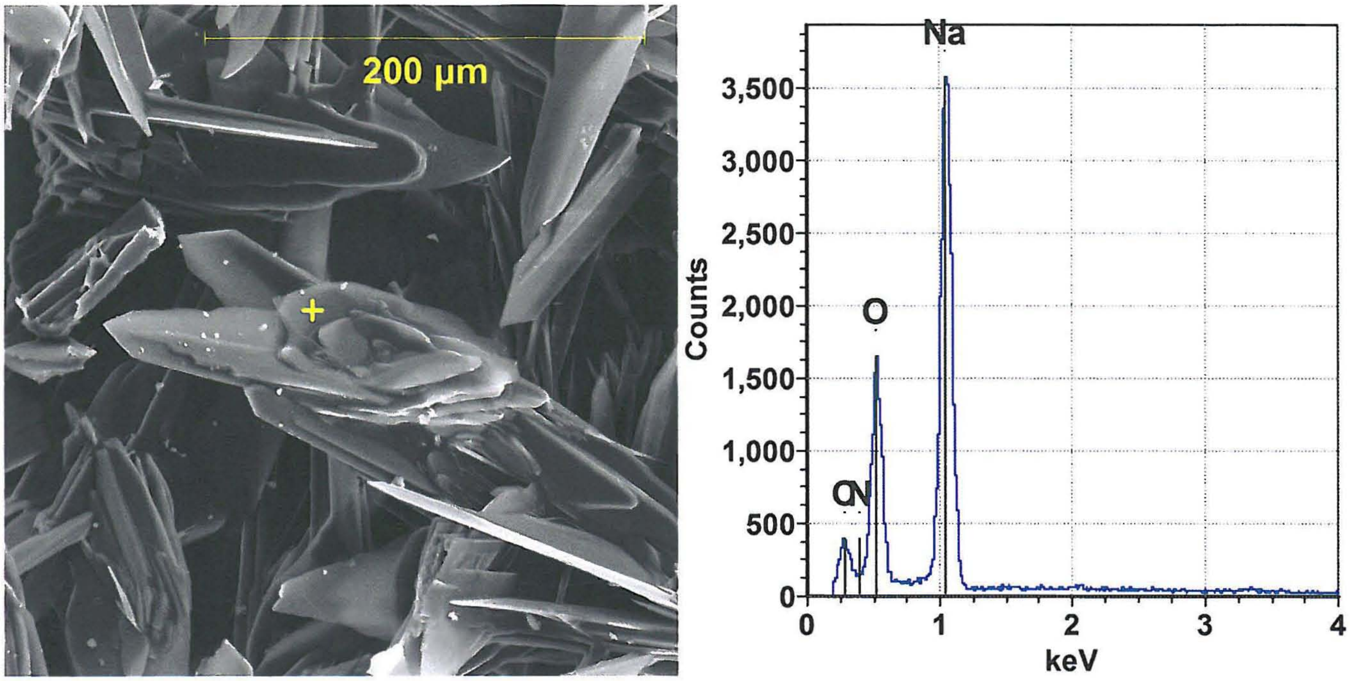
Sample 2AY-12-ANU-3A consisted of dry white solid aggregates with a minor amount of reddish-brown particles. The sample weighed 0.20 grams. The light colored particulate was separated from the reddish brown rust and scale. This light colored material was crushed in an agate mortar and pestle and sub-sampled for Solid Phase Characterization (SPC). Prior to complete crushing, several pieces were removed and reserved for SEM analysis. A portion of the crushed powder was transferred to an adhesive carbon tab mounted on an SEM planchet. The fine particulate was pressed into place and the larger particulate was added and also pressed into the adhesive surface. For XRD analysis, a portion of the completely ground material was placed in the well of a zero background mount, compressed with a glass slide and fixed with a collodion binder. A portion of the crushed sample was examined by PLM. The PLM specimen was prepared by transferring a small amount of the dry powder onto a glass slide, adding a drop of oil with a 1.55 index of refraction.

XRD analysis revealed a series of strong peaks. Nearly all of them could be attributed to crystalline phases that are consistent with tank waste salts. The following phases and relative abundances were found:

Chemical Name	Mineral Name	Formula	~Relative Amount
Sodium Carbonate Anhydrous	Natrite	Na_2CO_3	Major
Sodium Hydrogen Phosphate	Nahpoite	Na_2HPO_4	Minor
Sodium Nitrite	--	$NaNO_2$	Minor
Sodium Oxalate	Natroxalate	$Na_2C_2O_4$	Minor

The SEM analysis confirmed the presence of a phase consistent with the anhydrous sodium carbonate (Figure 7). This figure, and the other SEM images in this report are paired with an EDS spectrum taken from the area marked with the yellow +. This phase is responsible for the blade and lath-like crystals observed in the optical microscope (Figure 4). Sodium carbonate occurs in tank waste. However, it is found as the monohydrate phase Thermonatrite (Na_2CO_3-H_2O). Apparently, the temperature near this sample was high enough to dehydrate the normally hydrated sodium carbonate or to allow the anhydrous form to precipitate directly. This is consistent with a temperature above 90 degrees Centigrade.

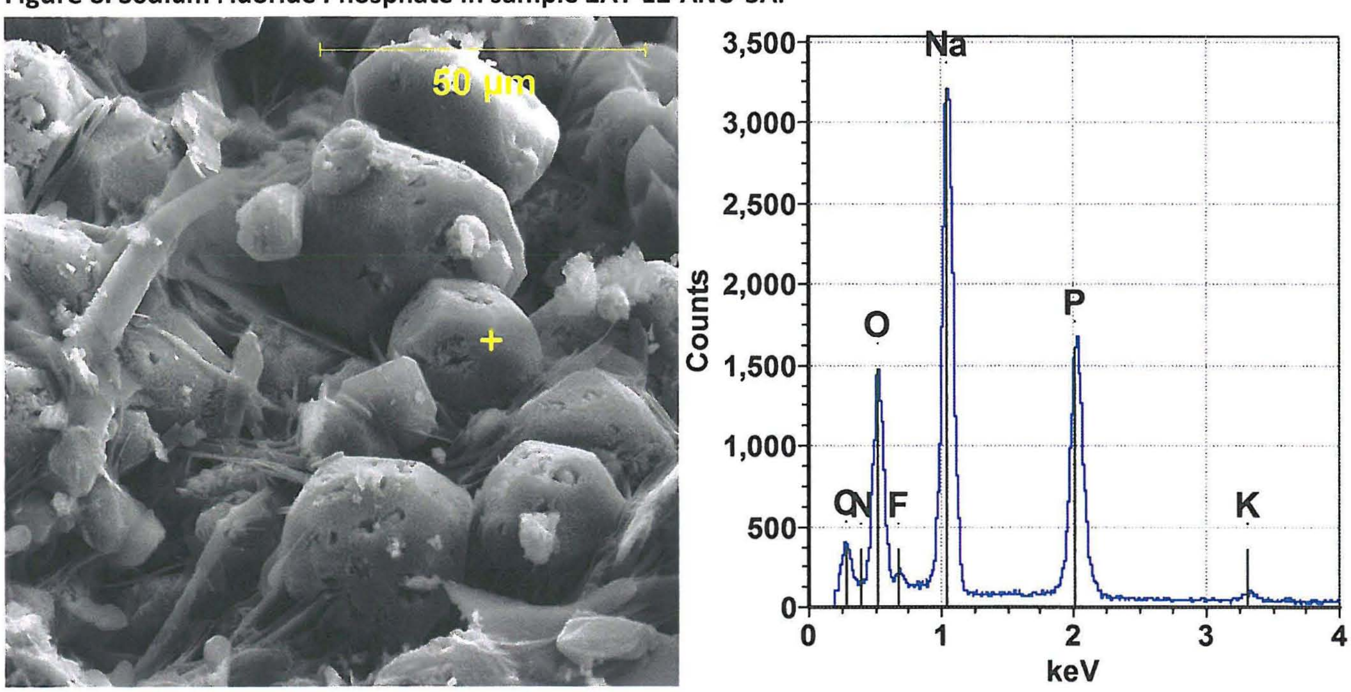
Figure 7. Sodium Carbonate laths in Sample 2AY-12-ANU-3A.



The SEM could not confirm the sodium nitrite that was observed in the XRD scan. The nitrogen peak is particularly insensitive, and there needs to be a nearly pure sodium nitrite before the peak can be observed on the EDS spectrum. The presence of an elevated background where the nitrogen peak is located could be seen on many of the EDS spectra, but never a discrete peak.

The phase identified as Nahpoite (Na_2HPO_4) in the XRD pattern was not observed in the SEM specimen. Instead, equant octahedral crystals with the appearance and the EDS spectra consistent with the common tank waste phase Natrophosphate ($Na_7F(PO_4)_2$-$19H_2O$) was seen (Figure 8). However, the SEM image shows crystals that are pock-marked and pitted. This would be consistent with dehydration.

Figure 8. Sodium Fluoride Phosphate in sample 2AY-12-ANU-3A.

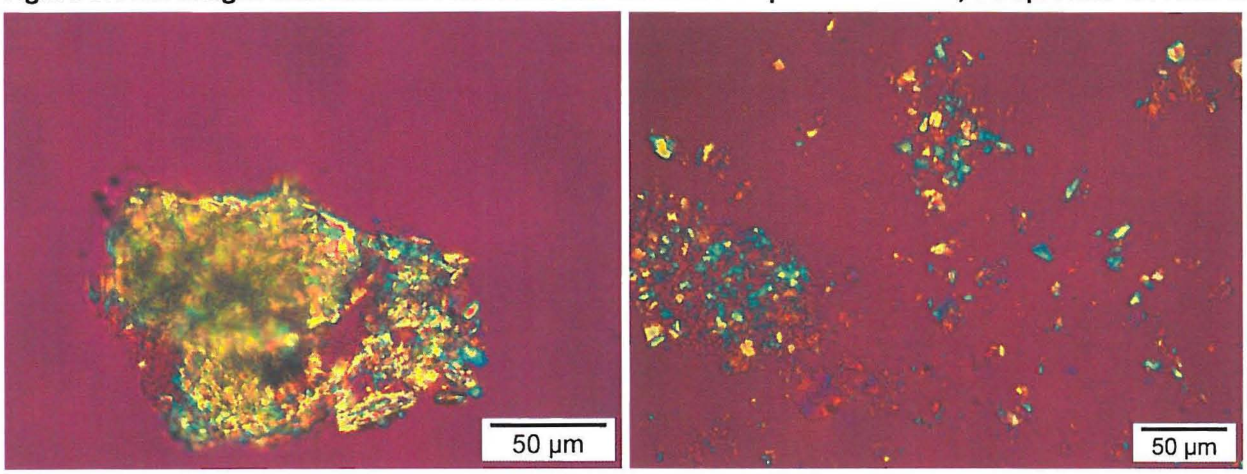


Little is known about the dehydration of this phase. The lack of reference information on the anhydrous ($Na_7F(PO_4)_2$ suggest that it is rare or non-existent. It appears that eventually, the phase will dehydrate and recrystallize as the simple salts NaF and Na_3PO_4. The SEM and XRD results here can be reconciled if the dehydrated phase(s) are amorphous, and the sample contains Na_2HPO_4 unseen on the SEM but identified in XRD sample. If so, this would suggest a more neutral pH than the 2AY-12-ANU-1 sample from the floor of the annulus. Alternatively, there could be an intermediate dehydrated phase with the composition $Na_7F(PO_4)_2$ that has a crystalline structure identical to the Na_2HPO_4.

No evidence of the sodium oxalate was observed in the SEM. However, that phase cannot be chemically distinguished from the sodium carbonate on the EDS spectra. Therefore we would be relying on slight differences in the morphology. No crystals with a morphology that is consistent with sodium oxalate were observed.

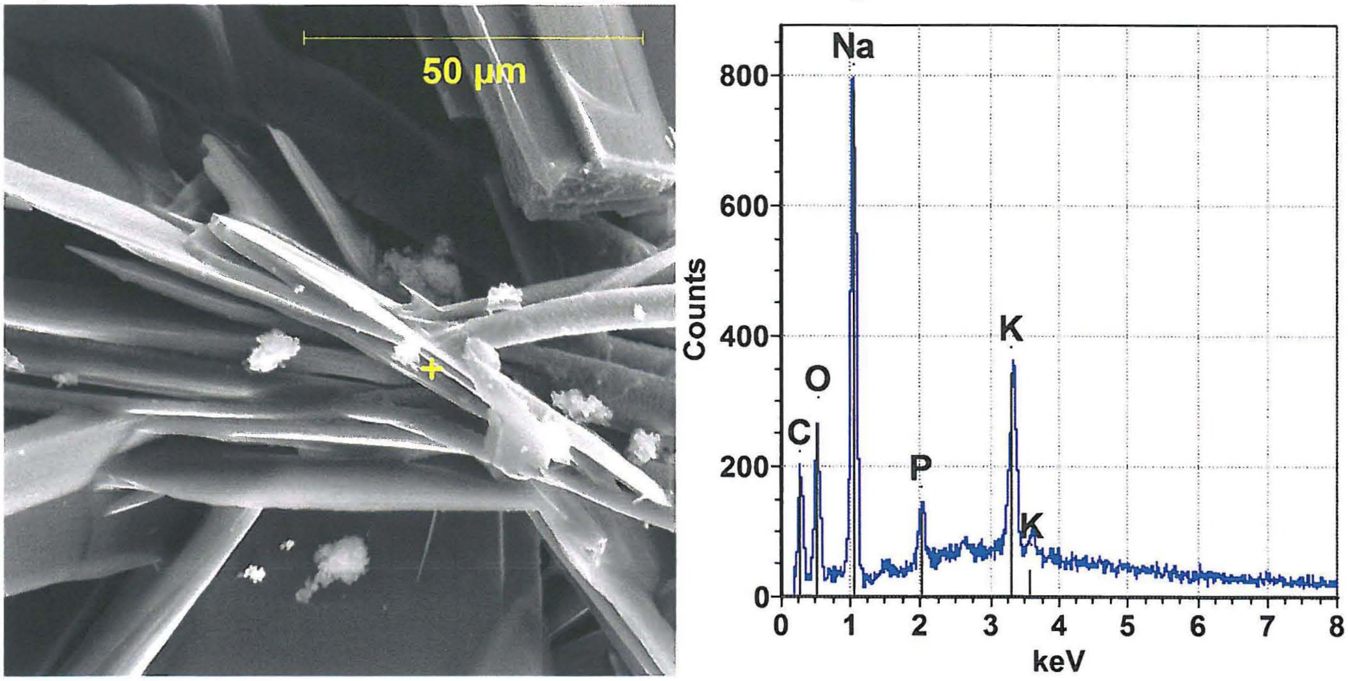
Polarized light microscopy of this sample revealed the coarser particulate to be composed of fine crystallites (Figure 9). The PLM analysis was able to confirm the presence of sodium oxalate and found a trace amount of Gibbsite ($Al(OH)_3$). Gibbsite was not observed in the XRD and SEM analysis. The fine-grained aggregate nature of the larger particles lends credence to the decomposition of the sodium fluoride phosphate into NaF and Na_3PO_4.

Figure 9. PLM Images with Crossed Polarizers and the Red Compensation Plate, Sample 2AY-12-ANU-3A



While there appeared to be some potassium in the sample, there was no evidence of a discrete potassium nitrate phase, as had been seen on the floor sample (2AY-12-ANU-3A). The highest concentration of potassium observed in the EDS spectra was from a particle that was largely obscured by sodium carbonate laths (Figure 10).

Figure 10. Minor Potassium Peak in EDS Spectrum from Sample 2AY-12-ANU-3A.



SPC of Sample 2AY-12-ANU-5A

The 2AY-12-ANU-5A sample weighed only 0.12 grams and was crushed in its entirety. No attempt was made to separate the rust from the few light colored fragments that were present. XRD and SEM analysis was conducted on this material, consuming nearly the entire sample. As a result of our preliminary examination, we recommended that both samples be examined by PLM as well.

The particulate from sample 2AY-12-ANU5A was seen on the SEM to consist predominantly of rust or mill scale (Figure 11). Soil particles are the next most abundant particle type. Figures 12 through 15 show particles with chemical compositions consistent with minerals found in Hanford soil or sand. There was also a small amount of a sodium-rich phase (Figure 16), and a single particle of a sodium sulfate was also seen (Figure 17).

The XRD pattern for this sample showed no significant peaks for any crystalline phase. This suggests that the crystalline mineral material and the sodium-rich phase (if crystalline) make up less than 20 percent of the sample. The diffraction peaks from these phases would be difficult to detect in the high iron matrix of the sample. Visual estimates from the PLM and SEM sample preparations suggest that the rust/scale makes up 75 to 85 percent of the 12-ANU-5A sample

The SEM sample specimen contained no detectible beta/gamma radiation using the room monitors. The only evidence for tank waste material in this sample was the sodium-rich particulate, estimated to make up about 5% of the sample. The only source outside of tank waste that could provide a sodium rich particulate is clean caustic.

Figure 11. SEM Secondary Electron Image of Rust/Scale, Sample 12-ANU-5A

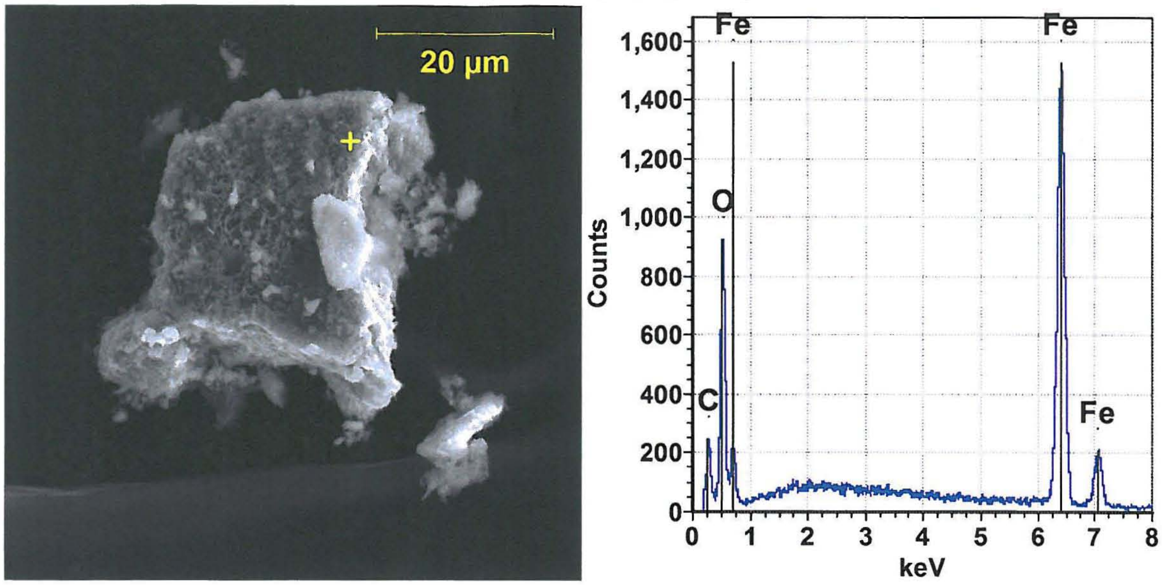


Figure 12. SEM Secondary Electron Image of Quartz, Sample 12-ANU-5A

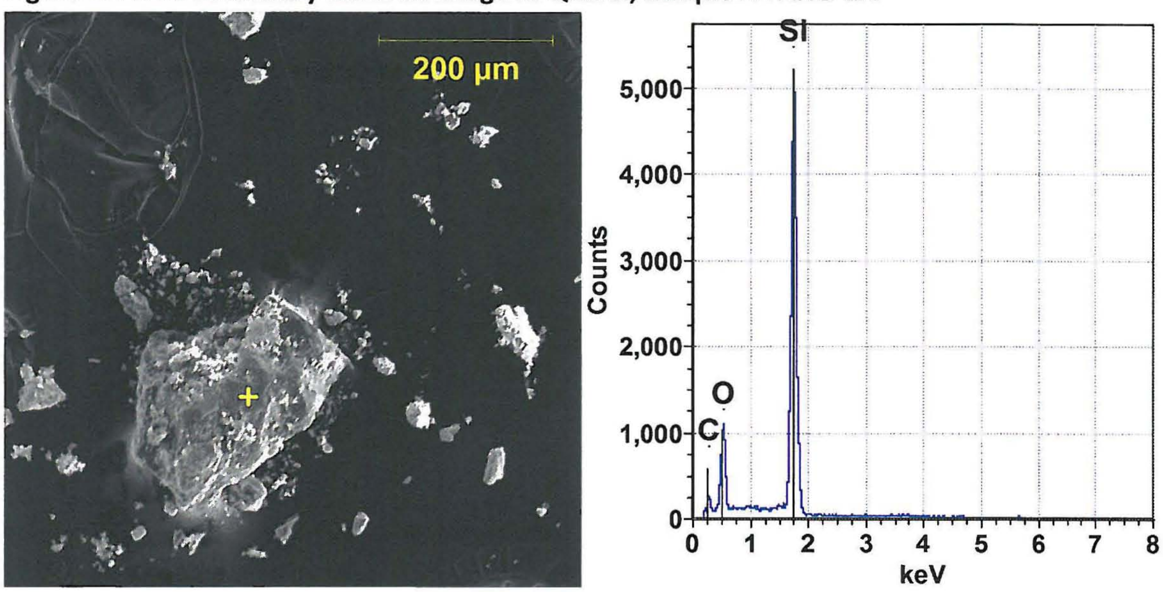


Figure 13. SEM Secondary Electron Image of Potassium Feldspar, Sample 12-ANU-5A

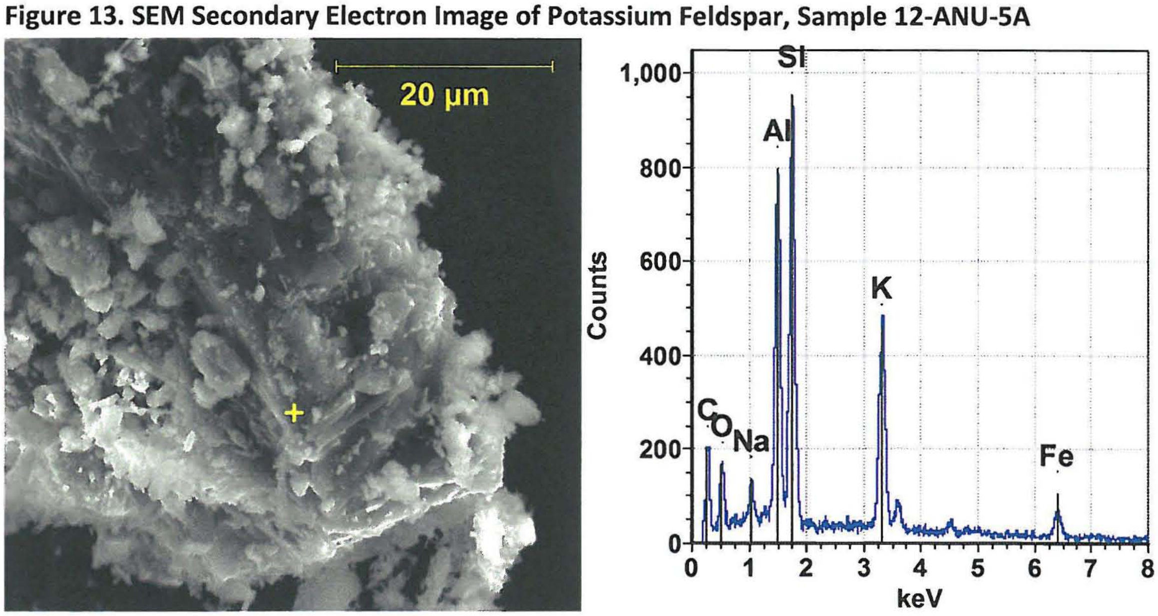


Figure 14. SEM Secondary Electron Image of Plagioclase Feldspar, Sample 12-ANU-5A

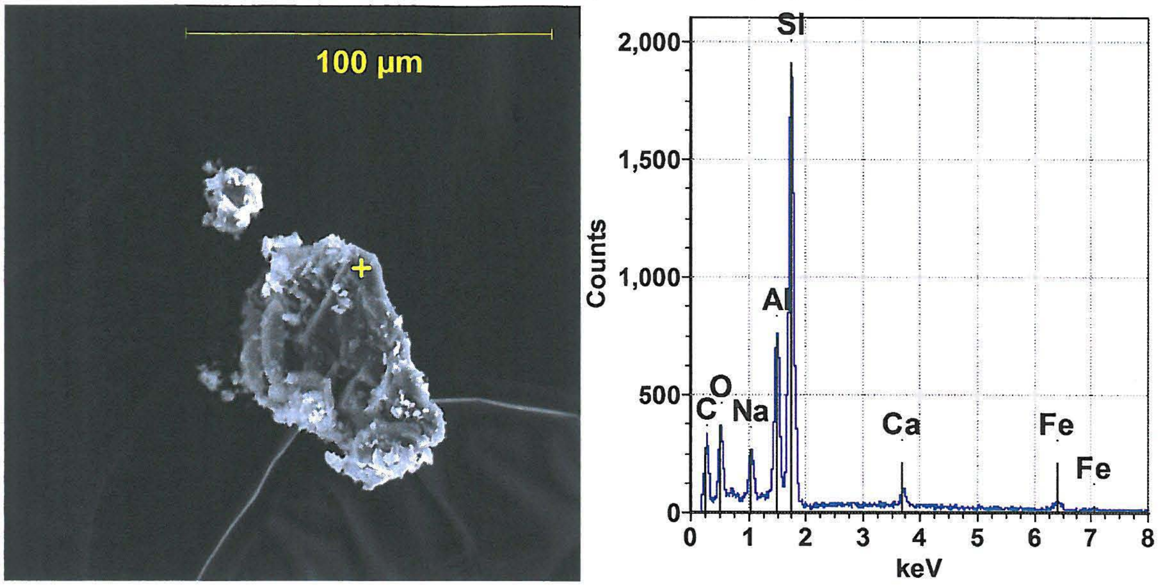


Figure 15. SEM Secondary Electron Image of Amphibole or Pyroxene, Sample 12-ANU-5A

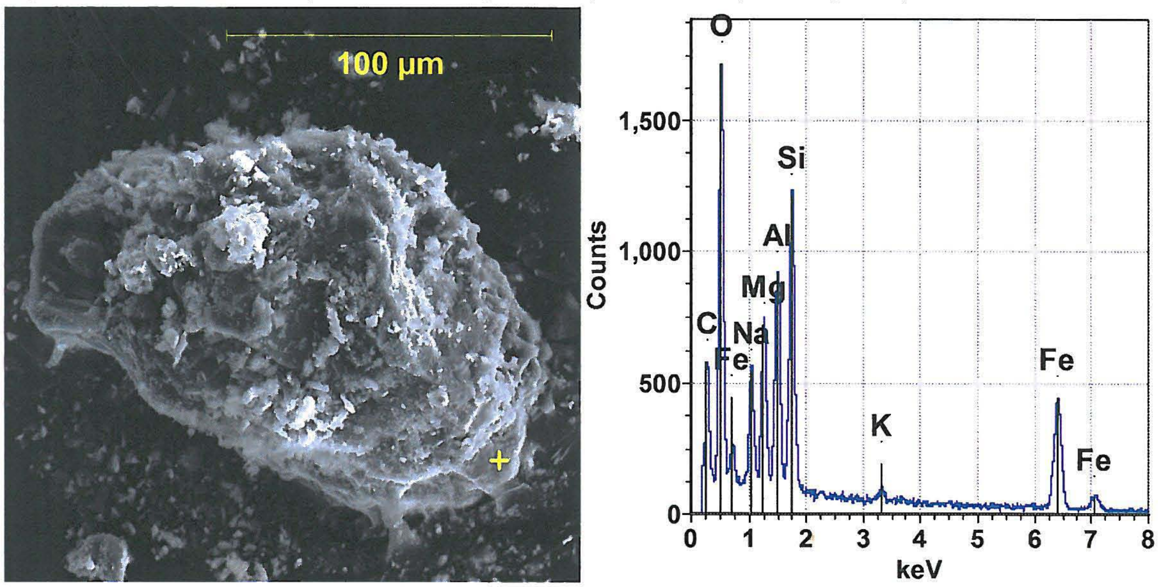


Figure 16. SEM Secondary Electron Image of Sodium-Rich Particulate, Sample 12-ANU-5A

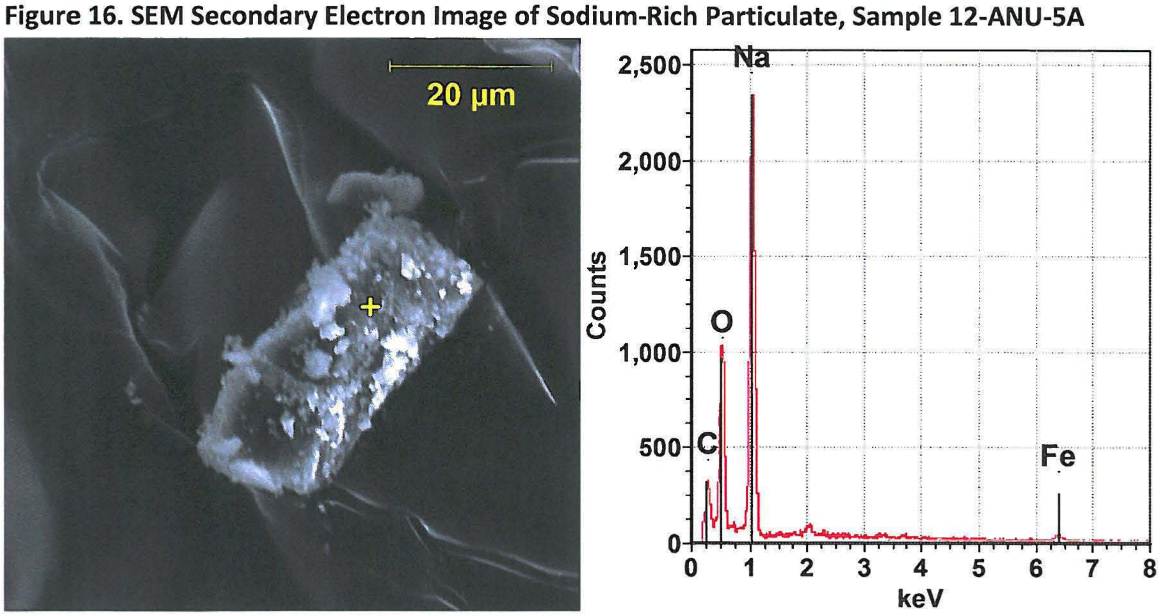
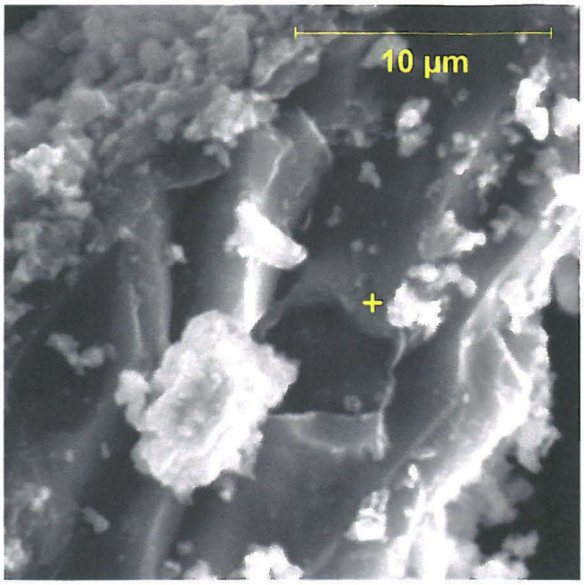
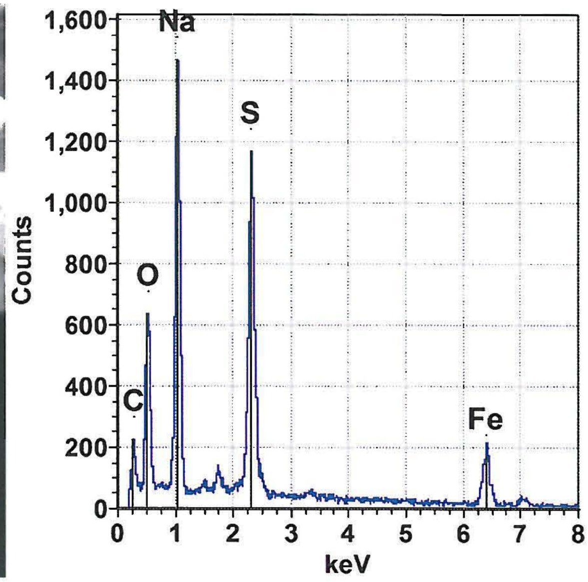


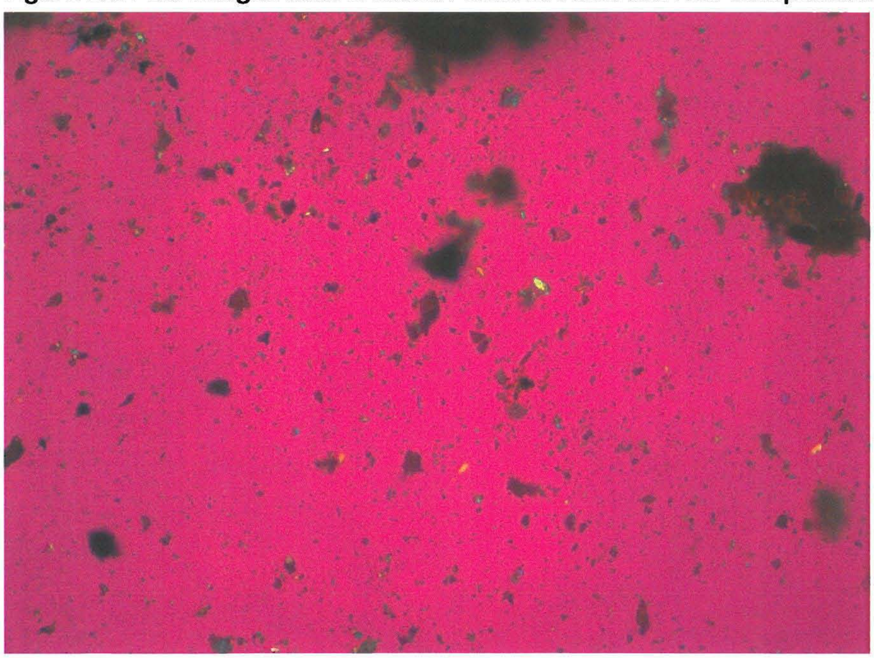
Figure 17. SEM Secondary Electron Image of Sodium Sulfate Particulate, Sample 12-ANU-5A





The PLM analysis indicated that the material was greater than 90% opaque (Figure 18). The remaining material was a fine-grained and birefringent particulate, consistent with ground soil.

Figure 18. PLM Images with Crossed Polarizers and the Red Compensation Plate, Sample 2AY-12-ANU-5A



Harlow, Donald G

From:	Harrington, Stephanie J
Sent:	Thursday, October 25, 2012 3:20 PM
To:	Rosenkrance, Chelsea L; Venetz, Theodore J; Boomer, Kayle D; Girardot, Crystal L; Washenfelder, Dennis J
Subject:	FW: 12-ANU-5A sample discussion
Attachments:	Sample12-ANU-5ASEM.doc

Please find the (pre-preliminary) AY-102 annulus sample 5A solid results attached for use in the leak assessment report.

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Cooke, Gary
Sent: Thursday, October 25, 2012 3:12 PM
To: Harrington, Stephanie J
Subject: 12-ANU-5A sample discussion

See attached.

Gary A. Cooke
gary_cooke@rl.gov **(509) 373-2154 Cell: (509) 845-3988**
Washington River Protection Solutions, contractor to the United States Department of Energy

The 2AY-12-ANU-5A weighed only 0.12 grams and was crushed in its entirety. No attempt was made to separate the rust from the few light colored fragments that were present. XRD and SEM analysis was conducted on this material, consuming nearly the entire sample. As a result of our preliminary examination, we recommended that both samples be examined

The particulate from sample 2AY-12-ANU5A was seen on the SEM to consist predominantly of rust or mill scale (Figure 1). Soil particles are the next most abundant particle type. Figures 2 through 5 show particles with chemical compositions consistent with minerals found in Hanford soil or sand. There was also a small amount of a sodium-rich phase (Figure 6), and a single particle of a sodium sulfate was also seen (Figure 7).

The XRD pattern for this sample showed no significant peaks for any crystalline phase. This suggests that the crystalline mineral material and the sodium-rich phase (if crystalline) make up less than 20 percent of the sample. The diffraction peaks from these phases would be difficult to detect in the high iron matrix of the sample. Visual estimates from the PLM and SEM sample preparations suggest that the rust/scale makes up 75 to 85 percent of the 12-ANU-5A sample

The SEM sample specimen contained no detectible beta/gamma radiation using the room monitors. The only evidence for tank waste material in this sample was the sodium-rich particulate, estimated to make up about 5% of the sample. The only source outside of tank waste that could provide a sodium rich particulate is clean caustic.

Figure 1. SEM Secondary Electron Image of Rust/Scale, Sample 12-ANU-5A

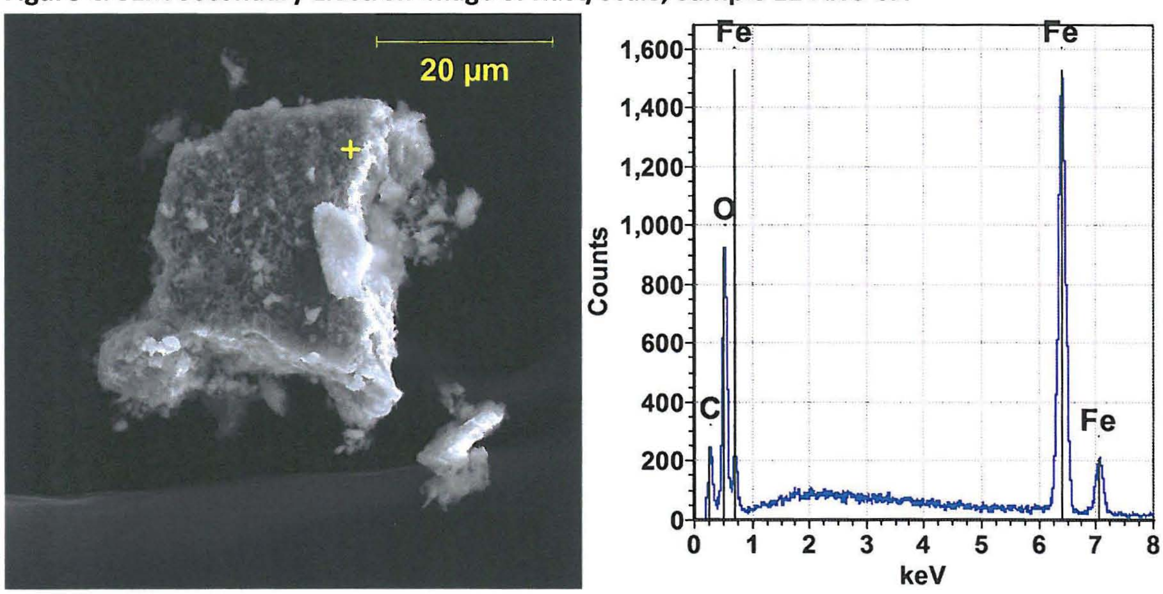


Figure 2. SEM Secondary Electron Image of Quartz, Sample 12-ANU-5A

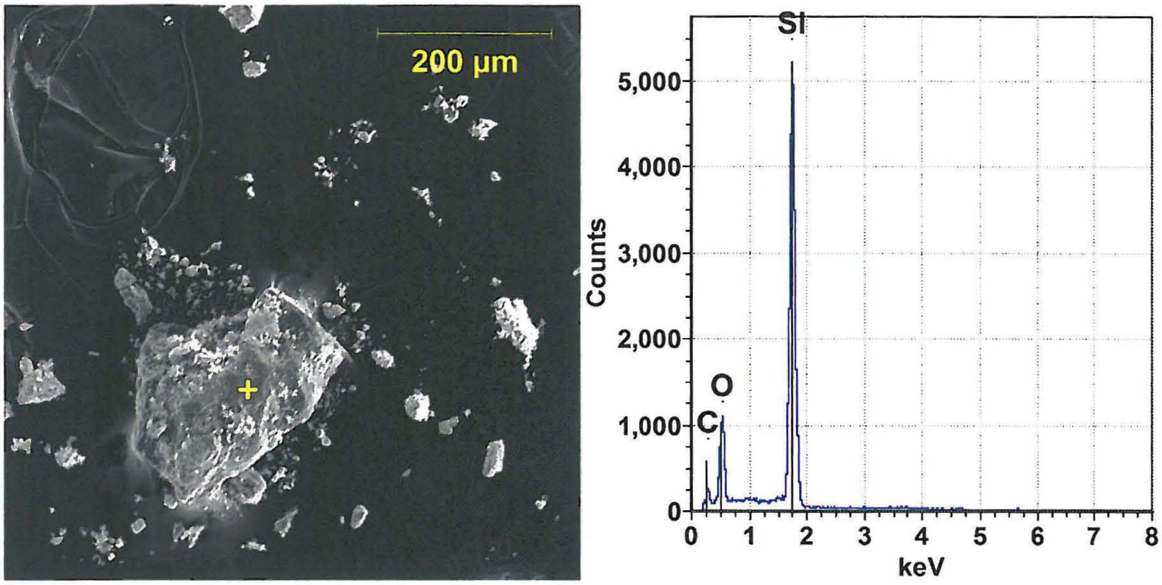


Figure 3. SEM Secondary Electron Image of Potassium Feldspar, Sample 12-ANU-5A

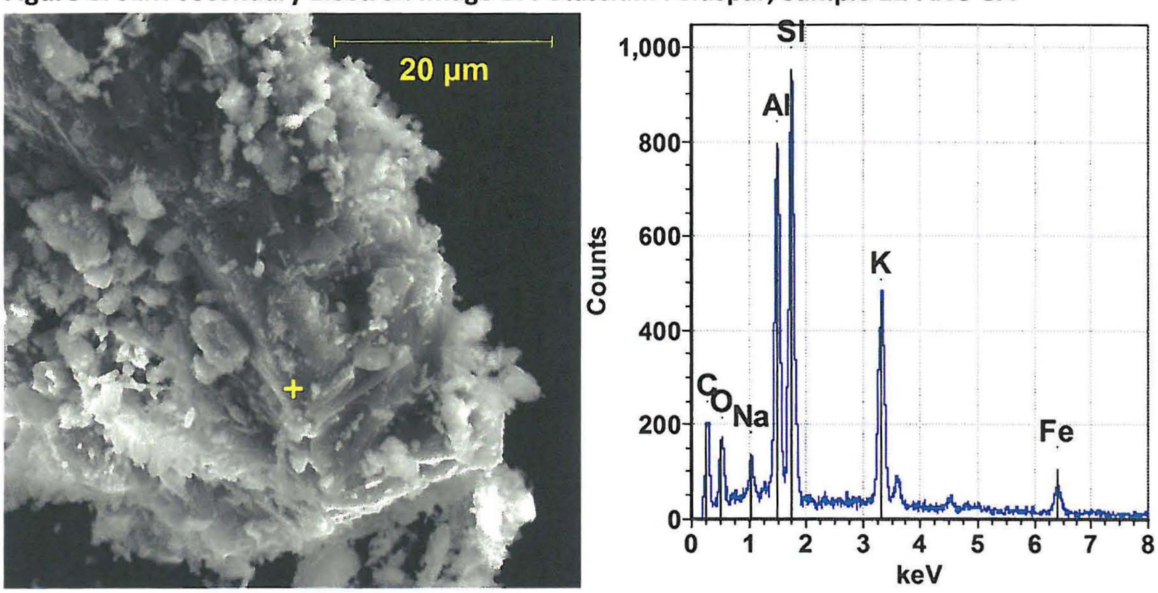


Figure 4. SEM Secondary Electron Image of Plagioclase Feldspar, Sample 12-ANU-5A

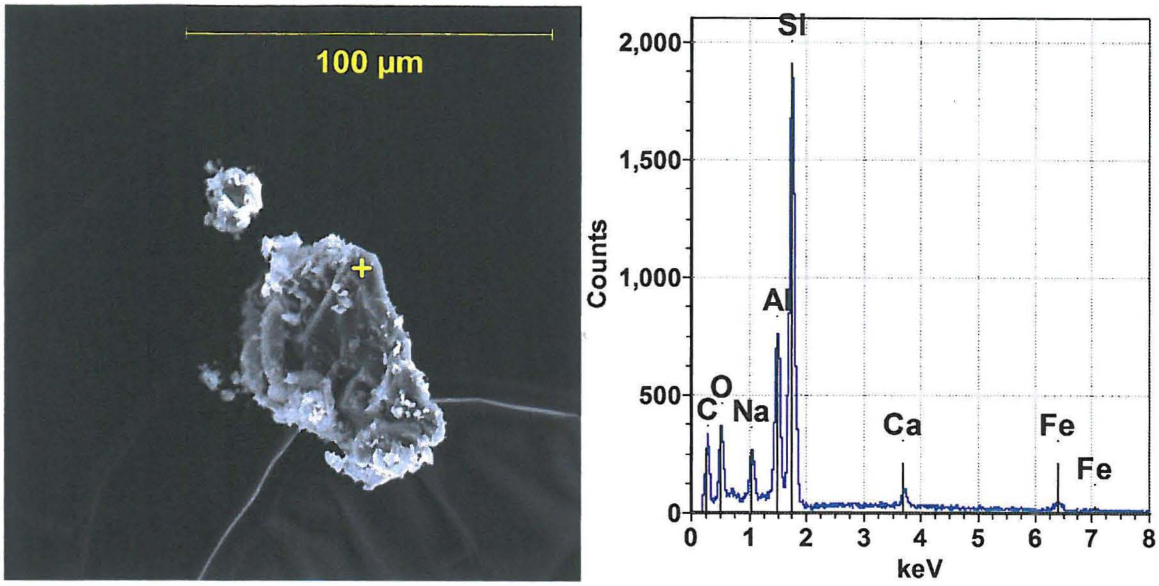


Figure 5. SEM Secondary Electron Image of Amphibole or Pyroxene, Sample 12-ANU-5A

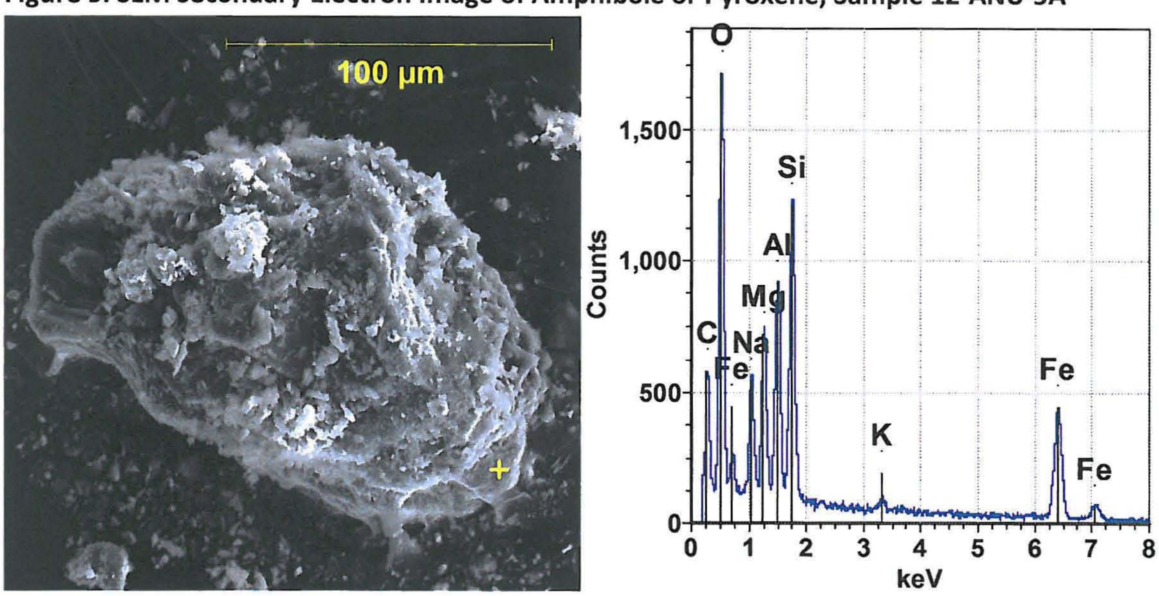


Figure 6. SEM Secondary Electron Image of Sodium-Rich Particulate, Sample 12-ANU-5A

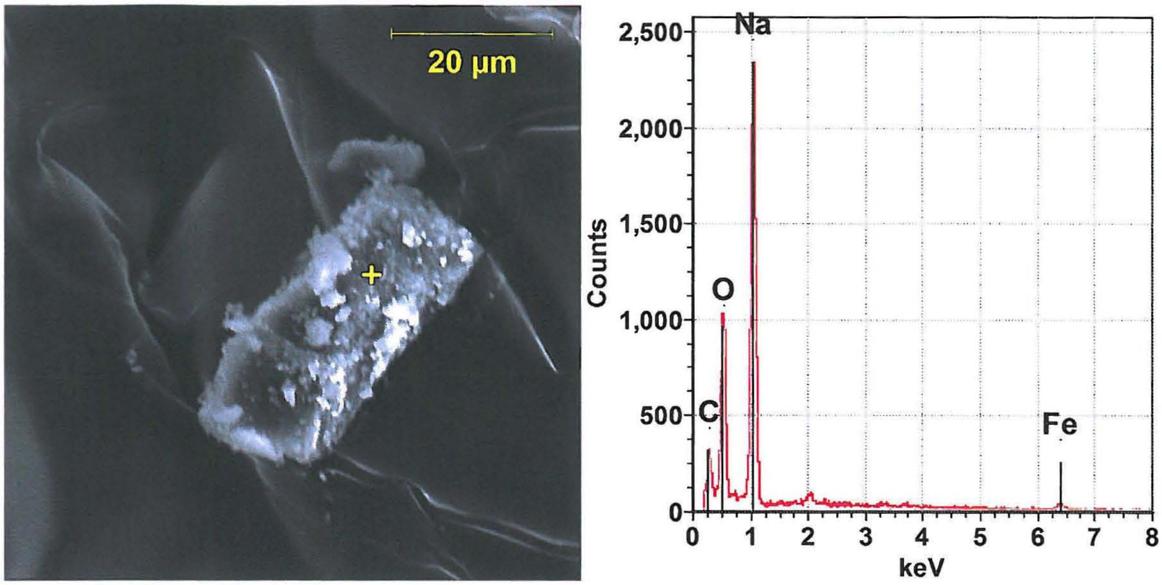
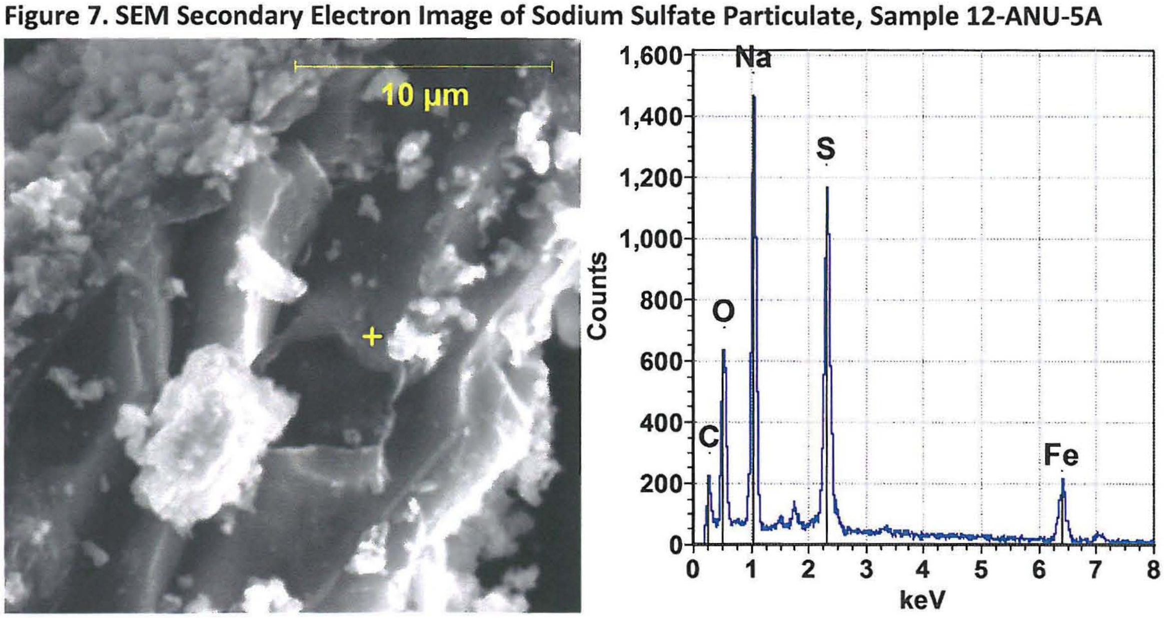


Figure 7. SEM Secondary Electron Image of Sodium Sulfate Particulate, Sample 12-ANU-5A



Venetz, Theodore J

From: Harrington, Stephanie J
Sent: Wednesday, October 24, 2012 4:11 PM
To: Rosenkrance, Chelsea L; Sams, Terry L; Washenfelder, Dennis J; Kirch, Nicholas W (Nick); Venetz, Theodore J; Boomer, Kayle D
Cc: Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Reynolds, Jacob G
Subject: FW: Interim Results for AY102 Annulus - TIC/TOC (ANU1) and ICP (ANU3A)

Importance: High

Please find the preliminary results below for the TIC/TOC analyses on the sample from near riser 83 (the floor sample) as well as the ICP metals analysis results for the second air duct sample taken on Oct. 17th near riser 90.

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

AY102 Annulus TIC-TOC 2AY-12-A...

AY102 Annulus ICP 2AY-12-ANU3A...

From: Bushaw, Ruth A
Sent: Wednesday, October 24, 2012 3:54 PM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; McKinney, Steve G; Cooke, Gary
Subject: Interim Results for AY102 Annulus - TIC/TOC (ANU1) and ICP (ANU3A)
Importance: High

Stephanie,

The attached spreadsheets provide the interim results for the TIC/TOC analysis requested for sample 2AY-12-ANU1 and the ICP results for sample 2AY-12-ANU3A.

For the TIC/TOC analysis, the spike recovery for the TIC was 207% but the amount of spike added was much less than 25% of the concentration in the sample, so no qualifier flags or reanalyses were required.

For the ICP analysis, there was no preparation standard because the digest that was requested was originally just for radchem, so no standard was prepared. Also, we forgot to run the preparation blank associated with this sample, the chemist is going to ask the technician if maybe it had been consumed with the radchem analyses and wasn't available. If it was just overlooked, I asked them to run that and rerun the sample to see if some of the instrument QC issues will not be present in the rerun.

Recall that there was also insufficient sample material to digest a duplicate sample portion or a spike. The analytical batch also contained solid samples from the recent AN101/C104 sampling event, and one of those samples was used for the sample QC. I'm reluctant to include that QC with this report because the sample matrix isn't quite the same.

As I stated in my previous email with ICP results, the digest methods that we have available at 222-S lab are not appropriate for digesting silicon. Therefore, it's likely that the LCS and spike recovery, if prepared for this sample, might have failed low, as they did with the SW846 Method 3050B prep that was used to digest the previous AY102 Annulus sample. I will discuss in the narrative that the silicon result might not be very accurate. Note that silicon was detected in the instrument blanks. For two of the blanks, the silicon was > EQL and >5% of the sample result, so I added a "B" flag. Since these were instrument blanks, I'm expecting that the reanalysis might be better. Silicon also failed high on the low level standard (LLS). Since the result in the sample was at approximately the same level as the LLS, this could indicate a high bias. This failure does not require a reanalysis, but since we are going to rerun anyway, the LLS might meet the requirement on the rerun.

Remember that these results have not been fully reviewed and may change, especially since we plan to rerun the ICP.

Thanks,

Ruth A. Bushaw
Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
222-S Laboratory
office: 509-373-4314
cell: 509-554-4978

24-oct-2012 15:15:09
INTERIM
AY102 Annulus
Data Summary of All Results

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7429-90-5	Aluminum	ug/g	99.0	<6.00E-03	982	n/a	n/a	n/a	n/a	27.8	n/a	
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-70-2	Calcium	ug/g	100	<0.0800	<370	n/a	n/a	n/a	n/a	370	n/a	U
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-47-3	Chromium	ug/g	98.7	<1.00E-03	133	n/a	n/a	n/a	n/a	4.63	n/a	
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7439-89-6	Iron	ug/g	100	<0.0100	54.7	n/a	n/a	n/a	n/a	46.3	n/a	J
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-09-7	Potassium	ug/g	99.0	<0.0200	7.15E+03	n/a	n/a	n/a	n/a	92.6	n/a	
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7439-95-4	Magnesium	ug/g	98.4	<2.00E-03	<9.26	n/a	n/a	n/a	n/a	9.26	n/a	U
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-23-5	Sodium	ug/g	97.9	<0.0400	3.75E+05	n/a	n/a	n/a	n/a	185	n/a	
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-02-0	Nickel	ug/g	101	<1.00E-03	<4.63	n/a	n/a	n/a	n/a	4.63	n/a	U
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7723-14-0	Phosphorus	ug/g	101	<3.00E-03	3.34E+04	n/a	n/a	n/a	n/a	13.9	n/a	
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7704-34-9	Sulfur	ug/g	104	<5.00E-03	858	n/a	n/a	n/a	n/a	23.1	n/a	
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-21-3	Silicon	ug/g	108	0.0662	509	n/a	n/a	n/a	n/a	23.1	n/a	B
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-62-2	Vanadium	ug/g	99.3	<1.00E-03	19.3	n/a	n/a	n/a	n/a	4.63	n/a	J
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	7440-33-7	Tungsten	ug/g	95.9	<6.00E-03	96.3	n/a	n/a	n/a	n/a	27.8	n/a	J

NA = Not Analyzed, ND = Not Detected

J - Estimated

a - LCS Outside Range

U - Less Than Detection Limit

Harlow, Donald G

From: Harrington, Stephanie J
Sent: Wednesday, October 24, 2012 9:17 AM
To: Rosenkrance, Chelsea L
Subject: RE: Riser 90 sample pictures from 10/15
Attachments: 2AY-12-ANU3 Open.jpg; 2AY-12-ANU5 Open.jpg

Chelsea,

These are the photos taken in the hotcell of the samples taken on the 15th. Most of the material in the images is rust (dark material), with some white material visible in sample 5. There was very little sample recovery on the 15th.

Hope this helps.

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Rosenkrance, Chelsea L
Sent: Wednesday, October 24, 2012 9:11 AM
To: Harrington, Stephanie J
Cc: Venetz, Theodore J
Subject: Riser 90 sample pictures from 10/15

Stephanie,

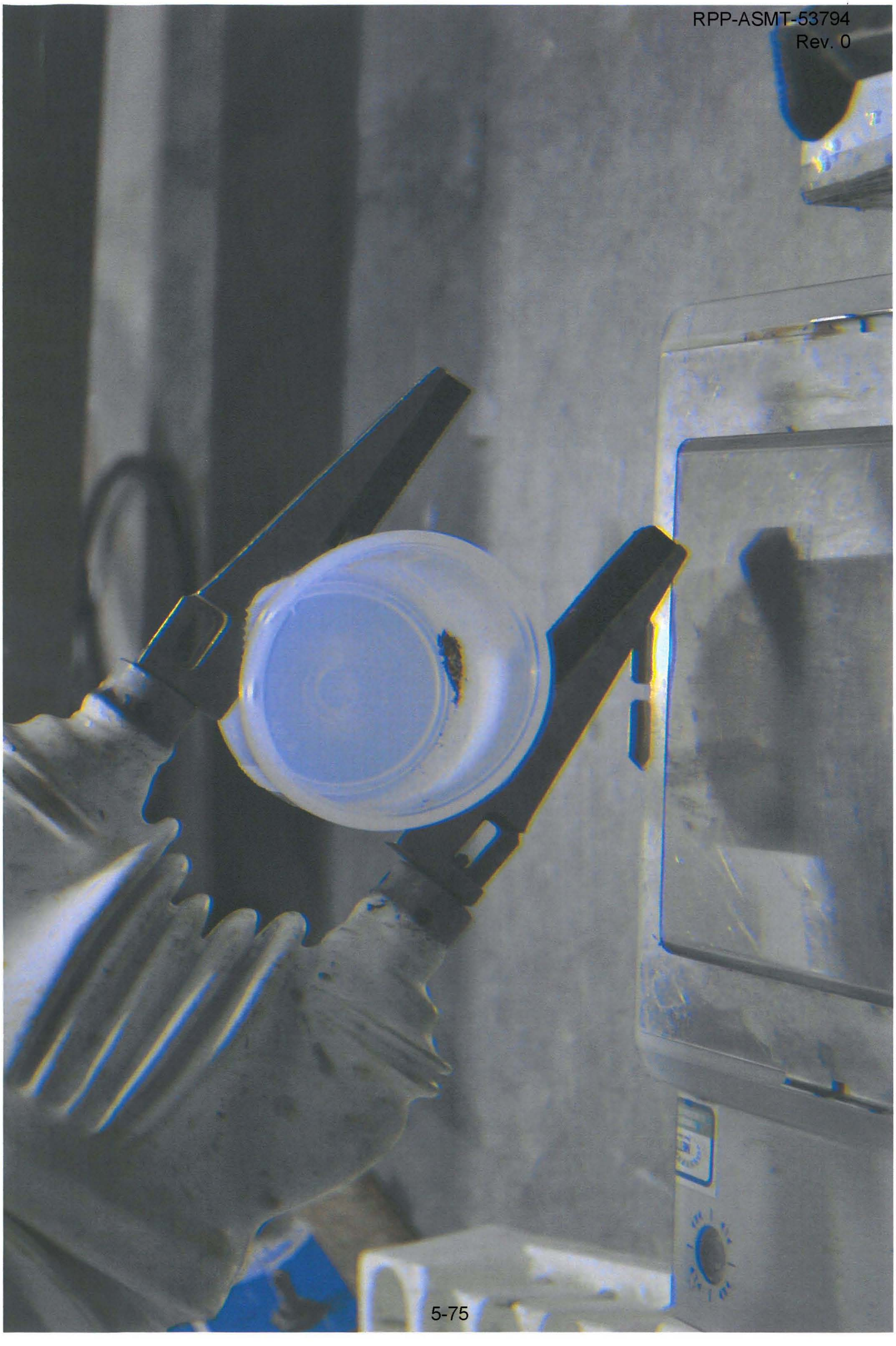
Do you have any pictures of the samples taken on 10/15? I was going to include them in the sample analysis in the leak assessment report.

Thanks,

Chelsea

Chelsea Rosenkrance
Phone: (509) 373-0098
Email: Chelsea_L_Rosenkrance@rl.gov

washington river protection solutions
Washington River Protection Solutions is a
Contractor to the United States Department of Energy



Harlow, Donald G

From: Venetz, Theodore J
Sent: Monday, October 22, 2012 9:58 AM
To: Rosenkrance, Chelsea L; Boomer, Kayle D
Subject: FW: Photographs of samples 3A and 5A in the hotcells
Attachments: 2AY-12-ANU5A open.jpg; 2AY-12-ANU3A open.jpg

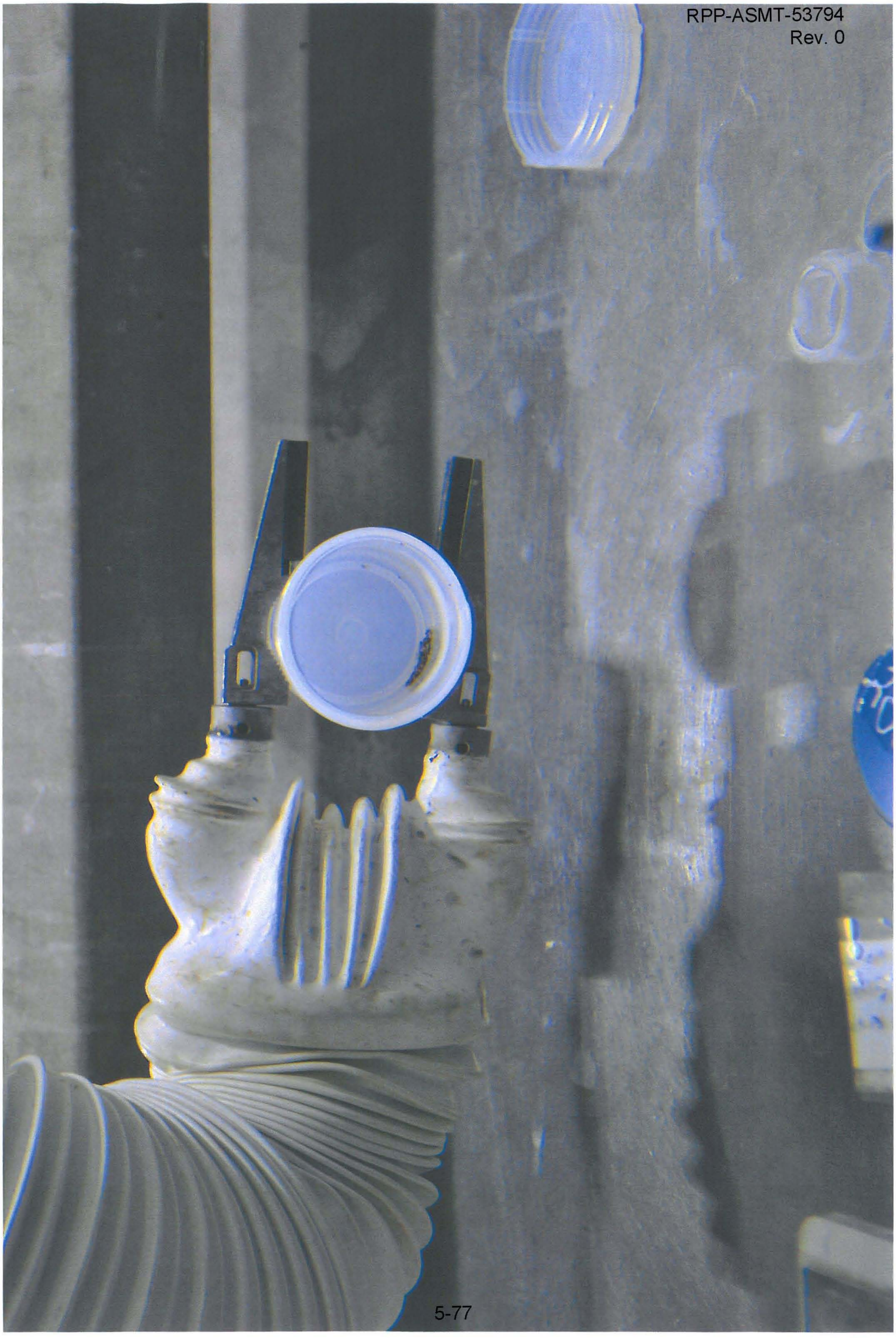
From: Harrington, Stephanie J
Sent: Monday, October 22, 2012 7:36 AM
To: Venetz, Theodore J
Subject: Photographs of samples 3A and 5A in the hotcells

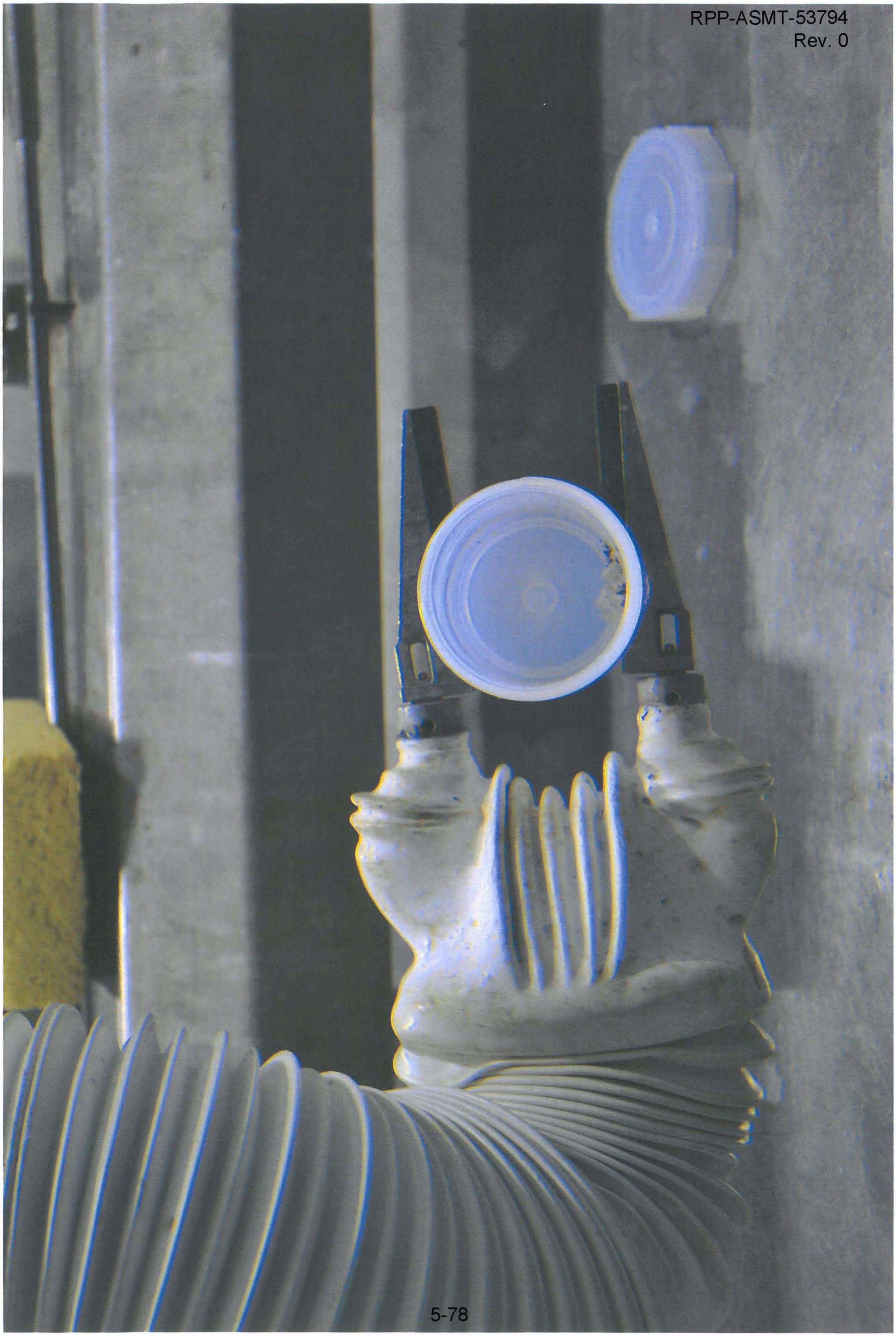
Ted,

Hope this does not put you in e-mail jail...

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336





Harlow, Donald G

From:	Harrington, Stephanie J
Sent:	Friday, October 19, 2012 10:29 AM
To:	Rosenkrance, Chelsea L; Sams, Terry L; Washenfelder, Dennis J; Kirch, Nicholas W (Nick); Venetz, Theodore J
Cc:	Rasmussen, Juergen H; Nguyen, Duc M; Templeton, Andrew M; Reynolds, Jacob G
Subject:	Cs-137 analytical results for AY-102 annulus sample 3A (air slot)
Attachments:	AY102 Annulus Cs-137 2AY-12-ANU3A.xls; AY102 Annulus Interim GEA and Sr90 Results.xlsx

Please find the results fresh from the laboratory for the Cs-137 analysis on the white material from the air slot (AY102 Annulus Cs-137 2AY-12-ANU3A.xls file). It is about half of the concentration measured from the floor on the other side of the tank (see AY102 Annulus Interim GEA and Sr90 Results.xlsx). We have some material remaining following GEA and Sr-90 analyses (which is currently being performed). I believe the plan will be to use this in an ICP analysis for sample 3A. I will keep you updated as new results are provided. If you do not want the updated preliminary laboratory data as it trickles in, please let me know.

Thank you,

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Ritenour, Gerald P
Sent: Friday, October 19, 2012 10:16 AM
To: Harrington, Stephanie J
Cc: McKinney, Steve G; Bushaw, Ruth A; Bushaw, Thomas H
Subject:

Stephanie,
The attached spreadsheet contains the preliminary result for the GEA of sample 2AY-12-ANU3A. During the digestion the sample effervesced very strongly indicating carbonate content. If you have any questions or need additional information please feel free to contact me at anytime.
JR

Gerald "JR" Ritenour
Project Manager
ATL Analytical Operations
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
(509) 372-2742 office
(509) 438-8837 cell
gerald_p_ritenour@rl.gov

INTERIM

AY102 Annulus

Data Summary Report

Riser	Segment Numb	Segment Portio	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNI	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
90	2AY-12-ANU:	Grab Sample (1	S12T021347	E	10045-97-3	Cesium-137	uCi/g	104	<0.0587	42.1	n/a	n/a	n/a	n/a	0.0531	0.22	

NA = Not Analyzed, ND = Not Detected

05-oct-2012 10:52:29
INTERIM
AY102 Annulus
Data Summary of All Results

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	10198-40-0	Cobalt-60	uCi/g	98.5	<0.0161	<0.0194	<0.0107	n/a	n/a	n/a	0.0194	n/a	U
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	10045-97-3	Cesium-137	uCi/g	104	<0.0192	92.7	89.2	90.9	3.89	n/a	0.0951	0.21	
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	14331-83-0	Actinium-228	uCi/g	n/a	<0.0637	0.0618	<0.0433	n/a	n/a	n/a	0.0567	30.34	J
83	2AY-12-ANU1	Grab Sample (Total)	S12T021142	F	SR-89/90	Strontium-89/90	uCi/g	104	<4.75E-03	0.105	0.135	0.120	24.7	n/a	4.76E-03	12.902	

NA = Not Analyzed, ND = Not Detected
U - Less Than Detection Limit

Harlow, Donald G

From:	Harrington, Stephanie J
Sent:	Monday, October 22, 2012 2:06 PM
To:	Kirch, Nicholas W (Nick); Sams, Terry L; Boomer, Kayle D; Powell, William J (Bill); Venetz, Theodore J; Rosenkrance, Chelsea L
Cc:	Nguyen, Duc M; Rasmussen, Juergen H; Templeton, Andrew M; Reynolds, Jacob G
Subject:	FW: Interim Results for AY102 Annulus Sample 2AY-12-ANU3A
Attachments:	AY102 Annulus Cs-137 2AY-12-ANU3A.xls; AY102 Annulus Sr-90 2AY-12-ANU3A.xlsx
Importance:	High

Update from the laboratory and preliminary Cs-137 and Sr-90 results for sample 3A (air duct).

Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Bushaw, Ruth A
Sent: Monday, October 22, 2012 12:51 PM
To: Harrington, Stephanie J
Cc: Bushaw, Thomas H; McKinney, Steve G; Cooke, Gary
Subject: Interim Results for AY102 Annulus Sample 2AY-12-ANU3A
Importance: High

Stephanie,

CCN 12-CCN-31 for AY102 Annulus sample 2AY-12-ANU3A requests Sr-90 and Cs-137 results within 2 business days of issue (10/18/2012), which is today. The GEA Cs-137 result was already provided on Friday, 10/19/2012, but I included it again in this message that adds the Sr-90 result.

The TIC/TOC rerun for 2AY-12-ANU1 and the ICP analysis for 2AY-12-ANU3A are being run today.

If you have any question about the attached results, please feel free to contact me.

Thanks,

Ruth A. Bushaw
Project Coordinator
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy 222-S Laboratory
373-4314

From: Ritenour, Gerald P
Sent: Friday, October 19, 2012 10:16 AM
To: Harrington, Stephanie J

Cc: McKinney, Steve G; Bushaw, Ruth A; Bushaw, Thomas H
Subject:

Stephanie,
The attached spreadsheet contains the preliminary result for the GEA of sample 2AY-12-ANU3A. During the digestion the sample effervesced very strongly indicating carbonate content. If you have any questions or need additional information please feel free to contact me at anytime.
JR

Gerald "JR" Ritenour
Project Manager
ATL Analytical Operations
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Contractor to the Office of River Protection
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gerald_p_ritenour@rl.gov

19-oct-2012 10:09:36 Page: 1 DSRSpreadsh DSR.Jar v. 2.7.27

INTERIM

AY102 Annulus

Data Summary Report

Riser	Segment Numb	Segment Portic	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNI	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
90	2AY-12-ANU3	Grab Sample ('	S12T021347	E	10045-97-3	Cesium-137	uCi/g	104	<0.0587	42.1	n/a	n/a	n/a	n/a	0.0531	0.22	

NA = Not Analyzed, ND = Not Detected

22-oct-2012 12:44:40
INTERIM
AY102 Annulus
Data Summary Report

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
90	2AY-12-ANU3A	Grab Sample (Total)	S12T021347	E	SR-89/90	Strontium-89/90	uCi/g	99.7	n/a	6.88	n/a	n/a	n/a	n/a	4.11E-03	1.275	

NA = Not Analyzed, ND = Not Detected

Harlow, Donald G

From: Harrington, Stephanie J
Sent: Thursday, October 18, 2012 4:20 PM
To: Venetz, Theodore J; Boomer, Kayle D; Washenfelder, Dennis J; Rosenkrance, Chelsea L
Cc: Reynolds, Jacob G; Nguyen, Duc M; Templeton, Andrew M; Rasmussen, Juergen H
Subject: FW: Status of AY-102 samples received at 222-S 10-17-2012

Preliminary results for the samples taken yesterday are described below...

Thank you,
Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Cooke, Gary
Sent: Thursday, October 18, 2012 3:59 PM
To: McKinney, Steve G; Harrington, Stephanie J; Sams, Terry L; Prilucik, John R; Seidel, Cary M; Hardy, Don B; Bushaw, Ruth A
Cc: Pestovich, John A; Page, Jason S; Rice, Andrew D; Huber, Heinz J
Subject: Status of AY-102 samples received at 222-S 10-17-2012

All,

We have completed an SEM and XRD examination of two samples received at the 222-S Laboratory on 10/17/2012.

The samples, identified as 2AY-12-ANU3A, 2AY-12-ANU5A were examined in the 11-A Hot Cells, photographed, weighed, transferred to glass jars and transferred to the CA portion of the lab. The samples were again photographed in the lab prior to analysis.

The 2AY-12-ANU3A sample consisted of pieces of rust and large (up to ½") white pieces that appeared to be aggregates of finer material. The white pieces were separated and crushed. XRD and SEM splits were removed from this crushed material. The remaining ground white material was placed in a pre-weighed 60 ml plastic bottle and given to ATL personnel for GEA analysis. Approximately 0.1 gram was available for this analysis.

The 2AY-12-ANU5A was crushed in its entirety. No attempt was made to separate the rust from the few light colored fragments that were present. XRD and SEM analysis was conducted on this material, consuming nearly the entire sample.

The white particulate from sample 2AY-12-ANU3A consists entirely of water soluble salts that are consistent with tank waste saltcake or supernatant dissolved solids. However, there are some notable differences between this material and the previous tank waste material that has been retrieved from the AY-102 annulus. These are being investigated further.

The particulate from sample 2AY-12-ANU5A was seen on the SEM to consist of a mixture of rust and soil with a small amount of a sodium-rich phase. The XRD pattern for this sample showed no significant peaks for any crystalline phase. The SEM sample specimen contained no detectible beta/gamma radiation using the room monitors. The only evidence for tank waste material in this sample was the sodium-rich particulate. The only source outside of tank waste that could provide a sodium rich particulate is clean caustic.

We recommend that Polarized Light Microscopy should be performed on these samples. It will aid in interpreting the XRD and SEM results. We have enough material left over from the SEM and XRD sample preparation to provide the small amount of material required for PLM analysis.

We will provide additional details on the XRD and SEM analysis tomorrow.

Gary A. Cooke

gary_cooke@rl.gov (509) 373-2154 Cell: (509) 845-3988

Washington River Protection Solutions, contractor to the United States Department of Energy

Harlow, Donald G

From: Harrington, Stephanie J
Sent: Wednesday, October 17, 2012 9:38 PM
To: Johnson, Jo M; Cooke, Gary; Bushaw, Ruth A; McKinney, Steve G; Prilucik, John R
Cc: Sams, Terry L; Rasmussen, Juergen H; Rosenkrance, Chelsea L
Subject: RE: AY-102 Annulus Sample Analysis

So, as most of you know we only got 0.12 grams of material from the mound (sample 5A) and 0.2 grams from the air slot (sample 3A). I was told that we needed at least 0.5 (+/- 0.1) grams for radiochemistry (Cs-137 and Sr-90). Since there is not enough material for that, I believe that the solid phase characterization (SEM, PLM, and XRD) is the best bet to get good results with the material we have. I am putting together a CCN to this effect, and will bring it around tomorrow morning for signatures.

Thank you,
Stephanie Harrington, PhD
Chemical Process Engineer
Washington River Protection Solutions,
contractor to the United States Department of Energy

2750E Room A219 or 639 Cullum B119
(509) 376-1336

From: Johnson, Jo M
Sent: Wednesday, October 17, 2012 3:48 PM
To: Johnson, Jo M; Hansen, Daniel R; Bushaw, Thomas H; Schroeder, Robert W; Akita, Raymond (Ray); Rice, Andrew D; Bushaw, Ruth A; Duchsherer, Mark J; Purcell, Michael A; Menjivar, Carolina S; Osborn, Julie A; Ritenour, Gerald P; Greenough, Keith J Jr; Seidel, Cary M; Keltner, Katherine A; Templeton, Andrew M; Nguyen, Duc M; Steele, Richard T; Soto, Edward; McKinney, Steve G; Cooke, Gary; Lucas, Daniel R (Dan); McColloch, Todd A
Cc: Sosa, Robert W; Fuller, Richard K (Keith); Hardy, Don B; Renberger, Duane L; Kimmel, Thomas S; George, Thomas E; Prilucik, John R; Frazier, Jason E; Sondag, Joseph M; Bamberger, Michael G; Cheadle, Jeffry E; McKinney, Steve G; Sams, Terry L; Brannan, Patrick B (Brad); Harrington, Stephanie J
Subject: FW: AY-102 Annulus Sample Analysis
Importance: High

The samples are expected to be to the lab around 6PM tonight. Tom Craft is the FWS. Thanks.

Jo Marie Johnson
Project Coordinator/Acting Manager-Sample Management Office (222-S Laboratory)
RJ Lee Group, Inc.
subcontractor to Washington River Protection Solutions
contractor to the United States Department of Energy
Phone: (509) 372-9474
Fax:(509) 372-1878

From: Johnson, Jo M
Sent: Wednesday, October 17, 2012 2:50 PM
To: Johnson, Jo M; Hansen, Daniel R; Bushaw, Thomas H; Schroeder, Robert W; Akita, Raymond (Ray); Rice, Andrew D; Bushaw, Ruth A; Duchsherer, Mark J; Purcell, Michael A; Menjivar, Carolina S; Osborn, Julie A; Ritenour, Gerald P; Greenough, Keith J Jr; Seidel, Cary M; Keltner, Katherine A; Templeton, Andrew M; Nguyen, Duc M; Steele, Richard T; Soto, Edward; McKinney, Steve G; Cooke, Gary; Lucas, Daniel R (Dan)
Cc: Sosa, Robert W; Fuller, Richard K (Keith); Hardy, Don B; Renberger, Duane L; Kimmel, Thomas S; George, Thomas E; Prilucik, John R; Frazier, Jason E; Sondag, Joseph M; Bamberger, Michael G; Cheadle, Jeffry E; McKinney, Steve G;

Sams, Terry L; Brannan, Patrick B (Brad); Harrington, Stephanie J
Subject: FW: AY-102 Annulus Sample Analysis
Importance: High

AY-102 sampling is complete for today, and the samples will be delivered tonight on swings. Thanks.

Jo Marie Johnson
Project Coordinator/Acting Manager-Sample Management Office (222-S Laboratory)
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From: Johnson, Jo M
Sent: Wednesday, October 17, 2012 12:07 PM
To: Johnson, Jo M; Hansen, Daniel R; Bushaw, Thomas H; Schroeder, Robert W; Akita, Raymond (Ray); Rice, Andrew D; Bushaw, Ruth A; Duchsherer, Mark J; Purcell, Michael A; Menjivar, Carolina S; Osborn, Julie A; Ritenour, Gerald P; Greenough, Keith J Jr; Seidel, Cary M; Keltner, Katherine A; Templeton, Andrew M; Nguyen, Duc M; Steele, Richard T; Soto, Edward; McKinney, Steve G; Cooke, Gary; Lucas, Daniel R (Dan)
Cc: Sosa, Robert W; Fuller, Richard K (Keith); Hardy, Don B; Renberger, Duane L; Kimmel, Thomas S; George, Thomas E; Prilucik, John R; Frazier, Jason E; Sondag, Joseph M; Bamberger, Michael G; Cheadle, Jeffry E; McKinney, Steve G; Sams, Terry L; Brannan, Patrick B (Brad); Harrington, Stephanie J
Subject: FW: AY-102 Annulus Sample Analysis
Importance: High

Sampling for AY-102 is expected to continue throughout the afternoon, and the current plan is to ship on swing shift tonight-10/17. Process Engineering has requested that sample breakdown be scheduled for tonight as well, so that the sample(s) are ready for analysis ASAP. Thanks.

Jo Marie Johnson
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6.0 Preliminary Leak Detection Pit Sample Results for RPP-ASMT-53793, Section 4.3.5, Leak Detection Pit Sample Results

6.1 Leak Detection Pit September 2012 Samples

From: Nguyen, Duc M
Sent: Wednesday, September 12, 2012 10:20 AM
To: Kirch, Nicholas W (Nick); Powell, William J (Bill); Reynolds, Jacob G; Jo, Jaiduk; Uytioco, Elise M; Rasmussen, Juergen H; Sams, Terry L; Boomer, Kayle D; Venetz, Theodore J
Cc: Prilucik, John R; Ritenour, Gerald P; Strasser, David W; Shultz, M V Jr (Milt)
Subject: RE: AY102A LDP 3-Day Format II Interim Rpt

Importance: High

All,

The lab re-measured pH for the field blank and samples and the new results are consistent with the results from the first round. QC results were good. Ion chromatography results indicate that the anomaly was not due to an acid residue (HNO3 or HCl) from the sample bottle cleaning. So what we have is a field blank pH result that indicates there is an unknown contaminant that is affecting (lowering) the pH of the field blank and, therefore, could be affecting (lowering) the pH of the LDP liquid samples. The lab verbally indicates that the sample pH results should be used as lower bounds for the actual pH of the liquid in the leak detection pit. They will send us an email summarizing what they found along with the usage recommendation.

Thanks,
Duc M. Nguyen
Washington River Protection Solutions LLC
Contractor to the United States Department of Energy
(509) 372-3042

From: Kirch, Nicholas W (Nick)
Sent: Tuesday, September 11, 2012 2:28 PM
To: Rasmussen, Juergen H; Sams, Terry L
Cc: Powell, William J (Bill); Nguyen, Duc M; Reynolds, Jacob G; Jo, Jaiduk; Uytioco, Elise M
Subject: RE: AY102A LDP 3-Day Format II Interim Rpt

A quick comparison of these results to the December 2007:

The Cs-137 is lower by an order of magnitude, the Sr-90 is lower by about half. pH is just below 7

Analyte	2007 Result	2012 Result
Cs-137	Between 3.3 and 6.3 (10-4) uCi/ml	Between 2.2 and 2.4 (10-5) uCi/ml
Sr-90	Between 5.5 and 5.6 (10-3) uCi/ml	Between 2.2 and 2.3 (10-3) uCi/ml
pH	Between 7.9 and 8.1	Between 6.6 and 6.9

The field blank pH was below 4, which is a bit of a head scratcher.

The plan is to transfer this to AY-101. We will need Milt Shultz as CSR to approve it since it is less than pH 7.

Nick Kirch, Manager

Base Operations Process Engineering
Washington River Protection Solutions
Contractor to the US Department of Energy
phone (509) 373-2380
cell (509) 438-9537

From: Rasmussen, Juergen H
Sent: Tuesday, September 11, 2012 1:54 PM
To: Kirch, Nicholas W (Nick); Sams, Terry L
Cc: Powell, William J (Bill); Nguyen, Duc M; Reynolds, Jacob G
Subject: FW: AY102A LDP 3-Day Format II Interim Rpt

Nick,

Here is the 3-day early report for the AY-102 leak detection pit samples. Being preliminary results, the values are subject to change when the data are reviewed and formally reported. The very low Cs-137 values are consistent with slightly contaminated rainwater. The lab is investigating the low pH of the field blank. This might possibly indicate an issue with the bottle cleaning procedure or the water used for the field blank.

Thanks--

Juergen Rasmussen
Washington River Protection Solutions,
contractor to the United States Department of Energy

From: Ritenour, Gerald P
Sent: Tuesday, September 11, 2012 1:20 PM
To: Rasmussen, Juergen H
Subject: FW: AY102A LDP 3-Day Format II Interim Rpt

Gerald "JR" Ritenour
Project Manager
ATL Analytical Operations
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy
(509) 372-2742 office
(509) 438-8837 cell
gerald_p_ritenour@rl.gov

From: Ritenour, Gerald P
Sent: Monday, September 10, 2012 1:41 PM
To: Nguyen, Duc M
Cc: McKinney, Steve G; Bushaw, Thomas H; Johnson, Jo M
Subject: AY102A LDP 3-Day Format II Interim Rpt

Duc,

The attached spreadsheet is the Format II Interim report for AY102A LDP samples. I have also included the Sr 89/90 results. If you have any question or need additional information please let me know.
JR

Gerald "JR" Ritenour
Project Manager
ATL Analytical Operations
Advanced Technologies and Laboratories International, Inc.
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(509) 438-8837 cell
gerald_p_ritenour@rl.gov

From: Nguyen, Duc M
Sent: Tuesday, October 02, 2012 10:29 AM
To: Sams, Terry L; Venetz, Theodore J; Boomer, Kayle D; Reynolds, Jacob G; Kirch, Nicholas W (Nick); Uytioco, Elise M; Harrington, Stephanie J; Rasmussen, Juergen H; Washenfelder, Dennis J; Tardiff, Gary R
Subject: FW: AY102A LDP 14-Day Format II Interim Rpt
Attachments: AY102A-LDP Format II 14-Day Rpt.xls

Attached is the second round of interim results on the AY-102 LDP samples. These data confirm that the liquid in the LDP is just slightly contaminated water.

Thanks,
Duc M. Nguyen
Washington River Protection Solutions LLC
Contractor to the United States Department of Energy
(509) 372-3042

From: Ritenour, Gerald P
Sent: Monday, October 01, 2012 10:18 AM
To: Ritenour, Gerald P; Nguyen, Duc M
Cc: McKinney, Steve G; Bushaw, Thomas H; Johnson, Jo M
Subject: RE: AY102A LDP 14-Day Format II Interim Rpt

Duc,
The attached spreadsheet is the 14 Day Format II Interim report for AY102A LDP samples. Results should be consider preliminary and are subject to change upon further review. If you have any questions or need additional information please let me know.
JR

Gerald "JR" Ritenour
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01-oct-2012 10:01:15 Page: 1 DSRSpr DSR.Jar v. 2.7.27
INTERIM
AY102A-LDP
Data Summary Report

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT _UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	<1.61E-03	n/a	n/a	105	1.61E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	<9.37E-03	n/a	n/a	105	9.37E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	<6.04E-03	n/a	n/a	103	6.04E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	<4.67E-03	n/a	n/a	98.7	4.67E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	0.0900	0.0890	0.0895	1.12	103	9.98E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	<0.0192	n/a	n/a	98.4	0.0192	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14808-79-8	Sulfate	ug/mL	96.5	<0.0187	0.204	0.217	0.210	6.18	94.7	0.0187	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		338-70-5	Oxalate	ug/mL	95.6	<0.0231	<0.0231	<0.0231	n/a	n/a	90.7	0.0231	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	<0.0580	n/a	n/a	84.2	0.0580	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14797-55-8	Nitrate	ug/mL	92.4	<0.0208	1.91	1.91	1.91	0.262	97.6	0.0208	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14265-44-2	Phosphate	ug/mL	90.6	<0.0167	<0.0167	<0.0167	n/a	n/a	91.7	0.0167	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-22-4	Silver	ug/mL	101	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7429-90-5	Aluminum	ug/mL	99.1	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-38-2	Arsenic	ug/mL	100	<5.00E-03	<5.00E-03	n/a	n/a	n/a	n/a	5.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-41-7	Beryllium	ug/mL	97.8	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-69-9	Bismuth	ug/mL	102	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-70-2	Calcium	ug/mL	101	<0.0800	3.12	n/a	n/a	n/a	n/a	0.0800	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-43-9	Cadmium	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-48-4	Cobalt	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-47-3	Chromium	ug/mL	100	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7439-89-6	Iron	ug/mL	100	<0.0100	0.0308	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-09-7	Potassium	ug/mL	97.1	<0.0200	7.73	n/a	n/a	n/a	n/a	0.0200	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7439-91-0	Lanthanum	ug/mL	99.1	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7439-96-5	Manganese	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-23-5	Sodium	ug/mL	98.1	<0.0400	38.1	n/a	n/a	n/a	n/a	0.0400	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-02-0	Nickel	ug/mL	103	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	n/a	n/a	n/a	n/a	3.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7439-92-1	Lead	ug/mL	102	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-16-6	Rhodium	ug/mL	9.9044E+01	<8.00E-03	<8.00E-03	n/a	n/a	n/a	n/a	8.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7704-34-9	Sulfur	ug/mL	99.7	<5.00E-03	0.115	n/a	n/a	n/a	n/a	5.00E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7782-49-2	Selenium	ug/mL	100	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-21-3	Silicon	ug/mL	106	0.0221	1.07	n/a	n/a	n/a	n/a	5.00E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-24-6	Strontium	ug/mL	101	<2.00E-03	0.0555	n/a	n/a	n/a	n/a	2.00E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-33-7	Tungsten	ug/mL	9.8497E+01	<6.00E-03	7.03E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-66-6	Zinc	ug/mL	102	<4.00E-03	<4.00E-03	n/a	n/a	n/a	n/a	4.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7440-67-7	Zirconium	ug/mL	96.1	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		SPECGRAVIT	Specific gravity	unitless	100.4	n/a	1.003	1.003	1.003	0.0	n/a	1.000E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		SR-89/90	Strontium-89/9	uCi/mL	98.0	3.92E-07	2.21E-03	2.20E-03	2.20E-03	0.566	n/a	2.79E-07	0.62	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		%WATER	Percent water	%	98.4	n/a	107	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	n/a	n/a	n/a	n/a	1.61E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	n/a	n/a	n/a	n/a	9.37E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	n/a	n/a	n/a	n/a	6.04E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	n/a	n/a	n/a	n/a	4.67E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	0.0770	n/a	n/a	n/a	n/a	9.98E-03	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	n/a	n/a	n/a	n/a	0.0192	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		14808-79-8	Sulfate	ug/mL	96.5	<0.0187	0.215	n/a	n/a	n/a	n/a	0.0187	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		338-70-5	Oxalate	ug/mL	95.6	<0.0231	<0.0231	n/a	n/a	n/a	n/a	0.0231	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	n/a	n/a	n/a	n/a	0.0580	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		14797-55-8	Nitrate	ug/mL	92.4	<0.0208	1.86	n/a	n/a	n/a	n/a	0.0208	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		14265-44-2	Phosphate	ug/mL	90.6	<0.0167	<0.0167	n/a	n/a	n/a	n/a	0.0167	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		7440-22-4	Silver	ug/mL	101	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	92.4	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		7429-90-5	Aluminum	ug/mL	99.1	<6.00E-03	<6.00E-03	6.63E-03	n/a	n/a	95.7	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		7440-38-2	Arsenic	ug/mL	100	<5.00E-03	<5.00E-03	<5.00E-03	n/a	n/a	98.3	5.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904		7440-41-7	Beryllium	ug/mL	97.8	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	95.1	1.00E-03	n/a	U

na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-69-9	Bismuth	ug/mL	102	<6.00E-03	<6.00E-03	<6.00E-03	n/a	n/a	96.2	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-70-2	Calcium	ug/mL	101	<0.0800	3.11	3.09	3.10	0.562	95.1	0.0800	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-43-9	Cadmium	ug/mL	102	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	95.7	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-48-4	Cobalt	ug/mL	102	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	97.3	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-47-3	Chromium	ug/mL	100	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	96.8	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7439-89-6	Iron	ug/mL	100	<0.0100	0.0493	0.0489	0.0491	0.776	96.1	0.0100	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-09-7	Potassium	ug/mL	97.1	<0.0200	7.30	7.84	7.57	7.24	97.7	0.0200	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7439-91-0	Lanthanum	ug/mL	99.1	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	94.6	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7439-96-5	Manganese	ug/mL	102	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	96.6	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-23-5	Sodium	ug/mL	98.1	<0.0400	36.5	38.3	37.4	4.65	98.9	0.0400	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-02-0	Nickel	ug/mL	103	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	97.0	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	<3.00E-03	n/a	n/a	96.9	3.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7439-92-1	Lead	ug/mL	102	<6.00E-03	<6.00E-03	<6.00E-03	n/a	n/a	102	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-16-6	Rhodium	ug/mL	9.9044E+01	<8.00E-03	<8.00E-03	<8.00E-03	n/a	n/a	95.5	8.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7704-34-9	Sulfur	ug/mL	99.7	<5.00E-03	0.116	0.113	0.114	2.05	97.6	5.00E-03	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7782-49-2	Selenium	ug/mL	100	<6.00E-03	<6.00E-03	<6.00E-03	n/a	n/a	99.3	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-21-3	Silicon	ug/mL	106	0.0221	1.00	1.02	1.01	1.52	107	5.00E-03	n/a	e
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-24-6	Strontium	ug/mL	101	<2.00E-03	0.0560	0.0556	0.0558	0.627	96.5	2.00E-03	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-33-7	Tungsten	ug/mL	9.8497E+01	<6.00E-03	0.102	0.0173	0.0599	142	94.1	6.00E-03	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-66-6	Zinc	ug/mL	102	<4.00E-03	<4.00E-03	<4.00E-03	n/a	n/a	97.5	4.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	7440-67-7	Zirconium	ug/mL	96.1	<1.00E-03	<1.00E-03	<1.00E-03	n/a	n/a	95.2	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	SPECGRAVIT	Specific gravity	unitless	100.4	n/a	1.010	n/a	n/a	n/a	n/a	1.000E-03	n/a	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	SR-89/90	Strontium-89/9	uCi/mL	98.0	3.92E-07	2.22E-03	n/a	n/a	n/a	n/a	2.78E-07	0.617	
na	2AY-LDP-12-01I	Grab Sample (Total)	S12T019904	%WATER	Percent water	%	98.4	n/a	105	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-01I	Field Blank	S12T019901	16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	n/a	n/a	n/a	n/a	1.61E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	n/a	n/a	n/a	n/a	9.37E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	n/a	n/a	n/a	n/a	6.04E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	n/a	n/a	n/a	n/a	4.67E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	<9.98E-03	n/a	n/a	n/a	n/a	9.98E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	n/a	n/a	n/a	n/a	0.0192	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	14808-79-8	Sulfate	ug/mL	96.5	<0.0187	<0.0187	n/a	n/a	n/a	n/a	0.0187	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	338-70-5	Oxalate	ug/mL	95.6	<0.0231	<0.0231	n/a	n/a	n/a	n/a	0.0231	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	n/a	n/a	n/a	n/a	0.0580	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	14797-55-8	Nitrate	ug/mL	92.4	<0.0208	<0.0208	n/a	n/a	n/a	n/a	0.0208	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	14265-44-2	Phosphate	ug/mL	90.6	<0.0167	<0.0167	n/a	n/a	n/a	n/a	0.0167	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-22-4	Silver	ug/mL	101	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7429-90-5	Aluminum	ug/mL	99.1	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-38-2	Arsenic	ug/mL	100	<5.00E-03	<5.00E-03	n/a	n/a	n/a	n/a	5.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-41-7	Beryllium	ug/mL	97.8	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-69-9	Bismuth	ug/mL	102	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-70-2	Calcium	ug/mL	101	<0.0800	0.0868	n/a	n/a	n/a	n/a	0.0800	n/a	
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-43-9	Cadmium	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-48-4	Cobalt	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-47-3	Chromium	ug/mL	100	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7439-89-6	Iron	ug/mL	100	<0.0100	<0.0100	n/a	n/a	n/a	n/a	0.0100	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-09-7	Potassium	ug/mL	97.1	<0.0200	<0.0200	n/a	n/a	n/a	n/a	0.0200	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7439-91-0	Lanthanum	ug/mL	99.1	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7439-96-5	Manganese	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-23-5	Sodium	ug/mL	98.1	<0.0400	0.348	n/a	n/a	n/a	n/a	0.0400	n/a	
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-02-0	Nickel	ug/mL	103	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	n/a	n/a	n/a	n/a	3.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7439-92-1	Lead	ug/mL	102	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-16-6	Rhodium	ug/mL	9.9044E+01	<8.00E-03	<8.00E-03	n/a	n/a	n/a	n/a	8.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7704-34-9	Sulfur	ug/mL	99.7	<5.00E-03	<5.00E-03	n/a	n/a	n/a	n/a	5.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7782-49-2	Selenium	ug/mL	100	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-21-3	Silicon	ug/mL	106	0.0221	0.137	n/a	n/a	n/a	n/a	5.00E-03	n/a	
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-24-6	Strontium	ug/mL	101	<2.00E-03	<2.00E-03	n/a	n/a	n/a	n/a	2.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-33-7	Tungsten	ug/mL	9.8497E+01	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-66-6	Zinc	ug/mL	102	<4.00E-03	<4.00E-03	n/a	n/a	n/a	n/a	4.00E-03	n/a	U
na	2AY-LDP-12-01I	Field Blank	S12T019901	7440-67-7	Zirconium	ug/mL	96.1	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	n/a	n/a	n/a	n/a	1.61E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	n/a	n/a	n/a	n/a	9.37E-03	n/a	U

na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	n/a	n/a	n/a	n/a	6.04E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	n/a	n/a	n/a	n/a	4.67E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	0.0720	n/a	n/a	n/a	n/a	9.98E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	n/a	n/a	n/a	n/a	0.0192	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	14808-79-8	Sulfate	ug/mL	96.5	<0.0187	0.208	n/a	n/a	n/a	n/a	0.0187	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	338-70-5	Oxalate	ug/mL	95.6	<0.0231	<0.0231	n/a	n/a	n/a	n/a	0.0231	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	n/a	n/a	n/a	n/a	0.0580	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	14797-55-8	Nitrate	ug/mL	92.4	<0.0208	1.83	n/a	n/a	n/a	n/a	0.0208	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	14265-44-2	Phosphate	ug/mL	90.6	<0.0167	<0.0167	n/a	n/a	n/a	n/a	0.0167	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-22-4	Silver	ug/mL	101	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7429-90-5	Aluminum	ug/mL	99.1	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-38-2	Arsenic	ug/mL	100	<5.00E-03	<5.00E-03	n/a	n/a	n/a	n/a	5.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-41-7	Beryllium	ug/mL	97.8	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-69-9	Bismuth	ug/mL	102	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-70-2	Calcium	ug/mL	101	<0.0800	3.11	n/a	n/a	n/a	n/a	0.0800	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-43-9	Cadmium	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-48-4	Cobalt	ug/mL	102	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-47-3	Chromium	ug/mL	100	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7439-89-6	Iron	ug/mL	100	<0.0100	0.0799	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-09-7	Potassium	ug/mL	97.1	<0.0200	7.59	n/a	n/a	n/a	n/a	0.0200	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7439-91-0	Lanthanum	ug/mL	99.1	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7439-96-5	Manganese	ug/mL	102	<1.00E-03	1.32E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-23-5	Sodium	ug/mL	98.1	<0.0400	37.5	n/a	n/a	n/a	n/a	0.0400	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-02-0	Nickel	ug/mL	103	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	n/a	n/a	n/a	n/a	3.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7439-92-1	Lead	ug/mL	102	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-16-6	Rhodium	ug/mL	9.9044E+01	<8.00E-03	<8.00E-03	n/a	n/a	n/a	n/a	8.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7704-34-9	Sulfur	ug/mL	99.7	<5.00E-03	0.112	n/a	n/a	n/a	n/a	5.00E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7782-49-2	Selenium	ug/mL	100	<6.00E-03	<6.00E-03	n/a	n/a	n/a	n/a	6.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-21-3	Silicon	ug/mL	106	0.0221	1.03	n/a	n/a	n/a	n/a	5.00E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-24-6	Strontium	ug/mL	101	<2.00E-03	0.0579	n/a	n/a	n/a	n/a	2.00E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-33-7	Tungsten	ug/mL	9.8497E+01	<6.00E-03	0.0102	n/a	n/a	n/a	n/a	6.00E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-66-6	Zinc	ug/mL	102	<4.00E-03	<4.00E-03	n/a	n/a	n/a	n/a	4.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	7440-67-7	Zirconium	ug/mL	96.1	<1.00E-03	<1.00E-03	n/a	n/a	n/a	n/a	1.00E-03	n/a	U
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	SPECGRAVIT	Specific gravity	unitless	100.4	n/a	1.008	n/a	n/a	n/a	n/a	1.000E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	SR-89/90	Strontium-89/9	uCi/mL	98.0	3.92E-07	2.29E-03	n/a	n/a	n/a	n/a	2.77E-07	0.607	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906	%WATER	Percent water	%	99.3	n/a	104	105	105	0.858	n/a	0.0100	n/a	

NA = Not Analyzed, ND = Not Detected

U - Less Than Detection Limit

e - SERDIL Outside Range

Harlow, Donald G

From: Venetz, Theodore J
Sent: Thursday, September 13, 2012 7:44 AM
To: Rosenkrance, Chelsea L
Subject: FW: Anomalously Low pH results for AY102A-LDP Samples
Attachments: AY102A-LDP pH Anions Rpt.xls

From: Nguyen, Duc M
Sent: Wednesday, September 12, 2012 10:34 AM
To: Kirch, Nicholas W (Nick); Powell, William J (Bill); Reynolds, Jacob G; Jo, Jaiduk; Uytioco, Elise M; Rasmussen, Juergen H; Sams, Terry L; Boomer, Kayle D; Venetz, Theodore J; Prilucik, John R; Ritenour, Gerald P; Strasser, David W; Shultz, M V Jr (Milt)
Subject: FW: Anomalously Low pH results for AY102A-LDP Samples

FYI

Duc M. Nguyen
Washington River Protection Solutions LLC
Contractor to the United States Department of Energy
(509) 372-3042

From: Ritenour, Gerald P
Sent: Wednesday, September 12, 2012 10:28 AM
To: Nguyen, Duc M
Subject: Anomalously Low pH results for AY102A-LDP Samples

Duc,
As we have discussed, the pH results for all AY102A-LDP samples were anomalously low (see attached). Since the low results included the field blank, we might conclude that somehow during clean process an acid residue was left in the sample containers. However, the process used to clean the samples make this very unlikely - two acid soakings, drying, acetone rinse, drying, methylene chloride, and oven drying. More importantly the acids use are HCL and HNO3, which means that if the cleaning process resulted in contamination, chloride and/or nitrate anions should be present in the sample at concentration well above the MDL. As you can see from the attachment they were not present. This raise the question, what is causing the low pH? A significant unknown peak is present in all samples. It eludes between nitrite and sulfate at approximately 15 min. We will continue to investigate this.
The laboratory believe the low pH will only affect the TIC and pH results. TIC has not yet been analyzed. The pH results for the samples are anomalously low, but do represent a low boundary for the "actual" sample pH. If you have any question please let me know.
Thanks, JR

Gerald "JR" Ritenour
Project Manager
ATL Analytical Operations
Advanced Technologies and Laboratories International, Inc.
Contractor to the Office of River Protection
U.S. Department of Energy

(509) 372-2742 office
(509) 438-8837 cell
gerald_p_ritenour@rl.gov

INTERIM

Data Summary Report

Riser	Segment Number	Segment Portion	SAMPLE_R	A	CAS #	ANALYTE	RESULT_UNIT	STANDARD	BLANK	RESULT	DUPLICATE	AVERAGE	RPD	SPK_REC	Det Limit	COUNT_ERR	QUALIFIER
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	<1.61E-03	n/a	n/a	n/a	1.61E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	<9.37E-03	n/a	n/a	n/a	9.37E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	<6.04E-03	n/a	n/a	n/a	6.04E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	<4.67E-03	n/a	n/a	n/a	4.67E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	0.0900	0.0890	0.0895	1.12	n/a	9.98E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	<0.0192	n/a	n/a	n/a	0.0192	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14808-79-8	Sulfate	ug/mL	96.5	<0.0187	0.204	0.217	0.210	6.18	n/a	0.0187	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	<0.0580	n/a	n/a	n/a	0.0580	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		14797-55-8	Nitrate	ug/mL	92.4	<0.0208	1.91	1.91	1.91	0.262	n/a	0.0208	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	n/a	n/a	n/a	n/a	3.00E-03	n/a	
na	2AY-LDP-12-01	Grab Sample (Total)	S12T019902		PH	pH	unitless	n/a	n/a	6.83	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	n/a	n/a	n/a	n/a	1.61E-03	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	n/a	n/a	n/a	n/a	9.37E-03	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	n/a	n/a	n/a	n/a	6.04E-03	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	n/a	n/a	n/a	n/a	4.67E-03	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	0.0770	n/a	n/a	n/a	n/a	9.98E-03	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	n/a	n/a	n/a	n/a	0.0192	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		14808-79-8	Sulfate	ug/mL	96.5	<0.0187	0.215	n/a	n/a	n/a	n/a	0.0187	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	n/a	n/a	n/a	n/a	0.0580	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		14797-55-8	Nitrate	ug/mL	92.4	<0.0208	1.86	n/a	n/a	n/a	n/a	0.0208	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	<3.00E-03	n/a	n/a	96.9	3.00E-03	n/a	
na	2AY-LDP-12-01DUP	Grab Sample (Total)	S12T019904		PH	pH	unitless	n/a	n/a	6.89	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	n/a	n/a	n/a	n/a	1.61E-03	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	n/a	n/a	n/a	n/a	9.37E-03	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	n/a	n/a	n/a	n/a	6.04E-03	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	n/a	n/a	n/a	n/a	4.67E-03	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	<9.98E-03	n/a	n/a	n/a	n/a	9.98E-03	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	n/a	n/a	n/a	n/a	0.0192	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		14808-79-8	Sulfate	ug/mL	96.5	<0.0187	<0.0187	n/a	n/a	n/a	n/a	0.0187	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	n/a	n/a	n/a	n/a	0.0580	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		14797-55-8	Nitrate	ug/mL	92.4	<0.0208	<0.0208	n/a	n/a	n/a	n/a	0.0208	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	n/a	n/a	n/a	n/a	3.00E-03	n/a	
na	2AY-LDP-12-01FB	Field Blank	S12T019901		PH	pH	unitless	n/a	n/a	3.82	n/a	n/a	n/a	n/a	0.0100	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		16984-48-8	Fluoride	ug/mL	101	<1.61E-03	<1.61E-03	n/a	n/a	n/a	n/a	1.61E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		666-14-8	Glycolate	ug/mL	101	<9.37E-03	<9.37E-03	n/a	n/a	n/a	n/a	9.37E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		71-50-1	Acetate	ug/mL	97.3	<6.04E-03	<6.04E-03	n/a	n/a	n/a	n/a	6.04E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		12311-97-6	Formate	ug/mL	94.7	<4.67E-03	<4.67E-03	n/a	n/a	n/a	n/a	4.67E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		16887-00-6	Chloride	ug/mL	99.9	<9.98E-03	0.0720	n/a	n/a	n/a	n/a	9.98E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		14797-65-0	Nitrite	ug/mL	94.1	<0.0192	<0.0192	n/a	n/a	n/a	n/a	0.0192	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		14808-79-8	Sulfate	ug/mL	96.5	<0.0187	0.208	n/a	n/a	n/a	n/a	0.0187	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		24959-67-9	Bromide	ug/mL	92.6	<0.0580	<0.0580	n/a	n/a	n/a	n/a	0.0580	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		14797-55-8	Nitrate	ug/mL	92.4	<0.0208	1.83	n/a	n/a	n/a	n/a	0.0208	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		7723-14-0	Phosphorus	ug/mL	99.0	<3.00E-03	<3.00E-03	n/a	n/a	n/a	n/a	3.00E-03	n/a	
na	2AY-LDP-12-02	Grab Sample (Total)	S12T019906		PH	pH	unitless	n/a	n/a	6.66	6.76	6.71	1.49	n/a	0.0100	n/a	

7.0 Tardiff, G. R., 2001, Evaluation of AY-102 Annulus CAM Readings, CH2M HILL Hanford Group, Inc., Richland, Washington.

EVALUATION OF AY-102 ANNULUS CAM READINGS

G. R. Tardiff, AWF System Engineer
CH2M Hill Hanford Group, Inc.

June 29, 2001

I. Purpose

In April of this year, the 241-AY-102 annulus continuous air monitor (CAM) began to show an upward trend in radiation readings. This paper provides a technical evaluation of the possible causes for the trend and discusses activities planned to resolve the elevated CAM readings. It also addresses the concerns of an ORP Facility Representative raised in June 2001.

II. Introduction

The annulus CAM samples air after it is discharged from the annulus, just upstream of the exhaust HEPA filters. The purpose of the CAM is to detect leaks from the primary tank into the annulus. The latest readings have been less than 1500 counts per minute (cpm). The Action Limit setpoint for the CAM is 3000 cpm. Elevated CAM readings will result when contamination from the primary tank enters the annulus system. The contamination can enter the annulus via a direct leak, either liquid or vapor, from the primary tank, or as a vapor through other pathways that connect the primary tank vapor space with the annulus. The following discussion will address the various pathways that exist that may have allowed primary tank vapors to enter the annulus. The discussion will focus on past contamination of the annulus that may be contributing to the elevated CAM readings, and will describe the expected response of the CAM system to a leak from the primary tank to the annulus.

III. AY-102 Leak Path Evaluation

An overview of potential contamination pathways between the primary tank and the annulus, which were considered during the 1999 and 2001 investigations of elevated annulus CAM readings, is provided below. The potential leak pathways are shown on the attached AY-102 Leak Path Diagram. The pathways are color coded to correspond to the color noted in the parenthesis at the end of each of the following Section headings.

Leak Detection Pit and Annulus Pump Pit Cross-ties to Annulus Vent System (Green and Red)

All leak detection pits and annulus pump pits in AY and AZ tank farms are designed and built with an upper pit and lower pit. All upper pits contain components such as a drain line with a drain plug, 1 or 2 blanked wall nozzle connector heads, a transfer leak detector and either a transfer pump (mounted on a flange in the upper pit but extending into the lower pit) or a shield plug. All lower pits contain equipment such as the lower section of the pump; weight factor dip tubes and vent lines that tie into the annulus vent system.

All central pump pits (Blue), sluice pits, annulus pump pits and leak detection pits have drain-down legs that are piped back to the primary tank and are designed to discharge underneath the waste surface. However, the leak detection pits and annulus pump pits have the greatest potential to contaminate the annulus ventilation system since the lower part of these pits are vented directly to the annulus vent system. The purpose of the drain-down leg is to seal vapors from the pits. This was a critical design feature since the Aging Waste Facility (AWF) tanks were designed to handle high heat boiling waste at elevated temperatures. Each drain-down leg stops approximately 60 inches above the bottom of the tank, and is normally submerged below the waste surface.

The drain-down leg design creates a potential contamination pathway from the primary tank vapor space to any of the connected pits, if the liquid level in the double shell tank (DST) drops below 60 inches. The amount of contamination going into the top part of the pits will be increased if an open pathway exists from the top part of the pit to the bottom part of the pit. The magnitude of the contamination spread will be greatly increased if the shield plug and drain plug are removed or improperly sealed. In the event that the annulus vacuum is greater than the primary tank vacuum, contamination spread could be further increased.

To reduce the potential for cross contamination from the primary tank into the lower part of the pits, shield plugs or metal plate covers have been installed in all pump positions for all the AY/AZ annulus pump pits, leak detection pits, central pump pits and sluice pits. All shield plugs and plate covers are fitted with gasket material to provide a positive seal. In most cases the gasket is made of neoprene. However, since most of these plugs have been in service for 20-30 years, gasket degradation is a credible possibility.

Verification that shield plugs or metal plate covers are in place cannot be completed without entering each pit or dropping a camera (if possible) into the pit. Within the last two years, three out of four annulus pump pits have been visually confirmed as having shield plugs or metal plate covers (all except AZ-102 annulus pump pit). None of the six leak detection pit shield plugs have been visually verified within the last 10 years.

Another potential pathway into the annulus vent system is through the pump out routes from the annulus pump pits. These transfer lines are potential sources of cross contamination into the upper part of the annulus pits. Based on the 200 East Area Routing Board, all transfer route nozzles in AY and AZ annulus pump pits and leak detection pits have either a PUREX head process blank (H-2-72284 and H-2-72285) or an isolation blank (H-2-73453).

Therefore, the potential for a large cross contamination pathway from these pits into the annulus ventilation system is substantially reduced. The largest leak would be reduced to small cracks in the gasket material as the gasket material deteriorates over time. This type of leak will most likely show up as a small increase in the contamination sensed by the annulus CAM.

Side Fill Lines in AWF DSTs (Light Blue)

Each of the four tanks in the AWF have four side fill lines. The lowest transfer line is at an elevation of approximately 370 inches from the bottom of the tank. Each side fill line is sleeved or encased and runs through the annulus space. The sleeving material is Type

304 stainless steel. The sleeve consists of a bellows (or expansion joint) and a packed flanged section welded to the primary tank. The transfer line itself is not welded to the primary tank but is supported by the flanged section. Between the flanged section and the primary tank, and between the transfer pipe and encasement is a packing material sealing the encasement section from the primary tank. The packing material is graphite impregnated with long fiber asbestos (Ref H-2-67316 and H-2-64448).

There is a potential for this flanged section to leak waste or vapors from the primary tank into the annulus. To date, vapor leaks via annulus side fill lines have been theorized but never confirmed. Operation Limits contained within operating procedures are designed to control AWF liquid level below 364 inches to prevent waste attacking the packing or waste pressurizing the packing.

Cross-Tie Lines in AY and AZ DSTs (Light Purple)

The cross-tie lines are 8 inch lines connected to the annulus at one end and connected to the 20 inch primary tank vent line. Between the primary and annulus there were two 8 inch butterfly valves which could be opened. In theory, both the primary tank and the annulus could be ventilated on the primary tank vent system in the event of a primary tank failure. Project W-030 removed all 4 cross ties when they removed the old 20 inch vent lines from each of the AWF DSTs (Ref. H-2-131086 and H-2-131087) during construction of the 702-AZ ventilation system. Originally, the AZ cross-tie lines were going to be left in place since the project was going to tee into the 4A riser above the cross-tie lines. Project plans changed when the 14 inch vent line encasement had to be run to the top of the riser to meet environmental requirements. As a result, removal of the cross-tie lines in AZ Farms was necessary. The AY farm cross-ties were also removed as originally planned.

Consequently, the cross-tie lines connected to the annulus tanks do not present any risk of contamination spread from the primary tank to the annulus ventilation system.

AY Annulus Ventilation System (Yellow)

The AY-101 and AY-102 annulus vent systems were originally designed and built with a supply fan as well as an exhaust fan. Each system had air dryers and heaters to deliver dry air to the annulus system at less than 12 percent relative humidity. The exhaust fan had more capacity than the supply fan, so the annulus pressure operated slightly negative most of the time. The annulus operated at approximately 2000 scfm flow rate at –1 to +1 inch water gauge pressure inside the annulus. In 1983, this system was modified to the existing system, eliminating the supply fans and operating the annulus under negative pressure.

In 1997, after a long down time (~7 years), both annulus systems were repaired and new HEPA filter housings installed. The exhausters were repaired and adjusted to allow approximately 1200-1500 scfm through the system at approximately –1 inch vacuum. The AY-101 system ran only 6 weeks before it was shutdown because the tank's liquid level was being pumped below 64 in to support an Evaporator Campaign. At 64 inches, the annulus exhaust system must be shutdown as required per OSD 17.2.1.1, Primary Tank Liquid Level limit. The AY-102 system continued to operate for approximately 8 months, until W-320 annulus modification work required the system to be shutdown.

In 1998, the W-320 project modified the AY-102 vent system to allow 100% of the flow through the air slots under the primary tank. In order to achieve enough airflow through the slots, the annulus vacuum had to be significantly increased. Project W-320 evaluated the structural design of the AY DSTs and concluded that the annulus primary tank could withstand a 20 inch water gauge vacuum in the annulus. The exhaust fan was modified to allow the higher vacuums of –12 inches to –18 inches of vacuum at approximately 1000 scfm flow. It should be noted that the W-320 design change for the AY-102 annulus did not significantly change the flow rate. Sampling systems for both the record sampler and annulus CAM were evaluated by Engineering to determine if equipment changes were required to maintain representative sampling for the new flow conditions. No changes were made since the overall flow rate had not changed significantly.

OTP-320-001 was performed to test the new high vacuum system (Ref. HNF-2317 Operability Test Report). The system performed well. The average flow rate for the test was 1077 scfm with –16 inch vacuum. The average CAM reading was 413 cpm with a maximum CAM reading of 1100 cpm. The test demonstrated that there was no significant source of cross contamination as a result of the increased vacuum.

<u>241-AY-102 Tank Integrity Evaluation</u>

Over the past several months UT and video examinations were performed on the primary tank liner of AY-102. Cameras, UT equipment, light sources and reach rods were used inside several risers and the annulus space. All equipment placed into the annulus space was removed with no measurable amount of contamination. Additional annulus and primary tank video examinations are planned for this year to view and then evaluate as much of the tank as practical.

IV. History of Elevated AY-102 Annulus CAM Readings

The 241-AY-102 annulus has been subjected to numerous potential cross-contamination events over the years. The first event of interest occurred in October 1976 when a transfer of waste lowered the 241-AY-102 primary tank level to 15 inches. At this level, the leak detection pits drain-down legs, the central pump pit drain-down leg, the annulus pump pits drain-down legs and all the sluice pits drain-down legs were uncovered, exposing the drain-down legs to the primary tank vapor space. Between January 1982 and January 1990, all of the drain-down legs were uncovered twelve additional times. The attached Figure, *AY 102 LEVEL & ANNULUS DATA*, provides a comparison of tank level and annulus CAM readings from January 1984 to January 1999.

The annulus exhauster has an operating history of periods of operation followed by periods of shutdown. After each startup, the annulus CAM count rate has been in the range of 600 to 2,800 cpm with occasional higher peaks. The annulus exhauster was on line from late 1984 until mid 1987. In late 1986 and early 1987, the annulus leak detection CAM count rate showed fourteen peaks between 5,000 cpm and 20,000 cpm; these peaks correspond to periods when the tank waste level uncovered the drain-down legs. The annulus exhauster was off line from mid 1987 to early 1988. The exhauster was restarted and was on line from early 1988 to mid 1991. The CAM count rate during this period was nominally 1,000 to 2,000 cpm with many peaks in excess of 2,000 cpm. The largest peak was 10,000 cpm. The annulus exhauster was again secured in mid 1991 and remained offline until early 1997.

The exhauster was next operated for a short period between early 1997 and early 1998. CAM count rates during this period fluctuated between 500 and 1,500 cpm. The annulus exhauster's last shutdown period was early 1998 to mid 1998. In mid 1998, the annulus exhauster was started and has been on line since (except when shutdown for repairs). The CAM count rate increased upon startup with the count rate being a nominal 1,500 cpm with many peaks between 1,800 cpm and 2,800 cpm; four peaks were recorded at 3,000 cpm or higher.

In December 1998, the Tank Farm Contractor (TFC) issued Discrepancy Report 98-857 concerning the higher than normal count rate observed on the 241-AY-102 annulus CAM. As follow-on documentation, the TFC issued an Occurrence Report against the count rate. To resolve the Occurrence Report, HNF-4798, *Tank 241-AY-102 Annulus Continuous Air Monitor High Readings* was issued in July 1999. HNF-4798 states that surveillance data for the 1984 and 1986 level decreases clearly indicate a correlation between the level drop and the annulus CAM count rates.

Several historical incidents of contamination of pump pits have been documented. In October 1994, the AY-102 central (O2D) pump pit became contaminated from a failed transfer line. This line failed in the wall of the O2D pit and sprayed waste into the O2D pit, and set off the leak detector. At that time, there was an open wall nozzle in the O2D pit. This wall nozzle is part of a transfer line system connected to the annulus pump pit. The open wall nozzle could have allowed contamination to move into the upper part of the annulus pump pit. However, a PUREX blank was installed (and still is installed) on the annulus pump pit side. The condition of the PUREX head is unknown but historically PUREX heads when installed properly create a pressure tight seal.

A 1997 video of the annulus pump pit showed that the pump had been removed and all of the transfer lines had been blanked. On February 17, 1999, smears were obtained of the annulus pump pit pump opening, the pit drain area, and the floor of the pit. Smearable contamination was found on all samples with contamination levels ranging from 2,000 to 3,000 dpm/100 cm^2. Laboratory analysis revealed the presence of very low levels of Cs-137 and Sr-90.

During the activity to obtain annulus pump pit radiological contamination smears in 1999, it was discovered that the plug on the drain line leading to the primary tank, was lying on its side near the drain line. The plug was reseated in an effort to better seal the primary tank from the annulus pump pit. After sealing the drain line, CAM count rate remained in the range of 200 cpm to 2500 cpm

It is not known how long the drain line plug had been removed. With the drain line open, contamination from the primary tank has a much easier pathway to get into the upper annulus pump pit. In addition, a significant amount of moisture was observed in the annulus pump pit when reviewing the 1997 video of the pit. Water could be seen beading off the cover block and walls. The pit floor also looked wet. Contamination water could pass from the upper pit to the lower pit, if the shield plug has a deteriorated gasket.

The investigation conducted for HNF-4798 concluded that the increased annulus CAM count rate in the 241-AY-102 annulus was related to historical smearable contamination of the annulus pump pit. The existing contamination may be re-disturbed by changes in ventilation flow (startups and shutdowns) coupled with water intrusion into the annulus pump pit.

Review of the CAM data has shown that, since late 1984, the annulus CAM has indicated count rates of 500 cpm to as high as 20,000 cpm with the normal reading being 1,500 cpm to 2,500 cpm. During the week preceding the CAM shutdown on June 21, 2001, CAM readings ranged from 600 cpm to 900 cpm.

Investigation of the elevated count rate in the 241-AY-102 annulus has continued. As stated above, it is known that the annulus pump pit is contaminated. It is suspected that moisture (condensation, intrusion) within the annulus pump pit, as observed in a 1997 video, becomes contaminated as it drips down the pit walls. It then seeps through a deteriorated shield plug gasket and enters the annulus.

V. Annulus CAM Response to a Leak

In August 1998, Pacific Northwest National Laboratory issued PNNL-11956, "Calculation of SY Tank Annulus Continuous Air Monitor Readings After Postulated Leak Scenarios," in support of a Washington State Department of Ecology compliance inspection at 241-SY Farm. Table 1 of the report provides the expected CAM response for a 0.01 gallon per minute leak of tank waste. SY annulus exhaust rate was assumed to be 300 cfm. The report indicates that the count rate resulting from a leak of waste will be significantly higher than the CAM alarm set-point in a matter of minutes for a leak totaling 73 gallons, and a matter of just a few hours for the 0.01 gallon per minute leak. The CAMs are expected to reach their alarm state as a result of a very small leak well within the required twenty-four hour detection period required under 40 CFR 265 and WAC 173-303-640. Although the PNNL report was prepared to specifically address the SY tanks, the methodology of the analysis is applicable to AY-102.

When using the PNNL equation for AY-102 to make a direct comparison, the following assumptions are made:

1. The source terms in both tanks are approximately the same (AY-102 source term is actually greater).
2. The two annulus systems have approximately the same annulus volume - 21,900 $ft.^3$
3. The flow rate for AY-102 will be assumed to average 850 cfm (based on Operator Round Sheets).

Below is a comparison of the two tanks at the lowest leak rate (0.01 gal/min or 14 gal/day):

	CAM Readings above Background (CPM)	
Time (min)	SY Tanks	AY-102
60	400	215
120	1,100	930
180	5,500	2,120
240	10,300	3,770

The table above shows that the AY system will take longer to alarm than the SY system. The SY annulus system will alarm in approximately 140 minutes at the 3,000 cpm CAM setpoint, while the AY system will take approximately 215 minutes. Both are well within the 24 hour guide established by 40 CFR 265 and WAC 173-303-640, and will provide positive indication that waste has leaked from the tank.

A question has been raised regarding the setpoint for the annulus CAM system. CHG is currently reviewing the W-320 project files for the AY-102 annulus CAM setpoint calculation. In parallel we are reconstituting the setpoint calculation for the AY-102 annulus CAM. Preliminary results of the calculation indicate that the setpoint of 3000 cpm for the AY-102 annulus CAM is valid for the current system flow rate. The calculation demonstrates that the CAM sample flow rate is subisokinetic, which is conservative. The sample that enters the probe will be more concentrated than the effluent in the duct. Additionally, a preliminary calculation of the collection efficiency of the sample system indicates that it is approximately 83% efficient. This satisfies the requirement of ANSI N 13.1-1999, which requires a minimum of 50% sampling efficiency. The field configuration will be verified against the drawing and the calculation completed and verified prior to submittal to ORP.

VI. <u>CHG Conclusion</u>

CHG believes that the cross-contamination scenario, rather than a leak of waste from the primary tank, is considered the most probable cause of the increased count rate on the 241-AY-102 annulus leak detection CAM. This position is based on the following:

- High CAM counts have been observed in AY-102 since 1976 (ARHCO 1976b and 1976c, Rodgers 1976). In the past this phenomenon has been infrequent, and typically lasts for a few months and then disappears. The evidence and data for these past increases point to a slightly contaminated annulus pump pit that resulted from the lowering of tank waste levels below 60 inches, with the annulus ventilation running. This allowed contamination to travel up the drain-down keg and deposit onto pit surfaces. As a direct result of these occurrences, OSD-17.2.1 was written (Pan 1981) to ensure the annulus ventilation is shutdown prior to lowering tank liquid level below 64 inches.

- The tank integrity program has not identified any significant liner corrosion in 241-AY-102.
- There have been no annulus CAM alarms or annulus conductivity leak detector alarms.
- A leak from the primary tank would exceed the annulus CAM setpoint in a short period of time (i.e., hours), even for a very small leak.
- If the primary tank liner or any of the side fill lines were leaking, the annulus would be highly contaminated. Any equipment lowered into the annulus vapor space would also likely become contaminated. To date, no contamination has been found on any of the equipment lowered into the tank annulus space to perform tank integrity inspections.

Based on the review of historical data and potential contamination paths, the source of increased count rate in the 241-AY-102 annulus is postulated to be a result of previous contamination of the annulus pump pit and the subsequent movement of contamination into the annulus through deteriorating seals/gaskets in the pump pit. Present and past operating modes (i.e., greater vacuum in the annulus relative to the primary tank) of the annulus ventilation system coupled with moisture in the pit support the movement of liquid from the annulus pump pit into the annulus via the seals/gaskets.

VII. Path Forward

The following path forward is planned to resolve the elevated CAM problem:

Work package 2E-01-01027, "Seal 102-AY 02F Pit" is currently in the planning stage. The work will include resealing the funnel/plug assembly and replacing the gasket on the 12 inch shield plug. A second work package will spray the pit with fixative to prevent further contamination into the annulus system. Once this work has been completed, the pit will be closed up and resealed to prevent water or moisture intrusion. This work is anticipated to complete by the end of September 2001.

Field verification of the sample probe may require entry into the annulus exhaust duct, which will require planning and preparation of a work package. Alternately, additional document reviews may provide the information to verify the type of probe installed in the duct. If a field inspection is required, it will take two to three weeks to complete the

CAM setpoint calculation. If the proper documentation is available, the calculation will be complete early next week.

After the completion of the above actions, the annulus CAM will be monitored (i.e., tracked and trended) for at least a year (in order to see all the seasonal changes) to ensure that the problem has been resolved.

REFERENCES

ARHCO, 1972, 241-AY Tank Farm Information Manual, ARH-MA-102, October, Atlantic Richfield Hanford Company, Richland Washington.

ARHCO, 1975, *Alarm Signal from the 101-AY "B" Leak Detection Pit*, Occurrence Report 75-110, October 2, Atlantic Richfield Hanford Company, Richland Washington.

ARHCO, 1976a, *High Radiation in Tank 101-AY Annulus Exhaust Air*, Occurrence Report 76-132, September21, Atlantic Richfield Hanford Company, Richland Washington.

Rodgers, J.G., 1976, *Surveillance Operational Survey on the 102-AY Liquid Level Drop*, Letter to H. F. Jensen, October 20, Atlantic Richfield Hanford Company, Richland Washington.

Pan, R. B., 1981, *Structural Analysis of the 241-AW/AN Primary Steel Tank For Revised Operating Criteria*, Letter to G. T. Dukelow, July 29, Rockwell Hanford Company, Richland Washington.

WHC, 1989, Double-Shell Tank Annulus Air Flows, SD-WM-TA-017, July 24, Westinghouse Hanford Company, Richland Washington.

PNNL, 1998, *Calculation of SY Tank Annulus Continuous Air Monitor Readings After Postulated Leak Scenarios*, PNNL-11956, Pacific Northwest National Laboratory, Richland Washington.

LMH, 1999, *Tank 241-AY-102 Annulus Contamination Air Monitor High Readings*, HNF-4798, July 28, Lockheed Martin Hanford Company, Richland, Washington.

ATTACHMENT 1

I. Aging Waste Facility (AWF) Leak Path Evaluation

Below is an overview of potential contamination pathways from the various AWF structures and ancillary equipment considered during the 1999 and 2001 investigations of the elevated annulus CAM readings. The potential leak pathways are shown in the color noted in the parenthesis on the attached AWF Diagram.

Leak Detection Pit and Annulus Pump Pit Cross-ties to Annulus Vent System (Green and Red)

All leak detection pits and annulus pump pits in AY and AZ Tank Farms are designed and built with an upper pit and lower pit. All upper pits contain components such as a drain line with a drain plug, 1 or 2 blanked wall nozzle connector heads, a transfer leak detector and either a transfer pump (mounted on a flange in the upper pit but extending into the lower pit) or a shield plug. All lower pits contain equipment such as the lower section of the pump; weight factor dip tubes and vent lines which tie into the annulus vent system.

All central pump pits (Blue), sluice pits, annulus pump pits and leak detection pits have drain lines that are piped back to the primary tank and are designed to discharge underneath the waste surface. However, the leak detection pits and annulus pump pits have the greatest potential to contaminate the annulus ventilation system since the lower part of these pits are vented directly to the annulus vent system. The purpose of the drain line is to seal vapors from the pits. This was a critical design feature since the AWF DSTs were designed to handle high heat boiling waste at elevated temperatures. Each drain line stops approximately 60 inches off the bottom of the tank and is normally submerged beneath the waste.

The drain line design creates a potential contamination pathway from the primary tank vapor space to any of the connected pits, if the liquid level in the DST drops below 60 inches. The amount of contamination going into the top part of the pits will be increased if an open pathway exists from the top part of the pit to the bottom part of the pit. The magnitude of the contamination spread will be greatly increased if the shield plug and drain plug are removed or improperly sealed. In the event that the annulus vacuum is greater than the primary tank vacuum, contamination spread could be further increased.

To reduce the potential for cross contamination from the primary tank into the lower part of the pits, shield plugs or metal plate covers have been installed in all pump positions for all the AY/AZ annulus pump pits, leak detection pits, central pump pits and sluice pits. All shield plugs and plate covers are fitted with gasket material to provide a positive seal. In most cases the gasket is made of neoprene. However, since most of these plugs have been in service for 20-30 years, gasket degradation is a credible possibility.

Verification that shield plugs or metal plate covers are in place can not be completed without entering each pit or dropping a camera (if possible) into the pit. Within the last two years, three out of four annulus pump pits have been visually confirmed as having shield plugs or metal plate covers (all except AZ-102 annulus pump pit). None of the six leak detection pit shield plugs have been visually verified within the last 10 years.

Another potential pathway into the annulus vent system is through the pump out routes from the annulus pump pits. These transfer lines are potential sources of cross contamination into the upper part of the annulus pits. Based on the 200 East Area Routing Board, all transfer route nozzles in AY and AZ annulus pump pits and leak detection pits have either a PUREX head process blank (H-2-72284 and H-2-72285) or an isolation blank (H-2-73453).

Therefore, the potential for a large cross contamination pathway from these pits into the annulus ventilation system is substantially reduced. The largest leak would be reduced to small cracks in the gasket material as the gasket material deteriorates over time. This type of a leak will not produce sustainable elevated CAM readings, which is what has been observed over the past 20 years.

<u>Side Fill Lines in AWF DSTs (Light Blue)</u>

All 4 tanks in the AWF have side fill lines. Each tank has 4 side fill lines. The lowest transfer line is at an elevation of approximately 370 inches from the bottom of the tank. Each side fill line is sleeved or encased and runs through the annulus space. The sleeving is made out of 304 stainless steel with a bellows or expansion joint and a packed flanged section welded to the primary tank. The transfer line itself is not welded to the primary tank but is supported by the flanged section. Between the flanged section and the primary tank, and between the transfer pipe and encasement is a packing material sealing the encasement section from the primary tank. The packing material is graphite impregnated with long fiber asbestos (Ref H-2-67316 and H-2-64448).

There is a potential for this flanged section to leak waste or vapors from the primary tank into the annulus. To date vapor leaks via annulus side fill lines have been theorized but never confirmed. Operation Limits contained within operating procedures are designed to control AWF liquid level below 364 inches to prevent waste attacking the packing or waste pressurizing the packing.

<u>Cross-Tie Lines in AY and AZ DSTs (Light Purple)</u>

The cross-tie lines are 8 inch lines connected to the annulus at one end and connected to the 20 inch primary tank vent line. Between the primary and annulus there were 2 – 8 inch butterfly valves which could be opened. In theory, both the primary tank and the annulus could be ventilated on the primary tank vent system in the event of a primary tank failure. Project W-030 removed all 4 cross ties when they removed the old 20 inch vent lines from each of the AWF DSTs (Ref. H-2-131086 and H-2-131087) during construction of the 702-AZ ventilation system. Originally, the AZ cross-tie lines were going to be left in place since the project was going to tee into the 4A riser above the cross-tie lines. Project plans changed when the 14 inch vent line encasement had to be run to the top of the riser to meet environmental requirements. As a result, removal of the cross-tie lines in AZ Farms was necessary. The AY farm cross-ties were also removed as originally planned.

Consequently, the cross-tie lines connected to the annulus tanks do not present any risk of contamination spread from the primary tank to the annulus ventilation system.

AY Annulus Ventilation System (Yellow)

The AY-101 and AY-102 annulus vent systems were originally designed and built with a supply fan as well as an exhaust fan. Each system had air dryers and heaters to deliver dry air to the annulus system at less than 12 percent relative humidity. The exhaust fan had more capacity than the supply fan, so the annulus pressure operated slightly negative most of the time. The annulus operated at approximately 2000 scfm flow rate at –1 to +1 inch water gauge pressure inside the annulus. In 1983, this system was modified to the existing system, eliminating the supply fans and operating the annulus under negative pressure.

In 1997, after a long down time (~7 years), both annulus systems were repaired and new HEPA filter housings installed. The exhausters were repaired and adjusted to allow approximately 1200-1500 scfm flow rate through the system at approximately –1 inch vacuum. 101-AY system ran only 6 weeks before it was shutdown because the tank's liquid level was being pumped below 64 in to support an Evaporator Campaign. At 64 inches, the annulus exhaust system must be shutdown as required per OSD 17.2.1.1, Primary Tank Liquid Level limit. 102-AY continued to operate for approximately 8 months until W-320 annulus modification work required the system to be shutdown.

In 1998, the W-320 project modified the AY-102 vent system to allow 100% of the flow through the air slots under the primary tank. In order to achieve enough airflow through the slots, the annulus vacuum had to be significantly increased. Project W-320 evaluated the structural design of the AY DSTs and concluded that the annulus primary tank could withstand a 20 inch water gauge vacuum in the annulus. The exhaust fan was modified to allow the higher vacuums of –12 inches to –18 inches of vacuum at approximately 1000 scfm flow. It should be noted, that the W-320 design change for the 102-AY annulus did not significantly change the flow rate. Sampling systems for both the record sampler and annulus CAM were evaluated by Engineering to determine if equipment changes were required to maintain representative sampling for the new flow conditions. No changes were made since the overall flow rate had not changed significantly.

OTP-320-001 was performed to test the new high vacuum system (Ref. HNF-2317 Operability Test Report). The system performed well. The average flow rate for the test was 1077 scfm with –16 inch vacuum. The average CAM reading was 413 cpm with a maximum CAM reading of 1100 cpm. The test demonstrated that there was no significant source of cross contamination as a result of the increased vacuum.

241-AY-102 Tank Integrity Evaluation

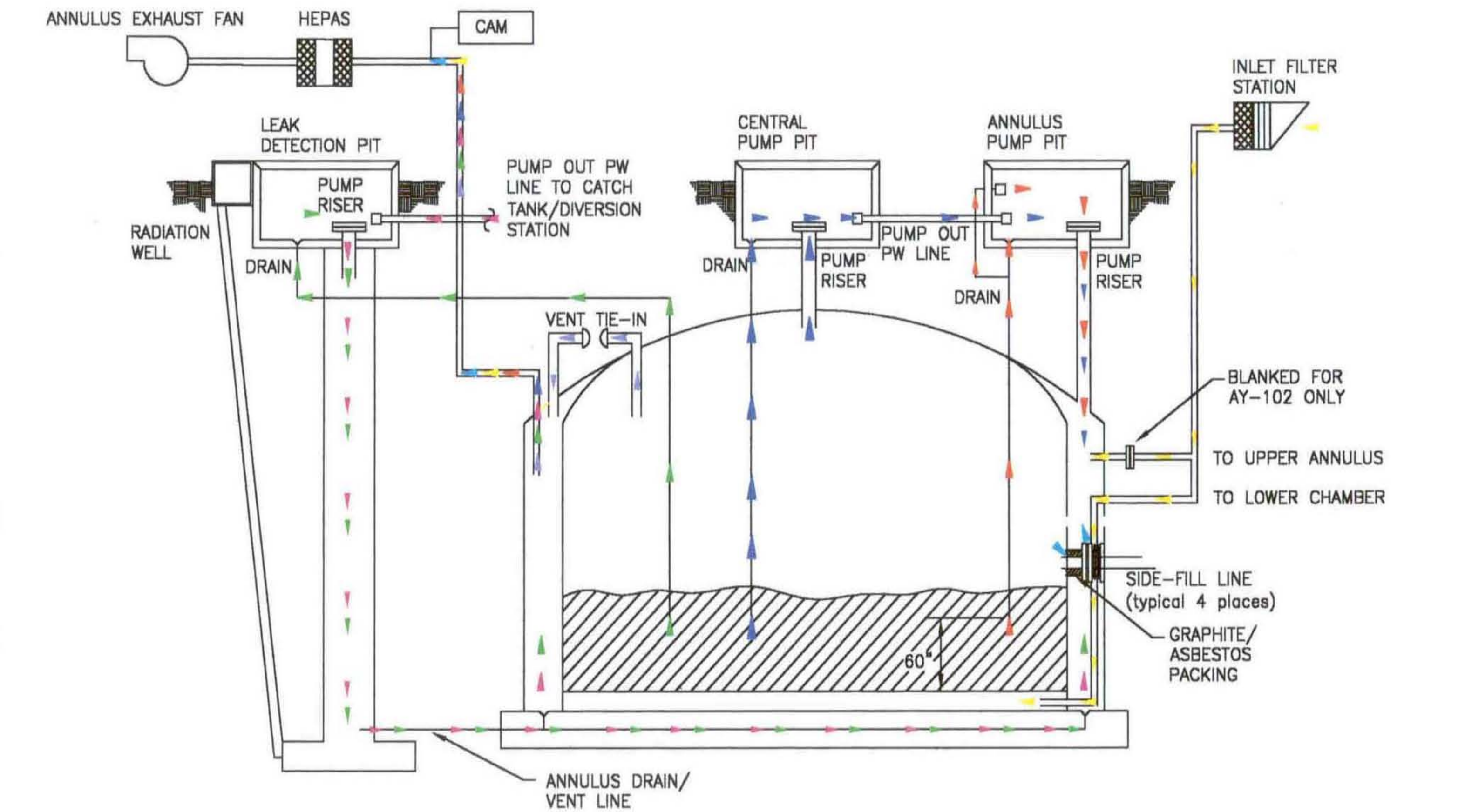
Over the past several months UT and video examinations were performed on the primary tank liner of 102-AY. Cameras, UT equipment, light sources and reach rods were used inside several risers and the annulus space. All equipment placed into the annulus space was removed with no measurable amount of contamination. Additional annulus and primary tank video examinations are planned for this year to view and then evaluate as much of the tank as practical.

II. Annulus CAM Behavior Evaluation

In August 1998, the Pacific Northwest National Laboratory issued PNNL-11956, "Calculation of SY Tank Annulus Continuous Air Monitor Readings After Postulated Leak Scenarios," in support of a Washington State Department of Ecology compliance inspection at 241-SY Farm. Table 1 of the report provides the expected CAM response for a 0.01 gallon per minute leak of tank waste. SY annulus exhaust rate was assumed to be 300 cfm. The report indicates that the count rate resulting from a leak of waste will be significantly higher than the CAM alarm set-point in a matter of minutes for a leak totaling 73 gallons, and a matter of just a few hours for the 0.01 gallon per minute leak. The CAMs are expected to reach their alarm state as a result of a very small leak well within the required twenty-four detection period required under 40 CFR 265 and WAC 173-303-640. Since the source term in AY-102 is greater than the source term in SY source term the response time should be similar.

We are currently reviewing the W-320 project files for the same setpoint calculation. In parallel we will reconstitute the setpoint calculation for the AY-102 annulus CAM. The calculation will be completed by July 6^{th}.

IV. AWF LEAK PATH DIAGRAM



PRIMARY TO ANNULUS VIA ANNULUS PUMP PIT

PRIMARY TO ANNULUS VIA LEAK DETECTION PIT AND ANNULUS VENT

PRIMARY TO ANNULUS VIA PRIMARY AND ANNULUS VENT TIE-IN

PRIMARY TO ANNULUS VIA INLET FILTER STATION

PRIMARY TO ANNULUS VIA CENTRAL PUMP PIT AND ANNULUS PUMP PIT

CATCH TANK/DIVERSION STATION TO ANNULUS VIA LEAK DETECTION PIT AND ANNULUS VENT

PRIMARY TO ANNULUS VIA SIDE-FILL LINE PACKING

POTENTIAL CROSS CONNECTIONS BETWEEN PRIMARY AND ANNULUS HEADSPACE

AGING WASTE FACILITY TANKS (TYPICAL)

8.0 Tank AY-102 Time Line of Events: Annulus ENRAF Leak Detectors, Continuous Air Monitor, Operational History, and Annulus Visual Inspections

8.1 Tank AY-102 Annulus ENRAF Leak Detectors Time Line

AY-102 Annulus ENRAF Leak Detectors		
Date	**Event**	**Reference**
May to June 2007	Riser 90 ENRAF above normal range and Environmental was notified. On 06-03-2007 Environmental was notified that all three annulus ENRAFs were out of range.	Personal Computer Surveillance Analysis Computer System (PCSACS)
05-21-2007	Work package was created to fix a faulty 10-in. gasket on Riser 88 (where ENRAF AY102-WSTA-LDT-151 is located). Air was sucking (easily heard standing near riser) into the annulus. If air could get in so could water. Metal tape has been used as a temporary patch to reduce the air/water in-leakage. This problem was never fixed and could be a source of water intrusion into the annulus.	WFO-WO-07-1451; Riser 88 Photo; Personal Communication G. R. Tardiff
07-02-2007	Riser 90 ENRAF declared out of service; plummet was stuck and needs calibration.	PCSACS
08-13-2007	Riser 90 ENRAF returned to service.	PCSACS
Jan. 2008 to Feb. 2009	4 incidents of ENRAF issues reported during this time relating to a broken ENRAF (AY102-WSTA-LDT-153) at Riser 91. Riser 91 ENRAF was replaced 02/02/2009 which fixed the drifting and other problems.	RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*
10-09-2011 to 10-10-2011	0.46 in. of rain occurred over a 6 day period. An additional 0.11 in. of rain fell on 10-10-2011.	Hanford Meteorological Station- October 2011 Month Summary
10-09-2011	Riser 90 ENRAF (AY102-WSTA-LDT-152) alarm above normal range; declared out of service.	PER-2011-2120, *Create Pre-Planned Work Package to Investigate Annulus Water Intrusion*
10-12-2011	Riser 90 ENRAF plummet is found wet ~ ½-in. up the plummet; some dose rate 2-4 mrem/hr in enclosure. Rainwater intrusion is thought to be the cause of the wetness.	TFC-WO-11-5469; TOC-ENV-NOT-2011-0012
10-13-2011	Ecology notified; Ecology visits.	TOC-ENV-NOT-2011-0012
10-13-2011	Bolts were reported to be missing on the AY-102 Riser 78 3-in. shield plug and the riser was only being held in place by some black tape. Bolts could have been missing as early as 2006. The flange was not very secure on the riser and could be a course of water intrusion into the annulus. Gasket and bolts were installed to reduce any in-leakage.	WRPS-PER-2011-2099, *Water intrusion into the AY-102 annulus*; Riser 78 Photo 1; Riser 78 Photo 2
10-17-2011	Ecology questions answered.	IDMS Accession 166681854
10-24-2011	Riser 90 ENRAF flushed with 10 gal of water and allowed to dry; dose 5 mrem/hr before flush then 1.5 mrem/hr after flush.	TFC-WO-11-5545; RSR WTO-022533
10-27-2011	Riser 90 ENRAF recalibrated and returned to service.	TFC-WO-11-5469
03-10-2012	Riser 90 ENRAF was declared out of service with a required repair date of 06-08-2012.	TOC-ENV-NOT-2012-0053
05-24-2012	During planned repairs to the Riser 90 ENRAF, the ENRAF displacer wire broke while attempting to retrieve the stuck displacer on the annulus floor.	TOC-ENV-NOT-2012-0053

AY-102 Annulus ENRAF Leak Detectors		
Date	**Event**	**Reference**
06-04-2012	A bullet-style video camera used to inspect Riser 90 ENRAF displacer in the annulus; Drum & reel contaminated 20,000 dpm/100 cm^2. Identified that the displacer was in a location that would interfere with the performance of the replacement ENRAF.	RPP-ASMT-53793; TOC-ENV-NOT-2012-0053
06-05-2012	Attempt to retrieve the stuck Riser 90 ENRAF displacer unsuccessful from the bottom of the annulus.	TOC-ENV-NOT-2012-0053
07-24-2012	Rotated upper flange of the riser to avoid the displacer and debris on the annulus floor; installed replacement drum and displacer on Riser 90. Functionally tested and returned to service.	TFC-WO-12-2156
08-05-2012	Annulus visual inspection in Riser 77 (mound) and Riser 87 (floor deposit) indicate material in vicinity of Riser 90.	RPP-RPT-34311, Rev. 1, *Double-Shell Tank Integrity Inspection Report for 241-AY Tank Farm*
08-10-2012	Removed Riser 90 ENRAF and performed visual inspection in Riser 90; floor sample ~800,000 dpm/probe area field measurement.	TFC-WO-12-4563; PER-2012-1379
08-13-2012	222-S Laboratory results of the annulus floor sample confirmed ^{137}Cs and ^{90}Sr in a ratio similar to sludge interstitial liquid (~40:1).	RPP-ASMT-53793
08-27-2012	Relocated Riser 90 ENRAF (AY102-WSTA-LDT-152) to Riser 89.	TFC-WO-12-4863
08-29-2012	Riser 89 ENRAF (AY102-WSTA-LDT-152) calibration which was completed the following day on 08-30-2012.	TFC-WO-12-4740

Note: Riser 90- ENRAF - AY102-WSTA-LDT-152 (moved to Riser 89 on 08-27-2012)
Riser 88- ENRAF - AY102-WSTA-LDT-151
Riser 91- ENRAF - AY102-WSTA-LDT-153

dpm = disintegrations per minute
IDMS = integrated document management system
mrem/hr = millirem per hour
PCSACS = personal computer surveillance analysis computer system

8.2 Tank AY-102 Continuous Air Monitor Time Line

AY-102 Annulus Continuous Air Monitor (CAM)		
Date	**Event**	**Reference**
Aug. 1975	A new radiation monitoring sampling system (continuous air monitor) was installed on AY-102 annulus exhaust.	ARH-LD-208-B, *ARHCO Monthly Report for August 1975*, page 11
1986-1987	High annulus CAM readings (between 5,000 and 20,000 cpm) were reported during this time (cause attributed to low liquid level in the tank uncovering drain leg from annulus pump pit).	Tardiff 2001, *Evaluation of AY-102 Annulus CAM Readings*
1997-1998	Four CAM readings were reported over 3,000 cpm (cause likely attributed to the significant changes made to the airflow through the annulus in 1998).	Tardiff 2001
01-09-1999 to 01-11-1999	Swabs of the tank annulus were taken on the sides of the primary tank and the annulus floor. No contamination was found.	HNF-4798, Rev. 0, *Tank 241-AY-102 Annulus Continuous Air Monitor High Readings*; RL-PHMC-TANKFARM-1999-0024, *AY-102 CAM Anomalous Readings*
02-17-1999	AY-102 annulus pump pit smears showed 2,000-3,000 dpm/100 cm^2. Drain line plug reseated during swabbing and annulus CAM counts decreased afterwards.	HNF-4798, Rev. 0
2001	Increased count rates on the AY-102 annulus leak detection CAM. Concluded to be the result of previous contamination of the annulus pump pit and movement into the annulus through deteriorating seals/gaskets in the pump pit.	Tardiff 2001
10-21-2011	Annulus CAM sample paper changed as part of regular biweekly monitoring routine.	RPP-ASMT-53793
10-26-2011	AY-102 annulus CAM alarms (2 days after Riser 90 ENRAF flush); air sample collected identified as 4,200 cpm via field count (CAM set point 2,000 cpm); sample sent to counting lab. Some radon progeny identified in sample by alpha spectroscopy after 1 day decay. Counting lab results. Air sample 10-21-2011 to 10-26-2011: α µCi/mL β µCi/mL β ncpm Initial 6.40E-13 4.32E-11 18,840 1 day decay 2.16E-13 4.22E-11 18,400 7 day decay 3.06E-14 4.14E-11 18,270 ^{137}Cs in CAM air sample (from 10-21-2011 to 10-26-2011) identified in gamma energy analysis on 11/14/2011, 1.46E-11 µCi/mL.	Sample CR11-02070; RPP-ASMT-53793
11-08-2011	AY-102 annulus exhaust shut down; 2 of 8 HEPAs failed penetration test, 99.994% and 99.986%.	TOC-ENV-NOT-2011-0022
11-09-2011	WDOH notified.	TOC-ENV-NOT-2011-0022
01-13-2012	Annulus HVAC back on line.	TFC-WO-11-5789
08-14-2012	Annulus CAM calibration and function test completed.	TFC-WO-12-4589

AY-102 Annulus Continuous Air Monitor (CAM)		
Date	**Event**	**Reference**
09-27-2012	Annulus CAM alarmed ~11am. CAM paper was changed and the alarm cleared. The record sampler paper was also changed; no action levels detected on the record sampler paper. CAM alarmed after 09-26-2012 sampling event at Riser 83, less than 24 hrs. Field count 7,734 cpm.	Sample CR12-01573; RPP-ASMT-53793
10-16-2012	Annulus CAM alarmed 8-9pm the day after the 10-15-2012 sampling event during dayshift at Riser 90. 1 day decay sample count 18,729 cpm on 10-17-2012.	Sample CR12-01717; RPP-ASMT-53793
10-18-2012	Annulus CAM alarmed the day after the 10-17-2012 sampling event during dayshift at Riser 90.	RPP-ASMT-53793

Note: PCSACS = personal computer surveillance analysis computer system
WDOH = Washington State Department of Health

8.3 Tank AY-102 Operational Time Line

AY-102 Operational History		
Date	**Event**	**Reference**
1968-1971	AY Farm construction. AY-102 was the first DST to be constructed.	RPP-ASMT-53793
Feb. 1971	AY-102 initially filled with 264 kgal of water and heated to prepare the tank to receive HLW. Tank designated as aging waste spare.	PPD-421-DEL, *U.S. AEC Richland Operations Office Monthly Report for February 1971*, Page AIV-16
March 1971	Preheating of AY-102 continued intermittently throughout the month. Water temperature was 163°F at month end.	PPD-429-DEL, *U.S. AEC Richland Operations Office Monthly Report for March 1971*, Page AIV-16
March 1972	Received waste water from tank A-104: 62 kgal in the 1st quarter and 60 kgal in the 2nd quarter. AY-102 was maintained at ~160°F to evaporate added water.	WHC-MR-0132, *A History of the 200 Area Tank Farms*, page 102-AY-3
April 1972	AY-102 water level of 86 in. and water temperature of 166°F.	PPD-493-4-DEL, *U.S. AEC Richland Operations Office Monthly Report for April 1972*, Page AIV-18
July 1972	AY-102 was reported at a temperature ~126°F and holding 91 in. of water.	PPD-493-7-DEL, *U.S. AEC Richland Operations Office Monthly Report for July 1972*, Page AIV-18
1972	Condensate was periodically added from tank A-417 to maintain the liquid level between 72 in. and 80 in.	Internal Memo 1007190520, *December 1972 Monthly Report*
May 1974	The liquid in AY-102 was sampled and showed a pH of 11.1. It is plausible the waste water and/or condensate added from tank A-417 was alkaline.	Occurrence Report 74-30, *Failure to Obtain Routine Monthly Samples in Tank 102-AY*
Aug. 1975	A new radiation monitoring sampling system (continuous air monitor) was installed on AY-102 annulus exhaust.	ARH-LD-208-B, *ARHCO Monthly Report for August 1975*, page 11
11-09-1975	Misrouting of 2,750 gal of B Plant waste into waste into tank 241-AY-102 instead of 241-A-103. AY-102 reported to be maintained at 120 to 140°F as an aging waste spare; also receives "... sump batches from the diverter stations." [Note: PUREX Current Acid Waste was transferred from 1968 to 1972 through the 151-AX diverter station to AR Vault and then to B Plant for processing. Waste from the PUREX acified sludge solvent extraction process was transferred to AY-101 (not AY-102) beginning in 1971].	ARH-LD-211-B, *ARHCO Monthly Report for November 1975*, page 11; Occurrence Report 75-127, *Misrouting of Process Solution*; ARH-CD-691, *1976 Strontium Recovery from PUREX Acified Sludge*
May-June 1976	Excessive annulus ventilation system negative pressure was reported in the AY Farm tanks. The system was reported in June 1976 to be operating with a riser open on the annulus.	ARH-LD-217-B, *ARHCO Monthly Report for May 1976*, page 12
June 1976	Steam coil was reported to be operated to maintain the tank liquid level and reduce buildup of radioactive material on the filters of the 702-A vessel ventilation building.	ARH-LD-218-B, *ARHCO Monthly Report for June 1976*, page 12
July 1976	It was reported that direct steam addition was installed on the tank AY-101 seal loop to provide the necessary moisture for controlling the contamination of the filters in the 702-A vessel ventilation building. Operation of the steam coil in tank AY-102 "... must be limited due to the low pH condensate which is produced and the excess heat which is added to Tank 102-AY."	ARH-LD-219-B, *ARHCO Monthly Report for July 1976*, page 16

AY-102 Operational History		
Date	**Event**	**Reference**
10-04-1976	Liquid level decrease of 2.5 in. over 5 days exceeded criteria of 0.5 in. over 7 days following shutting off steam to heating coil.	ARH-LD-222-B, *ARHCO Monthly Report for October 1976*, page 7; Occurrence Report 76-138, *Liquid Level Decrease Exceeding Criteria*
10-22-1976	Tank liquid level was pumped down to 15 in. Minimum liquid level specification was 15 in. (with the annulus ventilation system operating) during this time period to prevent bottom uplift. The standard states a minimum liquid level of 17 in. Liquid level below 60 in. opens a pathway for contamination in the annulus pump pit. On 10-29-1976, the annulus ventilation was shut off and process condensate was added to raise the tank liquid level to 20 in.	ARH Occurrence Report 76-148, *Possible Specification Violation: Liquid Level Decrease to Below a Minimum Level*; ARH-1601, *Specifications and Standards for the Operation of Radioactive Waste Tank Farms and Associated Facilities*
Oct. 1976	Liquid pumped from AY-102 to A-101. A system was installed for direct steam addition on the Tank AY-102 seal loop, similar to Tank AY-101 to eliminate the use of the steam coil in Tank AY-102.	ARH-LD-222-B, *ARHCO Monthly Report for October 1976*, page 14
March-April 1977	AY-102 started receiving evaporator feed "aging waste" (dilute supernatant) from B Plant.	WHC-MR-0132, *A History of the 200 Area Tank Farms*; WHC-SD-WM-ER-454, Rev. 0, *Tank Characterization Report for Double-Shell Tank 241-AY-102*
May 1977	AY-102 received ~198 kgal of Battelle Northwest Laboratory (BNW) waste which apparently included 16 casks of high-level waste (HLW) received from BNW at B Plant, 130 kgal of waste from B Plant which was low in ^{137}Cs and ^{90}Sr, and 35 casks in preparation for the Commercial Nuclear Waste Vitrification Program.	ARH-LD-229-B, *ARHCO Monthly Report for May 1977*, page 31
1978	In the 1st and 2nd quarters of 1978, Tank AY-102 received approximately 157 kgal of commercial vitrification process test waste. In the 3rd and 4th quarters, AY-102 received 14 kgal of double-shell slurry feed (DSSF).	WHC-SD-WM-TI-689, Rev. 1, *Waste Status and Transaction Record Summary for the Southeast Quadrant of the Hanford 200 Area*; WHC-SD-WM-ER-454, Rev. 0, *Tank Characterization Report for Double-Shell Tank 241-AY-102*
1980	In the 2nd quarter of 1980, ~ 302 kgal of DSSF was added with a reported solids level at 21 kgal on June 20, 1980.	WHC-SD-WM-ER-454, Rev. 0, *Tank Characterization Report for Double-Shell Tank 241-AY-102*
08-17-1981	Misrouting of waste to Tank AY-102 from Tank AY-101 leading to a liquid level increase of 0.2 in.	Occurrence Report 81-52, *Misrouting TK-AY-101 to TK-AY-102*
1981	AY-102 received plutonium uranium extraction miscellaneous waste, low-level dilute non-complexed waste from B-Plant cesium and strontium processing, and other dilute non-complexed wastes, and water until the second quarter of 1985.	RPP-RPT-42920, Rev. 0, *2009 Auto-TCR for Tank 241-AY-102*
1983	AY-102 ventilation system modified to eliminate the supply fans and begin operating the annulus under more negative pressure than the primary tank.	Tardiff 2001

AY-102 Operational History		
Date	**Event**	**Reference**
1984	Failure of line SL-233 (from B Plant to 244-A) after being in service since 1975.	WHC-SD-RE-TI-148, *Rev. 0, Metallurgical Analysis of Leak Failure of 241-A-B Valve Pit Jumper*
1985	AY-102 received dilute non-complexed waste from N Reactor, B-Plant vessel clean out and B-Plant low-level wastes from B-Plant, low-level non-complexed waste from T-Plant, and laboratory wastes until the first quarter of 1996. Large transfers were made to Tanks AW-102, AW-106, AP-103, AP-104, AP-106, and AP-108 during this period.	RPP-RPT-42920, Rev. 0, *2009 Auto-TCR for Tank 241-AY-102*
Jan. and May 1986	During transfers from AY-102 to AW-102, liquid levels indicate level was below 60 in. (the minimum operating specification at this time). Potential pathway exists for contamination in the annulus pump pit.	TWINS; PCSACS; OSD-T-151-00017, Rev. B-0
03-31-1986	Annulus vent system was punctured and found severely corroded.	7G410-JKE/MJR-007-005, *Evidence of Annulus Moisture Accumulation in Tanks 241-AY-101 and 241-AY-102*
1988-1989	Original annulus ventilation system replaced for AY-102 by Project B-672. The original annulus ventilation system was abandoned in place, cut and capped piping, installed new/upgraded ventilation system.	7G410-JKE/MJR-007-005
June 1991	AY-102 annulus ventilation system shut down and remained down until March 1997.	7G410-JKE/MJR-007-005
11-28-1991	Misrouting from the saltwell receiver tank 244-CR-003 leading to a liquid level rise of 0.2 in. in Tank AY-102.	Occurrence Report RL-WHC-TANKFARM-1991-1068, *Unexpected Rise in DST 241-AY-102 Liquid Level during Transfer of Waste from Catch Tank 244-CR-003 to DST 241-AY-101*
06-08-1994	AY-102 grab samples reported to be out-of-specification for hydroxide (pH reported to be between 10.4 to 10.7). Samples were re-analyzed 08-19-1994 and consistent with June 1994 results.	Occurrence Report RL-WHC-TANKFARM-1994-0046, *Analysis of Waste Samples Results in Discovery of Out-of-Specification Levels of Hydroxide in 200 East Area Waste Tanks*
Sept. to Nov. 1994	Approximately 90,000 gram moles of NaOH was added to Tank AY-102.	RPP-7795, Rev. 9, *Technical Basis for Chemistry Control Program*
10-26-1994	During a flush of line SL-503 (connects AY-102 sluice pit 02D to central pump pit 02A), a leak was discovered within the AY-102 02D sluice pit. It was determined that line SL-503 failed and a ½ in. by ¾ in. hole was discovered in the carbon steel section and appeared to have developed from the inside and progressed through the pipe wall. The stainless steel section of the pipe appeared to be in good condition.	Occurrence Report RL-WHC-TANKFARM-1994-0059, *During a Flush of Waste Transfer Line SL-503, a Leak within the 241-AY-102 02D Sluice Pit was Discovered*
09-18-1995	AY-102 supernatant reported to be out-of-specification with a hydroxide concentration less than 0.0025 M.	Occurrence Report RL-WHC-TANKFARM-1995-0105, *Tank 102-AY Chemistry Analysis Reveals Low Hydroxide Content*; RPP-7795, Rev. 9
01-16-1996	Added 1,700 gal of 50 wt% NaOH to Tank AY-102.	RPP-7795, Rev. 9
July 1996	AY-102 chemistry reported to be out-of-specification.	RPP-7795, Rev. 9
Aug. to Oct. 1996	Waste mixing + 5,500 gal 50 wt% NaOH + 4,200 gal 10-15 wt% NaOH.	RPP-7795, Rev. 9

AY-102 Operational History		
Date	**Event**	**Reference**
March 1997	AY-102 annulus ventilation system comes back online after being off for approximately 6 years. The AY-102 annulus ventilation system operates for ~8 months until Project W-320 required the system to be shut down.	RPP-7695, *Double-Shell Tank Annulus Ventilation Engineering Study*
09-08-1997	Misrouting to Tank AY-102 as a result of a leaking valve from AY-101.	Occurrence Report RL-PHMC-TANKFARM-1997-0073, *Leak through of a Newly Installed Process Valve*
Sept. 1997	Addition of approximately 10 kgal of caustic deficient waste from AY-101.	TWINS, Tank Transfers (Pre-2001)
Jan. 1998	Sludge interstitial liquid of AY-102 was less than the detection limit for hydroxide.	Interoffice memo 7KN00-00-TCO-039
June to July 1998	Addition of 21,650 gal of 50 wt. % NaOH with subsequent mixing with air lift circulators.	Interoffice memo 7KN00-00-TCO-039
July 1998	389 kgal of dilute non-complexed waste was transferred out of Tank AY-102 to Tank AW-102.	TWINS, Tank Transfers (Pre-2001)
Nov. 1998 to Oct. 1999	97% of the high-heat sludge from tank C-106 was sluiced to Tank AY-102 using the supernatant in Tank AY-102 as the sluicing medium; ~187 kgal of waste from C-106.	RPP-RPT-32137, Rev. 0, *Ultrasonic Inspection Results for Double-Shell Tank 241-AY-102- FY2007*; RPP-19919, Rev. 0, *Campaign Report for the Retrieval of Waste Heel from Tank 241-C-106*
March 1999	Tank annulus swabs of primary wall and floor were taken with no contamination detected.	Occurrence Report RL-PHMC-TANKFARM-1999-0024, *AY-102 CAM Anomalous Readings*
1999	Annulus exhaust system modified by Project W-320 to support C-106 sluicing. Rerouted all airflow through vent lines leading into AY-102 refractory concrete. Annulus vacuum increased to ~15 in.	RPP-RPT-25731, Rev. 27, *System Health Report for East Base Operations AY/AZ Farm Waste Tank Structures Mixing and Monitoring System for the Fourth Quarter CY 2011*; Project W-320 for vent upgrades.
1999	Level in AY-102 leak detection pit starts to increase after years of a low, steady level. Increased to above OSD limit in September 1998. Coincident with increase of annulus negative and C-106 transfers.	PCSACS
06-04-1999	Initial UT inspection of AY-102 and data showed no reportable indications.	HNF-4818, *Final Results of Double-Shell Tank 241-AY-102 Ultrasonic Inspection*
July 1999	Added 4.5 kgal of 50 wt. % NaOH- predicted to be out of specification. Prior depletion rate was approximately 0.5M/yr.	Interoffice memo 7KN00-00-TCO-039
12-13-1999	During excavation for Project W-320, holes were found in original annulus ventilation piping.	7G410-JKE/MJR-007-005
Dec. 1999	AY-102 chemistry reported to be out-of-specification.	RPP-7795, Rev. 9
June 2000	Interstitial liquid in sludge layer of AY-102 below administrative control (AC) 5.16 lower limit for both hydroxide and nitrite.	CH2M-0303535, R21, *Contract Number DE-AC27-99RL14047-Revised Tank 241-AY-102 Recovery Plan to Restore Chemistry Control*; Tank 241-AY-102 Recovery Plan, Rev. 5

AY-102 Operational History		
Date	**Event**	**Reference**
10-20-2000	AY-102 calculated hydroxide (based on pH results) reported to be out-of-specification. Nitrite concentrations in sludge were below the detectable limit.	Occurrence Report RP-CHG-TANKFARM-2000-0073, *Calculated Hydroxide and Nitrite Readings are below Specification Limits of TSR Administrative Control 5.15 Limits*
1999-2003	AY-102 leak detection pit hovers around "historical" level of 39 in.	PCSACS
Feb. 2001	Added 72 kgal of 25-wt% NaOH for corrosion control.	RPP-RPT-34311, *Double-Shell Tank Integrity Inspection Report for 241-AY Tank Farm*
March 2001	Interstitial liquid from the sludge layer of AY-102 was below the AC 5.16 limit for both nitrite and hydroxide. Established the TSR Corrosion Mitigation Control.	Occurrence Report RP-CHG-TANKFARM-2003-0033; Recovery Plan No. TFRP-03-02; Sample results, Letter FH-0103293
04-19-2001	AY-102 sludge chemistry identified as out-of-specification for chemistry control for nitrite concentration.	Occurrence Report RP-CHG-TANKFARM-2000-0073, *Calculated Hydroxide and Nitrite Readings are below Specification Limits of TSR Administrative Control 5.15 Limits*
11-30-2001	Added 62 kgal of 40-wt% $NaNO_2$ for corrosion control.	RPP-RPT-34311
12-06-2001	Corrosion observed on AY-102 primary tank during video inspection of the annulus section attributed to water intrusion from external sources, coupled with shutdown of the annulus ventilation system for an extended period.	Occurrence Report RP-CHG-TANKFARM-2001-0106, *Corrosion Observed in Double-Shell Tank 241-AY-102 during Video Inspection of the Annulus Section*
06-12-2002	Failure to support a Defense Nuclear Facilities Safety Board (DNFSB) staff request to review the reasoning for considering AY-102 to be a unique event in nitrite depletion.	PER-2002-3409, *Low Nitrite Cause Not Evaluated*
July 2002	AY-102 began receiving dilute non-complexed condensate transfers from catch tank 241-AZ-151 (Periodic condensate additions starting July 2002 until October 2005).	Letter Report CH2M-0303535, R21, Recovery Plan No. TFRP-03-02
Sept. 2002	Electrochemical corrosion testing out-of-specification, AY-102 sludge results in little to no corrosion.	RPP-12077, *Electrochemical Corrosion Study for tank 241-AY-102 Sludge*
10-17-2002	The condensate added to AY-102 does not appear to be mixing with the supernatant which could result in the surface layer of the waste not being in compliance with the AC 5.15 Chemistry Control Limits. It was recommended that samples should be taken.	PER-2002-5680, *Potential Mixing of Condensate not Occurring Causing AC 5.15 Compliance Question*
Nov. 2002	Grab samples were taken from AY-102. Sample results showed the tank waste was in chemistry limits and reasonably well-mixed just four days after condensate addition.	PER-2002-5680
Feb. 2003	Corrosion product sampled from annulus side of primary tank and found no radioactivity.	RPP-15758, *Analysis of Corrosion Product Retrieved From The Primary Tank Wall in the Annulus of Tank 241-AY-102*
2003	Unknown drop in level in AY-102 leak detection pit.	PER-2003-1048, *AY801-WSTA-WFI-122 Level Going Down*

AY-102 Operational History		
Date	**Event**	**Reference**
April 2003	Received a transfer of 29.2 kgal from Tank C-106 retrieval decant operation (18 kgal residual supernatant and 11 kgal flush water). AY-102 sludge samples were out-of-specification for hydroxide and nitrite concentrations.	Letter Report CH2M-0303535 R21; Occurrence Report RP-CHG-TANKFARM-2003-0033, *Sample Results from 241-AY-102 Below Required Administrative Control (AC) 5.15 Limits*; RPP-19919, Rev. 0; TWINS; PER-2003-2580, *AY-102 Core Sample pH Results Non-Reportable*
Nov. 2003	Bottom region of sludge layer is still outside the AC 5.16 limit for nitrite and hydroxide. Dynamic mixing model indicates OH^- concentration will be within limits between Feb 2004 and July 2005. A PER was written as a result of an immiscible liquid phase found in the AY-102 sludge samples. Core sample results indicated layering of the supernatant with a large concentration gradient. This indicates mixing is not occurring between the AZ-151 condensate transferred into AY-102 with the rest of the supernatant forming a "cold cap."	Letter Report CH2M-0303535, R21, Recovery Plan No. TFRP-03-02; PER-2004-1247, *Continued Condensate Transfers into AY-102 May Cause Supernate to Fall Outside Corrosion Limits*; PER-2003-5225, *An Immiscible Liquid Phase was Found in Tank 241-AY-102 Sludge Samples Being Analyzed at the 222-S Laboratory*
2004	ENRAFs installed in AY/AZ annulus for leak detection replacing conductivity probe.	ECN-720173 R2, *241-AY-102 Annulus Leak Detection using Three ENRAF Level Gauges*
04-15-2005	In the process of removing a drill string from Riser 58, the lower half of the drill string (approximately 33 ft long and weighing 125 lbs) fell into Tank AY-102 (approximately 27 ft) after it disconnected from the upper section. Dropped portion of the drill string has remained upright through a waste transfer to 80 in. with 60 in. of solids as identified in the 2012 in-tank visual inspection.	PER-2005-1582, *Lower half of drill string fell into AY-102 when it was disconnected from the upper section*; RPP-RPT-25778, *Analysis for Continuing Core Sampling of Tank 241-AY-102, Riser 058*
April/May 2005	Supernatant sample data indicated the waste surface of AY-102 was nearing the AC 5.16 lower limit of 0.01M as a result of 241-AZ-151 condensate additions since July 2002. Interstitial liquid data was invalid for this sampling event. From the surface layer and thermocouple readings, it was evident that a "cold cap" formed from condensate additions not mixing with supernatant below it.	Letter Report CH2M-0303535, R21, Recovery Plan No. TFRP-03-02; Interoffice Memo 7G300-03-MAK-004, *Effect of Tank 241-AZ-151 Condensate Additions on Tank 241-AY-102 Chemistry Control*, February 18, 2003
May 2005	Added 10 kgal of 4-wt% NaOH for corrosion control to mitigate the "cold cap."	Letter Report CH2M-0303535, R21
July 2005	Concerns related to the pH measurement from the May dilute NaOH addition led to a 9,900 gal second addition of 1M NaOH in mid-July, prior to the sampling event.	Letter Report CH2M-0303535, R21; Recovery Plan No. TFRP-03-02

AY-102 Operational History		
Date	**Event**	**Reference**
Aug. 2005	Interstitial liquid in lower portion of sludge of AY-102 remains below the AC 5.16 chemistry limits for nitrite and hydroxide, however concentrations are slowly increasing due to natural mixing. AY-102 supernatant was an order of magnitude above the AC 5.16 chemistry limit. The Riser 29 temperature profile indicates the "cold cap" is still present.	Letter Report CH2M-0303535, R21; PER-2005-3074, *AY-102 Preliminary Results Below (AC) 5.16 Chemistry Control Limit*; PER-2005-3187, *AY-102 Preliminary Results Below (AC) 5.16 Chemistry Control Limit*
09-27-2005	Authorization to combine hot commission low activity waste (LAW) (AP-101) with HLW (AY-102/C-106).	Letter DOE-ORP: 05-TPD-082, *Contract Number DE-AC27-99RL14047- Approval to Consolidate Waste Treatment and Immobilization Plant (WTP) Hot Commissioning Feeds Stored in Tanks 241-AP-101 and 241-AY-102*
Oct. 2006	Concern of Stress Corrosion Cracking in lower knuckle of AY-102 due to out-of-specification chemistry.	PER-2006-1799, *UT Examination of the AY-102 Knuckle Region (for cracking and pitting) is Vital to Assure the Safe Operation of the Tank*
Dec. 2006	715 kgal of AY-102 supernatant pumped out to AN-106 and AW-102.	Letter Report CH2M-0502844 R5, *Contract Number DE-AC27-99RL14047- Request for Approval of Revised Tank 241-AY-102 Recovery Plan*; TWINS
Dec. 2006	AY Farm visual inspections capture signs of ongoing water intrusion in the AY annuluses. Follow-up investigations include identifying possible water sources and pathways. Report issued July 2007.	7G410-JKE/MJR-007-005; RPP-RPT-34311
2006	Tested corrosion potential of AY-102 of out-of-specification of sludge interstitial liquid using waste simulants.	RPP-RPT-31932, *Interim Report Hanford Tanks AY-102 and AP-102: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking*
Jan. 2007	Addition of 782 kgal of AP-101 supernatant as authorized by Letter 05-TPD-082 on 09-27-2005. This was the last transfer for AY-102 to present. The calculated supernatant concentration after AP-101 transfer was 2.19M OH^-, 0.87M nitrite, and 1.73M nitrate.	Letter Report CH2M-0502844 R5; TWINS; SVF-1342, *AY102 FY07 Q3 Supernatant PK Vector*
March 2007	Tanks AY-101 and AY-102 Annulus Corrosion Recovery Plan, Rev. 0, submitted to the U.S. Department of Energy.	CH2M-0700558, *Contract Number DE-AC27-99RL14047- Request for Approval of Tanks 241-AY-101 and 241-AY-102 Annulus Corrosion Recovery Plan*

AY-102 Operational History		
Date	**Event**	**Reference**
May 2007	Moisture intrusion analysis indicates that natural precipitation is the likely source of water intruding into annulus of tanks AY-101 and AY-102. Tanks AY-101 and AY-102 settlement surveys completed to check for dome deflection.	RPP-RPT-37440, Rev. 0; RPP-ASMT-34090, Rev. 0, *Hanford Double-Shell Tank Thermal and Seismic Project-Effects of Dome Rebar and Concrete Degradation*; RPP-RPT-33273, Rev. 0, *241-AY-101/AY-102 Annulus Moisture Intrusion Analysis*
Aug. 2007	Analysis of neutron probe data indicated no buildup of water in the soil above the AY tanks indicative of preferential or collection areas.	7G410-JKE/MJR-007-005; CH2M-0700558 R4
08-14-2007	AY-102 leak detection pit pumped out.	CH2M-PER-2007-1975, *The AY-102 Leak Detection Pit has been Increasing*
Sept. 2007	Closed check valves downstream of valve V-141 to isolate raw water supply to 241-AX, -AY, and –AZ Farms.	RPP-RPT-37440, Rev. 0
09-28-2007	Leak detection pit exceeds OSD of 20 in.	CH2M-PER-2007-1975
10-25-2007	The Tanks AY-101 and AY-102 Annulus Corrosion Recovery Plan included a requirement to complete collection of the AY-101 annulus psychrometric data and make recommendations for future data collected needed to identify the ingress of water to the annulus. It was concluded that psychrometric data are not a reliable detection method for the onset of water ingress.	CH2M-0700558 R5; RPP-35008, Rev. 0, *AC-5.16 Engineering Evaluation Methodology and Sampling Strategy*
10-26-2007	Failed attempt to pump out the leak detection pit due to contamination detected in the transfer tubing.	CH2M-PER-2007-1975
10-30-2007	AY-102 leak detection pit level increasing by ~1.6 gal/day since 08-14-2007.	CH2M-PER-2007-1975
11-08-2007	The Tanks AY-101 and AY-102 Annulus Corrosion Recovery Plan included assessing the technical feasibility of performing a Fluorescein dye tracer test for potential leakage. It was determined the dye tracer test was not a feasible water ingress pathway detection method.	CH2M-0700558 R6
12-21-2007	Safety Evaluation Report replacing the annulus psychrometric data with periodic annulus video inspections as a result of the closure of the Tanks AY-101 and AY-102 Annulus Corrosion Recovery Plan.	DOE-ORP: 07-TED-055
2007	Expert panel reviewed and concurred of AY-102 sludge interstitial liquid corrosion potential and concluded low propensity for corrosion. Recommended installation of a corrosion probe.	RPP-ASMT-35619, *Expert Panel Oversight Committee Assessment of FY2007 Corrosion & Stress Corrosion Cracking Simulant Testing Program & the Impact on DST 241-AY-102*
2007	UT inspection of AY-102 and data indicated 5 areas of reportable wall thinning, multiple pit-like indications, but no cracking in any of the areas examined. Observed pit depth remained unchanged between 1999 and 2007. After UT inspection, no contamination of the equipment was observed.	RPP-RPT-32137, Rev. 0, *Ultrasonic Inspection Results for Double-Shell Tank 241-AY-102- FY2007*
12-05-2007	Samples collected from AY-102 leak detection pit resulting in a pH of 7.92, clear colorless liquid, and low but detectable uranium, ^{137}Cs, ^{90}Sr. Low but detectable sulfate, chloride, and nitrate. Confirmed that waste was not leaking from the primary tank.	RPP-RPT-36150, *Final Report for the 241-AY-102A Leak Detection Pit Grab Samples in Support of the Waste Compatibility Program*; CH2M-PER-2007-1975

AY-102 Operational History		
Date	**Event**	**Reference**
Jan. 2008	Raw water header cut and capped west of AN Farm to isolate all raw water supplies to 241-AX, -AY, and –AZ Farm.	RPP-RPT-37440, Rev. 1, *Tank 241-AY-101 Interim Surface Barrier Feasibility Study*
02-25-2008	Leak detection pit pumped out and the level in the pit remained constant.	CH2M-PER-2007-1975
05-21-2008	Leak detection pit pumped out.	PCSACS
July 2008	Leak detection pit exceeds OSD level.	PCSACS
03-26-2009	A 12-in. spool piece was installed on Riser 73 after it was found that the probe came in contact with the bottom of the tank 4-6 times as the probe was being installed. A recent dimensional analysis indicated the riser and bottom of the tank elevations were incorrect resulting in an approximate 8-in. discrepancy. However, there was limited potential for damage due to controlled installation speed.	RPP-ASMT-53793
July 2009	The new interstitial liquid chemistry limits for AY-102 were implemented into OSD-T-151-00007, Table 1.5.1-2. The limits for AY-102 interstitial liquid require a pH $\geq$ 10 with a temperature of $\leq$ 122°F.	OSD-T-151-00007, Rev. 2
08-14-2009	Closure of Technical Safety Requirement Recovery Plan for water intrusion into the annuli of Tanks AY-101 and AY-102. Concluded water no longer entering annuli of Tanks AY-101 and AY-102.	WRPS-0901335, *Contract Number DE-AC27-08RV14800-Washington River Protection Solutions LLC Closure of Technical Safety Requirement Recovery Plan for Water Intrusion into the Annuli of Tanks 241-AY-101 and 241-AY-102*
09-29-2009	Closure of Operating Specification document Recovery Plan for Tank AY-102.	WRPS-0901379
2010-2012	Manual readings for the AY-102 leak detection pit marked as suspect should be 13-15 in. higher due to high annulus vacuum.	PCSACS
12-29-2011	Insulating concrete exceeds 161°F (TE-005, TE-006, 21-ft from the center of the tank).	RPP-RPT-25731, Rev. 27, *System Health Report for East Base Operations AY/AZ Farm Waste Tank Structures Mixing and Monitoring System for the Fourth Quarter CY 2011*
01-02-2012	A sludge temp of 165°F is recorded in AY-102 (TE-073 /Riser 72 *TIC* 1), exceeds DST Time to Lower Flammability Limit of 161°F.	RPP-RPT-25731, Rev. 27
05-01-2012	The AY-102 supernatant consists of 702 kgal, the sludge solid is 119 kgal, and the interstitial is 32 kgal.	TWINS
09-05-2012	Sampled the AY-102 leak detection pit and sent samples to 222-S Laboratory. Sample indicated very low levels of ^{137}Cs and ^{90}Sr with a pH between 6.6 and 6.9, all of which indicated the liquid was not tank waste.	RPP-RPT-53805, *Final Report for 241-AY-102A Leak Detection Pit Grab Samples in Support of Waste Compatibility*
09-10-2012	Survey swabs of the material on the annulus floor underneath Riser 90 were retrieved. Contamination reading of 800,000 dpm was reported.	RPP-ASMT-53793
09-19-2012	Completed pumping of the AY-102 leak detection pit to Tank AY-101 central pump pit. Level at AY-102 leak detection pit following pumping was approximately 1-in.	Personal communication J. K. Engeman

AY-102 Operational History		
Date	**Event**	**Reference**
09-24-2012	At 0900, AY-102 leak detection pit sump level reading was zero (Riser closed and annulus pressure -12 in.). Camera confirmed that no bubbles were being forced into the sump liquid. At 1330, the sump level reading was 1.65 in. Camera confirmed that air was being forced into the water below the dip tube. At 1350, the level was at 1.84 in. (Riser open). Top hat was not sealed during these inspections.	Personal communication J. K. Engeman
09-25-2012	The AY-102 leak detection pit sump level was reading zero at 1400 hrs (Riser closed and annulus pressure -12 in). The level had apparently diminished substantially from the previous day (1 in. = 7.5 gal).	Personal communication J. K. Engeman
09-26-2012	Took a sample (~1 Tbl) of the material (beneath Riser 83) through Riser 91. Dose rate readings of the sample were 45 mr/hr. The sample was sent to the lab on 09-27-2012. A video under Riser 83 was taken to support the sampling effort. Sample results indicate principal constituents included: $NaNO_3$, Na_2CO_3, $NaNO_2$, KNO_3, Cs-137 (90.9 μCi/g), and Sr-90 (0.120 μCi/g). The AY-102 leak detection pit sump level was 0.6 in. at 0900 hrs (Riser closed and annulus pressure -3.5 in.). At 0930 hrs, sump level was 2.22 in. (Riser open and annulus pressure -3.5 in.). At 0935 hrs, sump level was 0.62 in. (Riser closed and annulus pressure -3.5 in.).	RPP-ASMT-53793; Personal communication J. K. Engeman
10-01-2012 to 10-05-2012	Took liquid level reading of AY-102 leak detection pit each day. Last level reading on 10-05-2012.	Personal communication J. K. Engeman
10-10-2012	Sampling event at Riser 90 during day and swing shift. Due to difficulties, no sample was retrieved.	Personal communication J. K. Engeman
10-15-2012	Sampling event at Riser 90 during dayshift.	RPP-ASMT-53793
10-17-2012	Sampling event at Riser 90 during dayshift.	RPP-ASMT-53793

Note: AC = administrative control
OSD = operating specification document
PCSACS = personal computer surveillance analysis computer system

8.4 Tank AY-102 Annulus Visual Inspection Time Line

AY-102 Annulus Visual Inspection History		
Date	**Event**	**Reference**
1992	Limited video inspections of AY-102 annuluses completed which did not indicate any leakage, degradation, or defect that would cause any of the tanks or the insulating concrete to be unfit for service.	WHC-SD-WM-RPT-078, *Visual Examination Report for Tank Annuli at the 241-AY and AZ Tank Farm*
July 12, 13, 19, 2001	Video inspections of AY-102 annuluses through Risers 79, 80, 84, and 86. Areas of corrosion were identified on the primary tank, with multiple regions showing a large increase in corrosion product compared to 1992 inspections.	RPP-RPT-34311, Rev. 0, *Double-Shell Tank Integrity Inspection Report for 241-AY Tank Farm*
09-5-2001	In-tank visual inspection of AY-102 through Riser 51. All visible older in-tank piping and instrumentation appears to be lightly corroded, with no significant cracking or pitting evident.	RPP-RPT-34311, Rev. 0
02-12-2003	Riser 80 visual inspection for surveillance of a corrosion product sample collection.	RPP-RPT-34311, Rev. 0; Occurrence Report RP-CHG-TANKFARM-2001-0106
Oct. to Dec. 2006	Video inspections of AY-102 annuluses through Risers 77, 79, 80, 82, 84, 86, 88, and 89. Corrosion product identified in 2001 on the primary tank wall as seen from the annulus appears to have increased over the course of the last 5 years.	RPP-RPT-34311, Rev. 0
Dec. 2006	In-tank visual inspection of AY-102 through Riser 65. Signs of light and moderate corrosion product accumulation on the tank dome. Difficult to compare with 2001 in-tank inspection due to the poor visibility in the 2001 inspection.	RPP-RPT-34311, Rev. 0
07-26-2012	In-tank visual inspection of AY-102 through Riser 51. Identified the portion of the drill string that is visible above the tank waste surface. The shaft is probably being held in place by ~5 ft of solids on the bottom of the tank.	RPP-RPT-34311, Rev. 1, *Double-Shell Tank Integrity Inspection Report for 241-AY Tank Farm*
08-01-2012	Video inspections of AY-102 annuluses through Risers 87 (white material on annulus floor) and 89 (crystal-like material on upper haunch). First indications of anomalies.	PER-2012-1363; RPP-RPT-34311, Rev. 1
08-05-2012	Video inspections of AY-102 annulus through Riser 77 (mound on annulus floor) which was the first indication at this location. No anomalies noted during the visual inspection through Riser 80.	PER-2012-1363; RPP-RPT-34311, Rev. 1
08-10-2012	Video inspections of AY-102 annulus through Riser 90 (Riser 90 ENRAF) which provided a better view of the areas of interest, the mound and the white deposits on the annulus floor.	TFC-WO-12-4563
08-16-2012	Visual inspection of AY-102 annulus through Riser 90 indicated no change in condition.	TFC-WO-12-4829
08-20-2012	Visual inspection of AY-102 annulus through Riser 90 indicated no change in condition from 08-10-2012.	TFC-WO-12-4829
08-23-2012	Visual inspection of AY-102 annulus through Riser 90 indicated no change in condition from 08-10-2012.	TFC-WO-12-4829
08-27-2012	Visual inspection of AY-102 annulus through Riser 90 indicated no change in condition from 08-10-2012.	TFC-WO-12-4829
08-29-2012	Visual inspection of AY-102 annulus through Riser 83. First indicated the area adjacent to the refractory retainer ring shows yellow and pink-colored nodules and evaporated material on the annulus floor.	RPP-ASMT-53793
08-30-2012	Visual inspection of AY-102 annulus through Riser 90 and Riser 87.	TFC-WO-12-4829
09-04-2012	Visual inspection of AY-102 annulus through Riser 90.	TFC-WO-12-4829
09-05-2012	Engineering determined no additional videos were required through Riser 90. This completes the twice per week video at Riser 90. Performed visual inspection of AY-102 annulus through Riser 88 and Riser 89. No anomalies identified in the Riser 88 inspection on the primary tank wall or the annulus floor.	TFC-WO-12-4829

AY-102 Annulus Visual Inspection History		
Date	**Event**	**Reference**
09-06-2012	Visual inspection of AY-102 annulus through Riser 91. No anomalies were identified along the primary tank wall or the annulus floor.	RPP-ASMT-53793
09-07-2012	Completed the 100% video inspection of the AY-102 annulus. Performed visual inspection through Riser 90, Riser 80, Riser 79, and Riser 86. No additional anomalies identified.	RPP-ASMT-53793
09-10-2012	Visual inspection of AY-102 annulus through Riser 83. Will be performed twice a week starting now.	RPP-ASMT-53793
09-13-2012	Visual inspection of AY-102 annulus through Riser 83. No change in condition.	RPP-ASMT-53793
09-17-2012	Visual inspection of AY-102 annulus through Riser 83. No change in condition.	RPP-ASMT-53793
09-24-2012	Visual inspection of AY-102 annulus through Riser 83. No change in condition.	RPP-ASMT-53793
09-26-2012	Visual inspection of AY-102 annulus through Riser 83 to support sampling efforts.	RPP-ASMT-53793
10-01-2012	Visual inspection of AY-102 annulus through Riser 83, 5 days after sampling event. Liquid present on 09-26-2012 was beginning to return to the state seen prior to the sampling.	RPP-ASMT-53793
10-04-2012	Visual inspection of AY-102 annulus through Riser 83. No change in condition.	RPP-ASMT-53793
10-08-2012	Visual inspection of AY-102 annulus through Riser 83. No change in condition since first Riser 83 inspection.	RPP-ASMT-53793
10-18-2012	Visual inspection of AY-102 annulus through Riser 83. Identified changes since previous 10-08-2012 inspection.	RPP-ASMT-53793
10-21-2012	Visual inspection of AY-102 annulus through Riser 83. Identified further changes since previous 10-18-2012 inspection.	RPP-ASMT-53793
10-25-2012	Visual inspection of AY-102 annulus through Riser 83.	TFC-WO-12-5018
10-30-2012	Visual inspection of AY-102 annulus through Riser 83.	TFC-WO-12-5018
11-01-2012	Visual inspection of AY-102 annulus through Riser 83.	TFC-WO-12-5018
11-05-2012	Visual inspection of AY-102 annulus through Riser 83.	TFC-WO-12-5018

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