241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity

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Abstract: This report provides the results of an extent of condition construction history review for the 241-AW tank farm. The construction history of the 241-AW tank farm has been reviewed to identify issues similar to those experienced during tank AY-102 construction. Those issues and others impacting integrity are discussed based on information found in available construction records, using tank AY-102 as the comparison benchmark. In the 241-AW tank farm, the fourth double-shell tank farm constructed, similar issues as those with tank 241-AY-102 construction occurred. The overall extent of similarity and affect on 241-AW tank farm integrity is described herein.

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EXECUTIVE SUMMARY

The construction history of the 241-AW tank farm has been reviewed to identify any concerns for the long-term integrity of the tanks. This initial review was prompted by construction issues identified during the formal leak assessment for tank 241-AY-102 (AY-102), RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*. In tank AY-102, bulges in the secondary liner, deterioration of insulating refractory (refractory) during post-weld stress relieving (post-weld heat treatment), and primary tank floor plate welding rework during construction left residual stresses in the tank that may have accelerated corrosion and contributed to the primary tank failure. The main purpose of this review was to determine whether the construction methods utilized after completion of the 241-AY tank farm either improved the quality and integrity of the fourth double-shell tank farm built (241-AW tank farm) or produced similar reduced margins.

The secondary liner bottom thickness was increased to 3/8 in. from 1/4 in. and the primary tank bottom thickness was increased from 3/8 in. to 1/2 in. The American Society for Testing and Materials (ASTM) A537-74a carbon steel plate material utilized in the 241-AW tank farm also varied from the ASTM A515-65 carbon steel utilized in the 241-AY tank farm.

During construction of the 241-AW tank farm, weld rejection rates for the tanks were similar to those for tank AY-102. High weld rejection rates and subsequent repairs are thought to be a contributor to out-of-tolerance distortions, or bulges. Tanks AW-102 and AW-106 had bulging in the secondary liner bottom that was similar to the bulging noted in RPP-ASMT-53793 for tank AY-102. In the 241-AW tank farm, each secondary liner was accepted as is, following engineering evaluation to determine any risk to tank structural integrity. No indication of bulging in any of the primary tank bottoms was found. All 241-AW tanks were accepted as successfully post-weld stress relieved. No post-weld stress relieving deficiencies similar to those that occurred during construction of the 241-AY tank farm were noted.

While Lite Wate 50 (LW50) was initially chosen as the castable refractory product to be used in the 241-AW tank farm, extensive out-of-specification low compressive strength tests of the first several refractory pads led to a material change to Lite Wate 70 (LW70). Tank AW-101 is the only tank in the 241-AW tank farm that utilized LW50 refractory material, with only Section D being composed of an enriched LW50, containing one additional bag of calcium aluminate binder. No issues were noted with refractory following the change to LW70.

As a result of refractory removal and replacement, scratches and gouges were inflicted upon the secondary liner bottom of several tanks. The construction specification provided direction for repair of such defects and it was applied satisfactorily in the discovered documented instances.

While tank bottom bulging, refractory material quality and post-weld stress relieving were improved, primary tank bottom weld rejection in the 241-AW tank farm experienced similar challenges when compared to tank AY-102. While these issues, along with others that were judged to be minor (e.g. surface defects and pitting), leave room for uncertainty of long-term tank integrity, the overall condition of the 241-AW tank farm following construction is judged to be better than that of tank AY-102.

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LIST OF TERMS

Abbreviations and Acronyms

AEC	Atomic Energy Commission
ARHCO	Atlantic Richfield Hanford Company
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
DOE	Department of Energy
DST	Double-Shell Tank
ERDA	Energy Research Development Administration
LDP	Leak Detection Pit
LW50	Lite Wate 50 castable refractory
LW70	Lite Wate 70 castable refractory
NCR	Non-Conformance Report
NDE	Non-Destructive Examination
WRPS	Washington River Protections Solutions LLC

Units

ft	Feet
in	Inch
mil	Thousandth of an inch
h	Hour
lb	Pound
gal	Gallons

TRADEMARK DISCLOSURE

ASME is a registered trademark of American Society of Mechanical Engineers
ASNT is a registered trademark of American Society for Nondestructive Testing
ASTM is a registered trademark of American Society for Testing and Materials
Fondu is a registered trademark of Ciments Lafarge Corporation
Kaolite is a registered trademark of Babcock & Wilcox Company

1.0 INTRODUCTION

This document provides an overview of the construction history noting any difficulties encountered for 241-AW tank farm, the fourth double-shell tank (DST) farm constructed. In October 2012, it was determined that the primary tank of DST 241-AY-102 (AY-102) was leaking (RPP-ASMT-53793, Rev. 0, *Tank 241-AY-102 Leak Assessment Report*). Bulges in the secondary liner, deterioration of refractory during post-weld stress relieving, and primary tank floor plate welding rework during construction compromised the intended robustness and corrosion resistance of the tank AY-102 design and probably contributed to the primary tank's failure.

Following identification of the tank AY-102 probable leak cause, an Extent of Condition (EOC) evaluation was prepared using U.S. Department of Energy's Energy Facilities Contractors Group (EFCOG) *Guidance for Extent of Conditions Evaluations*. The EFCOG process was used to identify other DSTs with construction, waste storage, or thermal histories similar to that of tank AY-102 (WRPS-1204931, *Double-Shell Tank 241-AY-102 Primary Tank Leak Extent of Condition Evaluation and Recommended Annulus Visual Inspection Intervals*). The EOC evaluation identified an initial six tanks with similar construction and operating histories for additional evaluation which included: 241-AY-101, 241-AZ-101, 241-AZ-102, 241-SY-101, 241-SY-102, and 241-SY-103.

One evaluation was to identify any similarities in construction that could be precursors for accelerated corrosion and premature failure. Analysis of these tanks was considered to be the first phase and was documented in the following reports:

- RPP-RPT-54817, *241-AY-101 Tank Construction Extent of Condition Review for Tank Integrity*
- RPP-RPT-54818, *241-AZ Tank Farm Construction Extent of Condition Review for Tank Integrity*
- RPP-RPT-54819, *241-SY Tank Farm Construction Extent of Condition Review for Tank Integrity*

Upon completion of the first phase of construction history review, a recommendation to proceed with reviews of the 241-AW, 241-AN, and 241-AP tank farms was provided in WRPS-1302595, *Washington River Protection Solutions LLC Submittal of Recommended Modifications to Double-Shell Tank Visual Inspections*. Phase two of the DST construction extent of condition review includes the twenty-one tanks contained in the 241-AW, 241-AN, and 241-AP tank farms.

1.1 PURPOSE

The construction history of the 241-AW tank farm has been reviewed to identify issues similar to those experienced during tank AY-102 construction. In this document, those issues and others impacting integrity are discussed based on information found in available construction records, using tank AY-102 as the comparison benchmark.

1.2 OVERVIEW

Six double-shell tank (DST) farms were constructed over a period of roughly 18 years (from 1968 to 1986), with a design life of 20 to 50 years. The 241-AW tank farm was the fourth farm to be constructed and is the focus of this report. Table 1-1, “Double-Shell Construction and Age as of 2013,” provides the construction dates, year of initial service, and the expected service life for the DSTs.

Table 1-1. Double-Shell Construction and Age as of 2013

Tank Farm	Number of Tanks	Construction Period	Construction Project	Initial Operation	Design Life	Current Age
241-AY	2	1968 – 1970	IAP-614	1971	40	42
241-AZ	2	1970 – 1974	HAP-647	1976	20	37
241-SY	3	1974 – 1977	B-101	1977	50	36
241-AW	6	1976 – 1979	B-120	1980	50	33
241-AN	7	1977 – 1980	B-130, B-170	1981	50	32
241-AP	8	1982 – 1986	B-340	1986	50	27
Total	28					

1.3 DOUBLE-SHELL TANK DESCRIPTION

Each DST consists of a primary carbon steel tank inside of a secondary carbon steel liner, which is surrounded by a reinforced-concrete shell. The primary steel tank rests atop an insulating refractory (refractory) slab separating it from the secondary steel liner, and providing for air circulation/leak detection channels under the primary tank bottom plate. An annular space of 2 1/2 ft. exists between the secondary liners and primary tanks, allowing for visual examination of the tank wall and secondary liner annular surfaces. The annular space also allows for ultrasonic volumetric inspections of the primary tank walls and secondary liners.

Figure 1-1. Double-Shell Tank Construction

The tanks in the 241-AW tank farm have between 59 and 64 risers penetrating the dome, providing access for video cameras, ultrasonic inspection devices, waste sampling devices, mixer pumps, and other equipment requiring access to either the primary tank interior or annular space.

2.0 241-AW TANK FARM CONSTRUCTION INFORMATION

The 241-AW tank farm was constructed between 1976 and 1979. It was designated as Project B-120, *241-AW Tank Farm*. The Atlantic Richfield Hanford Company (ARHCO) and Rockwell Hanford Operations (RHO) built the tank farm for the Energy Research and Development Administration (ERDA) and the Department of Energy (DOE).¹ The 241-AW tank farm contained six tanks and ancillary equipment. American Bridge Company was contracted to build the farm. Construction management was provided by Vitro Engineering.

The 241-AW tank farm was built according to ARH-CD-362, *Functional Design Criteria Additional High-Level Waste Storage Facilities*, and the following design and construction specifications:

- B-120-D1, *Design Specification for Primary and Secondary Steel Tanks 241-AW Tank Farm*.
- B-120-C1, *Construction Specification for the 241-AW Tank Farm Site Preparation*.
- B-120-C2, *Construction Specification for the 241-AW Tank Farm Excavation*.
- B-120-C3, *Construction Specification for the 241-AW Tank Farm Foundations*.
- B-120-C4, *Construction Specification for the 241-AW Tank Farm Primary and Secondary Steel Tanks*.
- B-120-C5, *Construction Specification for the 241-AW Tank Farm Concrete Tank Shells*.
- B-120-C6, *Construction Specification for the 241-AW Tank Farm Back Fill*.
- B-120-C7, *Construction Specification for the 241-AW Tank Farm Completion*.

To obtain information about the construction history, the Record Holding Area (RHA) and Integrated Data Management System (IDMS) were queried for boxes containing files from Project B-120, *241-AW Tank Farm*.

This information includes:

1. Radiographic Examination Reports
2. Materials Certifications
3. Non-conformance reports
4. Quality Assurance construction logbooks
5. Project reports, correspondence, and meeting minutes

Daily logbook entries, which describe key construction events and issues, are summarized in Appendix A. The following sections provide an aggregation of the information collected, highlighting important events and information relevant to leak integrity. The resulting quality of construction and any issues or difficulties noted are discussed in this document.

¹ The Department of Energy replaced the Energy Research and Development Administration on October 1, 1977. Rockwell Hanford Operations replaced the Atlantic Richfield Hanford Company on October 1, 1977.

3.0 MATERIALS OF CONSTRUCTION

The materials of construction evolved from the construction of 241-AY tank farm to the construction of the 241-AW tank farm. The primary change in material selection was to use American Society for Testing and Materials (ASTM²) A537-74a, Specification for Pressure Vessel Plates, Heat Treated, Carbon-Manganese-Silicon (Specification B-120-C4), for construction of the primary and secondary liner instead of ASTM A515, Pressure Vessel Plates, Carbon Steel, for Intermediate and Higher Temperature Service, Grade 60, used in the 241-AY tank farm. Also, the thickness of the secondary liner bottom plates was increased starting with the 241-AZ tank farm, from 1/4 in. to 3/8 in. for the secondary bottom sections. The primary bottom was increased from 3/8 in. to 1/2 in. thick sections. The refractory material was changed from Kaolite³ 2200LI castable refractory to Lite Wate 50 castable refractory (LW50) and Lite Wate 70 castable refractory (LW70). In addition, the refractory pour pattern was modified. Table 3-1 provides a comparison of the construction materials used in the 241-AY and 241-AW tank farms.

Table 3-1. Materials Comparison

Material	241-AY Tank Farm	241-AW Tank Farm
Concrete	3000 psi Type V for the walls Type III for the upper haunch and dome	4500 psi for the foundation 5000 psi for the walls, dome, and haunch ASTM C150, Type II
Reinforcing Bar	A15 for the foundation (40,000 psi) A432 for the walls and dome (60,000 psi)	A615, Grade 60 (60,000 psi), except #3 ties shall be Grade 40
Steel Plate	ASTM A515-65	ASTM A537-74a, Class 1
Refractory	Kaolite 2200LI	Lite Wate 50 in AW-101 ⁴ Lite Wate 70 in the remaining tanks

3.1 CONCRETE

Two types of structural concrete were used in the 241-AW tank farm. The concrete used in the foundations had a 4500 psi, 28-day compressive strength, while the concrete used in the shells had a 5000 psi, 28-day compressive strength. Concrete samples were taken and tested at 7 days, 28 days, and 90 days to confirm the compressive strength. The cement for the concrete shell and foundation conformed to American Society for Testing and Materials (ASTM⁵) C150 Type II.

² ASTM is a registered trademark of American Society for Testing and Materials.

³ Kaolite is a registered trademark of Babcock & Wilcox Company.

⁴ Lite Wate 50 enriched with additional calcium aluminate binder was utilized in Section D of the refractory slab.

⁵ ASTM is a registered trademark for American Society for Testing and Materials.

In the 241-AY tank farm, HWS-7791, *Specification for Side Walls and Dome Nuclear Waste Storage Tank Project IAP-614 Purex Tank Expansion*, specifies concrete made with Type V cement for tank walls and Type III cement for haunch and dome portions of the tank. From ASTM C150, *Standard Specification for Portland Cement*, Type II cement is for general use with moderate sulfate resistance and moderate heat of hydration. Type III cement is high early strength cement, and Type V cement is high sulfate resistant cement.

3.2 REINFORCING BAR

In the 241-AW farm, the tank foundations, walls, and domes were reinforced with ASTM A615, Grade 60, reinforcing steel for everything but the ties, which were ASTM A615, Grade 40 (specifications B-120-C3 and B-120-C5). ASTM A615, Grade 60, specified minimum yield strength of 60,000 psi, while ASTM A615, Grade 40, specified minimum yield strength of 40,000 psi (see drawings H-2-70305, *Structural Concrete Tank Foundation Plan and Details*, and H-2-70307, *Concrete Tank Section and Haunch Reinforcement*). Rebar used to reinforce the tank foundation was #5, #6, and #7 (see H-2-70305 for details), while #4, #6, #8, and #9 rebar was used to reinforce the concrete haunch and dome sections (see H-2-70307 for details).

In the 241-AY tank farm, the reinforcing bar for the foundation was manufactured to ASTM A15 specifications with minimum yield strength of 40,000 psi. The tank foundation was reinforced with #5, #6, and #7 rebar (see H-2-64306, *Tank Foundation Plan*, for details). The reinforcing bar for the concrete walls and dome sections was manufactured to ASTM A432 specifications with minimum yield strength of 60,000 psi. The concrete walls and dome sections were reinforced with #4, #6, #8, and #9 rebar (see H-2-64310, *Concrete Tank Section and Details*, for details).

3.3 STEEL PLATE

All primary tank and secondary liner plates used in the 241-AW tank farm were shipped from the United States Steel Corporation and were manufactured to ASTM A537-74a *Specification for Pressure Vessel Plates, Heat Treated, Carbon-Manganese-Silicon*, Grade 65. The selection of ASTM A537 was a change from ASTM A515 used in the 241-AY tank farm. ASTM A537 is a fine austenitic grain size metal, while ASTM A515 is a coarse grain size metal produced for moderate and higher temperature service. The smaller grain size in ASTM A537 increases the notch toughness and resistance to stress corrosion cracking over ASTM A515 used in the 241-AY tank farm and ASTM A516 used in the 241-SY tank farm as noted in Appendix B, App Figure B-1. The 241-AW tank farm tanks were erected using the American Society of Mechanical Engineers (ASME⁶), *Boiler and Pressure Vessel Code*, 1974 through summer 1975 Edition and Addenda of the code.

⁶ ASME is a registered trademark of American Society of Mechanical Engineers

3.3.1 Secondary Plate

The secondary liner plates consisted of 3/8 in. and 1/2 in. sections (see H-2-70394, *Tank Cross Section 241-AW Tank Farm*, for details). The 1/2 in. plate was used in the lower knuckle of the liner. The 3/8 in. plate was used for the liner floor, walls, and upper haunch. The 241-AY tank farm utilized 1/4 in. plate for the majority of the secondary liner with the exception of the top knuckle at 3/8 in. thick.

3.3.2 Primary Plate

The primary tank bottom utilizes primarily 1/2 in. carbon steel plates, except that a 4 ft. diameter by 1 in. thick carbon steel plate is located at the center of the primary tank bottom, and a 7/8 in. carbon steel plate is used for the primary bottom knuckle. The primary tank wall thickness varies from 7/8 in. thick carbon steel at the bottom knuckle to 1/2 in. thick at the course four plate. The first course is 3/4 in. thick, and the next three courses are 1/2 in. thick. The dome of the tank was constructed of 3/8 in. plate welded to the 3/8 in. thick top knuckle and closed with a 1/2 in. thick top dollar plate. Figure 3-1 shows the configuration of the primary tank wall and the thickness of each course.

Figure 3-1. Primary Tank Wall Configuration and Thickness

3.3.3 Material Certification

Material certifications, chemical test reports, and physical test reports were required for each steel plate. These documents contained heat and slab numbers to identify the plates. Material certifications contained yield strength and tensile strength information along with percent elongation for each specific heat and slab number. The chemical and physical test reports identify the percent of each element (i.e., carbon, manganese, phosphorus, etc.) contained within a sample of the material as well as properties such as yield point, tensile strength, percent elongation, and information gathered from bend test results.

3.4 REFRACTORY

The refractory was required to limit the structural concrete base slab to a maximum temperature of 500° F during the post-weld stress relief. In contrast to the refractory material for the 241-AY farm, which required a compressive strength of 200 psi, the material for the refractories in the 241-AW farm had to have a minimum compressive strength of 130 psi after heating, either wet or dry. In addition, the material had to be compatible with the chemicals found in the tank waste. While specification B-120-C4 initially called for the use of either Lite Wate 50 (LW50) or Kaolite 2000 (Kaolite) castable refractory in the 241-AW tank farm, a design change (B-120-53) was later made in favor of Lite Wate 70 (LW70). While the refractory material used in the 241-AY and 241-AZ farms was tested to ensure waste compatibility, no simulant testing was performed on either LW50 or LW70. Vendor statements asserted that these materials were compatible with the waste.

3.5 PIPING

All pipe used for permanent risers was manufactured to ASTM A53, Grade A, Type S or ASTM A106, Grade A or B specifications. Coal tar enamel wrapped in kraft paper or coal tar tape was used on carbon steel pipe exposed to earth.

4.0 CONSTRUCTION SEQUENCE

Construction of the six 241-AW tanks was awarded to American Bridge Division of United States Steel Corporation (American Bridge). Excavation began in 1976 and the project was completed in 1980. Vitro Engineering provided construction management for the project.

The tanks were constructed simultaneously. There was no discernible order while the secondary and primary tank bottoms were being constructed, but once the primary tank bottoms were finished, the remainder of the tank construction generally went in numerical order (i.e. AW-101, AW-102, etc.). A listing of the general construction sequence follows:

1. Install reinforced structural concrete foundation for each of the six tanks. The foundation has a tertiary leak detection system, which includes a waffle grid in the structural concrete, collection pipes, and the leak detection pit.
2. Install plywood protective layer over the tank foundations.
3. Install cribbing and jack stands for secondary liner bottom fabrication.
4. Fabricate secondary liner bottom on top of cribbing and jack stands.
5. Inspect secondary liner bottom.
6. Lower the secondary liner bottom onto the concrete foundation or move the liner from its construction location to its permanent location.
7. Install air distribution piping and thermocouple conduits to be embedded in the tank bottom refractory, as well as the retainer ring used as a form for the perimeter of the refractory.
8. Pour the refractory in five pour sections.
9. Cut air distribution channels into the refractory.
10. Install protective layer of plywood on the refractory.
11. Install cribbing and jack stands for primary tank bottom fabrication.
12. Fabricate primary tank bottom on top of cribbing and jack stands.
13. Inspect primary tank bottom.
14. Lower the primary tank bottom onto the refractory or move the tank bottom from its construction location to its permanent location.
15. Weld the first, second, third, and fourth plate course to the primary tank.
16. Fabricate tank dome and penetrations inside the primary tank.
17. Weld primary tank upper knuckle in place
18. Raise tank dome into place and weld it to the primary tank upper knuckle.
19. Weld the secondary liner course plates up to the last course (not including the upper knuckle).
20. Install insulation around the primary tank walls and dome in preparation for stress relief.
21. Conduct stress relief of the primary tank.
22. Conduct hydrostatic test of the primary tank.
23. Install upper knuckle and attach metal flashing between secondary upper knuckle and primary tank dome.
24. Install annulus penetrations.
25. Place the concrete in four sections, including two vertical lifts, a haunch pour, and a dome pour.
26. Install the leak detection system, including the leak detection drain, sump, and well.

27. Start backfilling the tank farm area.
28. Install appurtenances (thermocouple trees, pumps, etc.).
29. Backfill to top of the domes.
30. Install the waste transfer system of piping, pump pits, and valve pits.
31. Complete backfill.

4.1 CONCRETE FOUNDATION

The structural reinforced concrete foundation is 89 ft. 6 in. in diameter and is designed to distribute all weight loads uniformly. The circular center portion of the foundation is 6 ft. in diameter and 2 ft. thick. From the circular center portion, the foundation thickness decreases linearly out to about 1 ft. thickness at the 12 ft. 8 in. diameter and maintains that thickness out to approximately 45 ft. 6 in. in diameter. The thickness then increases linearly to a thickness of 2 ft. 9 in. over the next 12 radial ft. The 2 ft. 9 in. thickness is maintained to the perimeter of the tank at the 89 ft. 6 in. diameter.

The foundation is composed of reinforcing steel and concrete, requiring a 4500 psi, 28-day compressive strength (see drawing H-2-70305, *Structural Concrete Tank Foundation Plan and Details*, for details). The structural foundation contains drain slots to direct any leakage to the leak detection drain slot. This is a change from the configuration seen in the 241-AY tank farm. In the 241-AY tank farm, a drain pipe was used to drain the foundation at three different locations as seen in Figure 4-1, and the drain pipe drained to the leak detection sump.

Figure 4-1. Diagram of 241-AY Tank Farm Leak Detection Pit Drain Line

The change in design was made because a pipefitter strike threatened to delay the project as noted in Appendix B, App Figure B-2. The leak detection drain slot connects to a drain pipe at the foundation perimeter. The drain pipe then flows to the leak detection pit (LDP). Figure 4-2 is a diagram showing the leak detection drain slot, and the drain pipe into the leak detection well. Figure 4-3 shows the foundation prior to the placement of the concrete and the rebar and wood used to form the slots. Figure 4-4 shows the completed tank foundations, including the slots that direct any accumulation of liquid to the drain lines.

Figure 4-2. Diagram of 241-AW Tank Farm Leak Detection Drain System

Figure 4-3. Tank Foundations Prior to Concrete Placement Tank AW-101 is in Foreground Right, Tank AW-102 is in Foreground Left (Photo 75661-1) (Taken 9/21/1976)

Figure 4-4. 241-AW Tank Farm Completed Tank Foundations - Tank AW-102 in Foreground. (Photo 76756-4) (Taken 12/22/1976)

After backfilling and compacting the ground where the tank foundations were to be poured, two rebar mats were installed, followed by instrumentation conduit. Concrete forms were then set, including forms for the drain slots in the top of the foundation. After the concrete was poured and set, forms were removed and high spots on the foundation were ground down.

4.2 SECONDARY LINER BOTTOM

The secondary liner measures 80 ft. in diameter. The plates in the liner bottom are 3/8 in. thick carbon steel and the bottom knuckles are 1/2 in. thick carbon steel. This is an increase in thickness over the 1/4 in. thick bottoms and bottom knuckles of the 241-AY tank farm secondary liners. Secondary liner lower knuckle sections can be seen in Figure 4-5.

The secondary liner bottoms for the tanks in the 241-AW farm were constructed onsite. In this farm, some of the secondary liner bottoms were constructed on their corresponding concrete foundations and lowered into place after fabrication, while others were constructed on neighboring foundations and moved into place after fabrication. Table 4-1 provides the locations of construction for the secondary tank bottoms. Before beginning the fabrication of a liner bottom, crews would place a protective layer of plywood over one of the farm's reinforced concrete foundations. Staging was then erected on top of the plywood to provide an elevated structure on which to fabricate the tank bottom. This arrangement allowed access to the underside of the tank bottom during construction.

Figure 4-5. Secondary Liner Lower Knuckle Sections (Photo 76967-13) (Taken 1/19/1977)

Table 4-1. Secondary Tank Bottom Construction Locations

Secondary Tank Bottom	Constructed On
AW-101	AW-103
AW-102	AW-102
AW-103	AW-105
AW-104	AW-104
AW-105	AW-103
AW-106	AW-104

Individual plates were installed using fit-up tools to secure the plates within allowable tolerance for proper welding. The secondary liner bottom knuckles, which are 1/2 in. thick carbon steel, were fabricated offsite at an American Bridge fabrication facility in San Francisco, California,

prior to being shipped to the worksite for welding to join the knuckles with the adjacent plates. See Table 5-6, in Section 5.1, for weld NDE information.

After completion and inspection of the welds, as described in Table 5-3, in Section 5.1, the secondary liner bottom was lowered or moved onto the foundation using two cranes.

Lifting lugs were installed as part of a superstructure used to support the tank liner from above to limit deformation during the move. Prior to lowering the secondary liner bottom down onto the concrete foundation, the slots and center sump region of the foundation were cleaned with the knowledge that further access into these locations would not be provided again. Figure 4-6 shows the secondary liner of tank AW-105 being transferred to its foundation from AW-103, where it was constructed.

Figure 4-6. Moving Tank AW-105 Secondary onto Its Tank Foundation (Photo 77950-9) (Taken 3/2/1977)

4.3 REFRACTORY

The refractory design used for the six 241-AW tank farm tanks specified a nominal 8 in. thick layer refractory material to be located between the primary tank bottom and secondary liner bottom. Lite Wate 50 (LW50) was initially specified as the refractory material to be used in the 241-AW tank farm tanks. However, LW50 was replaced with Lite Wate 70 (LW70) mid-construction due to compressive strength issues as noted in Section 5.4. The primary purpose of the refractory was to act as an insulating barrier between the primary tank and the concrete foundation during post-weld stress relieving where temperatures of up to 1100° F were required in the primary tank. Its use was to prevent the structural concrete temperature from rising above 500° F.

Figure 4-7. Air Ventilation Piping Laid Out in Tank AW-105 and AW-106 Secondary Liner Bottoms (Photo 78074-17) (Taken 3/30/1977)

The refractory pad housed air ventilation piping, thermocouple conduit, and air distribution slots. The air distribution slots allowed airflow to

cool the primary tank bottom and to direct potential leaks to the tank annulus where leak detectors are located (see H-2-70304, *Structural Insulating Concrete Plan and Details*). The eight ventilation pipes terminate at the center of the tank at an air distribution ring. Air is drawn through this ventilation piping and out through the air distribution slots in the refractory. Figure 4-7 shows eight air ventilation pipes laid out in the tank AW-105 and AW-106 secondary liner bottoms.

Prior to pouring the refractory, a 7 in. x 3/4 in. carbon steel stiffener ring was installed around the perimeter of the pour and thermocouple conduits were installed. The stiffener ring was used as a refractory form. Thermocouples allowed temperature monitoring of the refractory and primary tank bottom during post-weld stress relieving. The refractory was placed in five sections (sections “A” through “E”) with air ventilation piping embedded in the refractory material. Figure 4-8 shows the orientation of the five refractory placement sections. Air distribution slots were cut instead of cast into the refractory.

Figure 4-8. Refractory Placement Sections

4.4 PRIMARY TANK BOTTOM

The primary tank measures 75 ft. in diameter. The 4 ft. diameter center plate of the liner bottom is 1 in. thick carbon steel, while the bottom knuckles are 7/8 in. thick carbon steel. The remainder of the plates in the liner bottom are 1/2 in. thick carbon steel, an increase in thickness over the 3/8 in. thick bottoms of the 241-AY tank farm primary tanks.

Following completion of refractory installation, the primary tank bottom was fabricated using a sequence similar to that used for the secondary liner bottom. A protective layer of plywood was placed on the refractory and staging was erected to support the liner during construction. The bottom plates of the tank were installed on the staging using fit-up tools to allow proper welding. Once the top and bottom sides of the primary tank bottom were completely welded, the knuckle was welded on to the bottom plate. Figure 4-9 shows the fabrication of the tank AW-106 primary bottom as the knuckle was being welded to the bottom plate. After inspection of the welds, the primary tank was then transferred to its final location and lowered onto the refractory. In the 241-AW farm, all of the primary tank liners were constructed on neighboring tank sites and moved into place using cranes and a stabilizing superstructure. Table 4-2 provides the locations of construction for the primary tank bottoms.

Figure 4-9. Fabrication of Tank AW-106 Primary Tank Bottom is Underway in the Foreground (Photo 79626-2) (Taken 9/7/1977)

Table 4-2. Primary Tank Bottom Construction Locations

Primary Tank Bottom	Constructed On
AW-101	AW-103
AW-102	AW-104
AW-103	AW-105
AW-104	AW-106
AW-105	AW-106
AW-106	AW-105

4.5 PRIMARY TANK WALL AND TANK DOME

The primary tank measures 75 ft. in diameter to the center of the vertical plate. The primary tank wall thickness ranges from 7/8 in. thick carbon steel at the bottom knuckle to 1/2 in. thick carbon steel at the course four plate. The first course is 3/4 in. thick, and the next three courses are 1/2 in. thick. Figure 3-1 shows the configuration of the primary tank wall and the thickness of each course.

The dome of the tank was constructed of two courses of 3/8 in. thick carbon steel plate welded to the 3/8 in. thick top knuckle and closed with a 1/2 in. thick top dollar plate. To facilitate the installation of tank dome plates, an opening was left in the side of the primary tank and staging was erected inside. This staging provided a resting place for the tank dome plates for proper fit-up and welding. Figure 4-10 shows the primary dome of tank AW-101 being fabricated on staging inside the primary tank; the opening in the tank would later be covered with a door sheet. Once the dome was welded together, riser penetration holes were cut and pipes were welded to the tank dome plates. These penetrations served as access points for the remainder of construction and they supported the installation of permanent and temporary equipment during operation. Once the penetrations were installed on the dome, it was lifted by crane and set on the upper knuckle, where it was welded in place.

Figure 4-10. Fabrication of Tank Dome AW-101 inside the Primary Tank (Photo 79677-39) (Taken 9/20/1977)

The primary tank was then cleaned and the door sheet was welded into place in preparation for stress relief and hydrostatic testing.

4.6 SECONDARY LINER WALL

Once the primary tank wall was constructed, the secondary liner wall was begun. The secondary liner wall is made up of four courses of plates between the lower and upper knuckles. These plates are 3/8 in. thick carbon steel, as is the upper secondary knuckle. Each course was set in place and welded to the previous course. In order to maintain access to the annulus, the upper knuckle was not installed on the secondary tank liner until after stress relieving and hydrostatic testing of the primary tank.

4.7 PRIMARY TANK STRESS RELIEVING

After the primary tank was completed, it was prepared for post-weld stress relief. Insulation was installed on the outer surface of the primary tank, including the dome penetrations, to help regulate the heating of the primary tank. The concrete foundation was protected from high stress relief temperatures by the refractory. Figure 4-11 shows the post-weld stress relief in progress on the AW-102 primary tank.

Figure 4-11. Tank AW-102 During Post-Weld Stress Relieving (Photo 81689-3) (Taken 3/23/1978)

The requirements for stress relieving were in accordance with ASME Boiler and Pressure Vessel Code, Section VIII (1974), which specified a holding, or “soaking,” temperature of 1100° F for 1 hour per inch of metal thickness. After dome deformations due to post-weld stress relieving in tank AW-101 (see Section 5.5.3), the requirement was changed to a soak temperature of 1000° F for 3 hours. Thermocouples were installed throughout the tank to measure the temperature inside the tank. The thermocouples installed during the insulating refractory pour were used to monitor the progress of the post-weld stress relieving temperatures in the primary tank bottom. In order to support the tank during post-weld stress relieving, the internal air pressure was to be maintained above 3 in. of water.

Section 15H, paragraph 3.C, “Stress Relieving,” of B-120-C4, *Construction Specification for Primary and Secondary Steel Tanks Project B-120 241-AW Tank Farm*, provided the following direction for stress relieving:

- (1) *“Perform stress relief in accordance with ASME, Section VIII, Division 2, Article F-4, except that:*
 - a. *The maximum allowable decrease in temperature below the specified temperature of 1100 F shall not exceed 100 F.*
 - b. *The rate of temperature rise and reduction between 600 F and 1100 F shall be no more than 100 F, per hour.*
 - c. *The period of heating from 600 F to 1100 F shall consume no more than 12 hours.*
 - d. *During the heating-up period, after any recorded temperature reaches 600 F, the temperature of all parts of the tank being heated shall be uniform with a maximum temperature differential at any time of 200 F.”*

The heating occurred in several stages and key events were captured in daily logbooks. Important entries from these reports have been included in Appendix A.

Table 4-3. Post-Weld Stress Relieving in 241-AW Tank Farm Tanks AW-101 through AW-103

Event	AW-101	AW-102	AW-103
Burners Turned On	4:35 p.m. March 3, 1978	6:30 p.m. March 22, 1978	6:30 p.m. April 13, 1978
Completed Final Hold Time for Post-Weld Stress Relief	8:30 a.m. March 5, 1978	9:30 p.m. March 23, 1978	12:00 a.m. April 15, 1978
	One Hour Hold at 1100°F	Three Hour Hold at 1000°F	Three Hour Hold at 1000°F
All Thermocouples Reading below 600°F, Recorders Turned Off	4:00 p.m. March 5, 1978	4:30 p.m. March 24, 1978	7:00 a.m. April 15, 1978

Table 4-4. Post-Weld Stress Relieving in 241-AW Tank Farm Tanks AW-104 through AW-106

Event	AW-104	AW-105	AW-106
Burners Turned On	8:45 a.m. April 26, 1978	11:00 a.m. June 7, 1978	5:00 p.m. June 15, 1978
Completed Final Hold Time for Post-Weld Stress Relief	2:30 p.m. April 27, 1978	9:00 a.m. June 8, 1978	12:30 p.m. June 16, 1978
	Three Hour Hold at 1000°F	Three Hour Hold at 1000°F	Three Hour Hold at 1000°F
All Thermocouples Reading below 600°F, Recorders Turned Off	8:30 p.m. April 27, 1978	3:00 p.m. June 8, 1978	5:30 p.m. June 16, 1978

4.7.1 Tank AW-101

Official startup of stress relieving on tank AW-101 was at 4:35 p.m. on March 3, 1978. The temperature of the tank reached 600° F at approximately 5:00 a.m. on March 4, and was maintained at that level until approximately 8:00 p.m. The burners were then adjusted to raise the temperature to 1100° F. The process was delayed when two of the burners flamed out and had to be restarted. On March 5, the soak temperature of 1100° F was attained at 7:30 a.m. (high of 1165°, low of 1105°). The internal air pressure during soak was approximately 2.2 in. water. The tank came out of soak at 8:30 a.m. (high of 1175°, low of 1125°), concluding post-weld stress relieving on tank AW-101.

4.7.2 Tank AW-102

Official startup of stress relief on tank AW-102 was at 6:30 p.m. on March 22, 1978. Soak at 1000° F started at 6:30 p.m. on the following day, March 23, and was then completed at 9:30 p.m. This concluded post-weld stress relieving for tank AW-102. The internal air pressure was 3.4 in. of water.

4.7.3 Tank AW-103

On April 11, 1978, four new 24 in. nozzles were installed for the burners on the tank AW-103 dome. Official startup of stress relief on this tank was at approximately 6:30 p.m. on April 13. On April 14, a leak was discovered in the gas lines and the burners were turned off at 6:20 a.m.; the temperature of the tank at that time was 500° F to 600° F. The leak was repaired and the burners were restarted at 9:00 a.m.; the temperature of the tank at that time was 400° F to 500° F. The heating process was slowed by rain at 6:30 p.m. Soak at 1000° F began at 9:00 p.m.; the internal air pressure was in excess of 3 in. of water. When the soak ended at approximately 12:00 a.m. on April 15, the tank was allowed to cool and its temperature was back down to 600° F at approximately 7:00 a.m. This concluded post-weld stress relieving for tank AW-103.

4.7.4 Tank AW-104

Official startup of stress relief for tank AW-104 was at 8:45 a.m. on April 26, 1978. Soak was started at 11:30 a.m. on April 27, with a temperature range of 1000° F to 1090° F. Internal air pressure was 3.8 in. of water. Soak finished at approximately 2:30 p.m., concluding post-weld stress relieving for tank AW-104.

4.7.5 Tank AW-105

Official startup of stress relief for tank AW-105 was at 11:00 a.m. on June 7, 1978. Soak at 1000° F started at approximately 6:00 a.m. on June 8, with internal air pressure approximately 4.4 in. of water, and was complete at approximately 9:00 a.m., concluding post-weld stress relieving for tank AW-105. During stress relieving, steam was observed and attributed to moisture in the refractory; see Section 5.4 for details.

4.7.6 Tank AW-106

Official startup of stress relief for tank AW-106 was at approximately 5:00 p.m. on June 15, 1978. Soak at 1000° F started at 9:30 a.m. on June 16, with internal pressure slightly over 4 in. of water, and was complete at approximately 12:30 p.m., concluding post-weld stress relieving for tank AW-106. During stress relieving, steam was observed and attributed to moisture in the refractory; see Section 5.4 for details.

4.8 PRIMARY TANK HYDROSTATIC TEST

After completion of post-weld stress relieving, the heating equipment and temporary insulation were removed in preparation for hydrostatic testing to begin.

Section 15H, paragraph 3.D, “Hydrostatic Test,” of B-120-C4, *Construction Specification for Primary and Secondary Steel Tanks Project B-120 241-AW Tank Farm*, provided the following direction for hydrostatic testing:

- (1) *“After the tank has been stress relieved, apply a full hydrostatic test to the primary tanks by filling with water to a depth of 35 feet from the bottom of the tank ± 1 inch. Use one of the vertical risers near the center of the tank dome for introduction of water. Provide air bleed ports to evacuate air within from the other vertical risers during the test. Coat all accessible welded joints below the water level with a mixture of blue chalk and water or alcohol.*
- (2) *Maintain the hydrostatic pressure for a minimum of 24 hours.*
- (3) *Leak detection shall be by visual inspection of each welded joint previously coated with a mixture of blue chalk and water or alcohol.”*

Daily logbook entries show that after the hydrostatic test for each tank was finished, more water was added, most likely in order to provide support for the concrete dome pour. The water remained in the tanks for several months before being pumped out. Table 4-5 shows how long the hydrostatic test water was retained in each tank.

Table 4-5. Duration of Hydrostatic Test Water Storage

Tank	Fill Date	Pump-out Date	Approx. Duration (Months)
AW-101	3/22/1978	12/19/1978	9
AW-102	4/11/1978	12/27/1978	8
AW-103	5/4/1978	12/14/1978	7
AW-104	5/23/1978	1/31/1979	8
AW-105	6/27/1978	12/13/1978	6
AW-106	7/6/1978	2/1/1979	7

4.8.1 Tank AW-101

Official startup of hydrostatic testing on tank AW-101 was on March 22, 1978, with the start of tank filling. Some seams were re-chalked on March 24, though there is no reason given in the daily logbook. Crews finished filling the tank on March 28 and the test was completed and accepted on March 29. Meeting minutes note that the water level was up to the dome on March 29.

4.8.2 Tank AW-102

Official startup of hydrostatic testing on tank AW-102 was on April 11, 1978, with the start of tank filling. The water was not turned off until 1:00 a.m. on April 12, at which point the water had overflowed the primary tank into the annulus and run out the access in the secondary shell. Further discussion of this overflow can be found in Section 5.4.3. The seams on the primary tank were re-chalked on April 14, 21, and 24, most likely due to the water overflowing into the annulus. Meeting minutes from May 3 note that the hydrostatic test for tank AW-102 was accepted.

4.8.3 Tank AW-103

Official startup of hydrostatic testing on tank AW-103 was on May 4, 1978, with the start of tank filling. Filling continued on May 5 and 23.

4.8.4 Tank AW-104

Official startup of hydrostatic testing on tank AW-104 was on May 23, 1978, with the start of tank filling. Filling continued on May 24 and 25 and testing was completed on May 26.

4.8.5 Tank AW-105

Filling continued on June 27, 1978, and completed on June 28. The hydrostatic test was completed on June 29 and crews began adding water to fill the tank to the dome; this was completed on June 30.

4.8.6 Tank AW-106

Official startup of hydrostatic testing on tank AW-106 was on July 6, 1978, with the start of tank filling. Primary tank weld seams were also chalked on this day. Filling continued on July 7 and was completed on July 17.

Figure 4-12. 241-AW Tank Farm Tanks in Various Stages of Fabrication. Primary and Secondary Tanks AW-101 and 102 are Nearly Complete, While Tanks AW-105 and AW-106 Have Begun Tank Dome Fabrication (Photo 81762-16) (Taken 4/17/1978)

Figure 4-12 shows the 241-AW tank farm tanks in various stages of construction. Fabrication on steel tanks AW-101 and AW-102 are nearly complete, tanks AW-103 and AW-104 are preparing for post-weld stress relieving operations, and fabrication on tank domes for tanks AW-105 and AW-106 have begun.

4.9 COMPLETE SECONDARY LINER WALL AND TANK PENETRATIONS

Once the hydrostatic testing was completed, the secondary liner top knuckle was installed and welded to the secondary liner vertical wall section. The secondary liner knuckle is not welded to the primary tank. By design, a 1 in. maximum gap exists between the primary tank dome and the edge of the secondary liner knuckle. To cover the gap and prevent the collection of debris or concrete in the annulus during the remaining construction, metal flashing was tack welded to the primary tank over the outside of the secondary top knuckle, as shown in Figure 4-13.

Figure 4-13. Tank AW-101 with Flashing Installed (Photo 7805773-12cn) (Taken 5/30/1978)

In order to retain access to the annulus space, penetrations were installed in the upper knuckle of the secondary liner. These penetrations were used for tank annulus processing and monitoring activities, such as ventilation, annular inspection, instrument leads, and construction access.

4.10 CONCRETE POUR

The concrete shell measures 83 ft. in outside diameter and is 1 ft. 5-3/8 in. thick; it rests on a 3/8 in. thick steel slide plate and a 1/4 in. thick bearing plate that are supported by the tank foundation (see Figure 4-14). These plates ran the full circumference of the wall and two sets of anchor studs were mounted on the slide plate to help anchor the concrete wall.

A significant amount of rebar, used to reinforce the concrete, was installed around the tank and over the dome before the concrete was poured. Once the rebar skirts were installed, the outer forms were set in place; the secondary liner's outer wall acted as the inner concrete form.

Figure 4-14. Concrete Wall to Concrete Foundation Interface (see Drawing H-2-70394)

The shell was poured in four parts: two vertical lifts on the sides of the tank, one haunch that covered the upper knuckles of the primary and secondary tanks, and one pour to cover the dome. Keyed construction joints connected each new pour to the previous section. Figure 4-15 shows the tanks in the 241-AW farm in various stages of concrete placement.

Temporary supports were used inside the tank to support the dome while the concrete was being poured. There is no available documentation to show what types of supports were used in this farm. However, a daily logbook entry and some meeting minutes mention filling tanks to the dome, implying that water may have been used to support the dome concrete pour. Another logbook entry mentions a pan and float being used for dome support.

Figure 4-15. 241-AW Tanks in Various Stages of Concrete Placement (Photo 83797-3) (Taken 10/20/1978)

Division 3, Part 3, Section 3.04, Paragraph B, “Rate of Placement,” of B-120-C5, *Construction Specification for the 241-AW Tank Farm Project B-120 Concrete Shell*, provided the following direction for concrete placement:

1. *“Limit the ratio of placement of concrete to not more than 2 feet in elevation per hour from the bottom of the tank sidewall to an elevation 2 feet above the tangent line of the dome.”*
2. *Limit the rate of placement of concrete to not more than 1 foot in elevation per hour in the haunch area from an elevation 2 feet above the tangent line of the dome to the construction joint approximately 9 feet in from the outer wall form.*
3. *After the concrete in the haunch area has cured a minimum of 3 days, place the concrete in the remainder of the dome in one continuous pour.”*

Once the concrete was poured and had cured for at least 7 days, any temporary supports inside the tank could be removed, although the center of the dome needed support for 14 days (Specification B-120-C4).

4.11 LEAK DETECTION SYSTEM

Once the vertical sections of concrete had been placed, the leak detection system was installed. The leak detection system consisted of a leak detection drain coming from the foundation of the tank, a leak detection sump, and leak detection well which extended from the sump up to ground level. Figure 4-16 shows the leak detection system installed on tank AW-101 and the excavation for the AW-102 leak detection sump.

Figure 4-16. Tank AW-101 Leak Detection Sump Installed (Photo83472-9) (Taken 8/21/1978)

4.12 TANK APPURTENANCES

After completing the concrete pours, the tank dome support structures were disassembled and removed in pieces through the existing 42 in. diameter riser penetrations. The equipment to be placed in the interior of the tank was then welded to the existing penetrations that had been installed on the tank dome prior to the tank stress relief.

5.0 CONSTRUCTION ISSUES

This section provides a detailed review of the construction issues identified during the fabrication of tanks AW-101, AW-102, AW-103, AW-104, AW-105, and AW-106. This information has been compiled from a review of the Quality Assurance (QA) construction daily logbooks, inspection sheets, memos, drawings, photos, and other construction records.

5.1 WELDING AND NON-DESTRUCTIVE EXAMINATION

5.1.1 Primary Tank Bottom Weld Film Rejection Rates

A quantitative comparison of welding success on the 241-AW tanks is shown in Table 5-1, Table 5-2, and Table 5-3. This same comparison was completed and included within RPP-ASMT-53793, for the 241-AY tank farm. Analysis of the tank AY-101 and tank AY-102 primary bottom radiographic test diagrams (weld maps) was completed for a second time as a part of this extent of condition effort to ensure accuracy and consistency. Those results are provided in Table 5-4 and are nearly identical to those previously tabulated, with some minor discrepancies resulting from omission of the center dollar plate welds in the primary tank bottom within RPP-ASMT-53793.

Table 5-1. Tanks AW-101 and AW-102 Primary Bottom Welding Success Comparison

	Tank AW-101			Tank AW-102		
	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)
Weld prior to inspection	735	N/A	N/A	735	N/A	N/A
Weld rejected after original weld	214	29%	29%	212	29%	29%
Weld rejected after first repair	69	32%	30%	87	41%	32%
Weld rejected after second repair	21	30%	30%	22	25%	31%
Weld rejected after third repair	6	29%	30%	6	27%	31%
Weld rejected after fourth repair	2	33%	30%	1	17%	31%
Weld rejected after fifth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	312			328		
Total weld	1047			1063		
Overall weld rejection rate	30%			31%		

Table 5-2. Tanks AW-103 and AW-104 Primary Bottom Welding Success Comparison

	Tank AW-103			Tank AW-104		
	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)
Weld prior to inspection	735	N/A	N/A	735	N/A	N/A
Weld rejected after original weld	225	31%	31%	274	37%	37%
Weld rejected after first repair	48	21%	28%	82	30%	35%
Weld rejected after second repair	5	10%	28%	18	22%	34%
Weld rejected after third repair	0	0%	27%	1	6%	34%
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	278			375		
Total weld	1013			1110		
Overall weld rejection rate	27%			34%		

Table 5-3. Tanks AW-105 and AW-106 Primary Bottom Welding Success Comparison

	Tank AW-105			Tank AW-106		
	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)
Weld prior to inspection	735	N/A	N/A	735	N/A	N/A
Weld rejected after original weld	252	34%	34%	200	27%	27%
Weld rejected after first repair	61	24%	32%	29	15%	24%
Weld rejected after second repair	10	16%	31%	3	10%	24%
Weld rejected after third repair	0	0%	31%	0	0%	24%
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	323			232		
Total weld	1058			967		
Overall weld rejection rate	31%			24%		

Table 5-4. 241-AY Tank Farm Primary Tank Bottom Welding Success Comparison

	Tank AY-101			Tank AY-102		
	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)
Weld prior to inspection	672	N/A	N/A	673	N/A	N/A
Weld rejected after original weld	67	10.0%	10.0%	229	34.0%	34.0%
Weld rejected after first repair	7	10.4%	10.0%	86	37.6%	34.9%
Weld rejected after second repair	1	14.3%	10.1%	27	31.4%	34.6%
Weld rejected after third repair	1	100.0%	10.2%	1	3.7%	33.8%
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	76			343		
Total weld	748			1016		
Overall weld rejection rate	10.2%			33.8%		

The overall primary tank bottom radiographic film rejection rates for the 241-AW tank farm are summarized below in Table 5-5.h

Table 5-5. 241-AW Tank Farm Primary Tank Bottom Weld Rejection Rate Summary

Tank	Total Weld Reject Rate (%)
AW-101	30%
AW-102	31%
AW-103	27%
AW-104	34%
AW-105	31%
AW-106	24%

The overall radiographic film rejection rate for tank AY-102 was similar, at 33.8%, and weld rejections were a noted issue in RPP-RPT-53793. The maximum number of times a weld section was repaired during 241-AY tank farm construction was four, with one weld section in tank AY-101 and one weld section in tank AY-102. It should be noted that a weld section is defined within this report as a one foot section. During 241-AW tank farm construction, three weld sections were repaired four times, with two weld sections in tank AW-101 and one weld section in tank AW-102. Correspondence between J.A. Jones Construction Company and American Bridge shows that J.A. Jones was becoming concerned regarding high weld film rejection rates. Both schedule impact and the quality of the work being performed were questioned.

On October 6, 1977, a letter was sent from J.A. Jones Project Manager, J.J. Flannery, to American Bridge Project Manager, C.J. Madewell, expressing concern for weld rejection rates in excess of 30%, reaching as high as 34%. The letter has been included as App Figure C-1, and is quoted, in part, below.

“Tracking of the combined X-Ray, Inc. and Vitro radiograph reject rate for the month of September, 1977 indicates the average reject rate to be 30% and the last ten days to be 34% with porosity and slag inclusions being the major problems. We are very concerned that a reject rate of this magnitude, combined with a 20% manpower shortage, will have an adverse impact on your schedule in that welders are being diverted from production welding in order to perform the required repairs.”

Following the initial correspondence regarding poor welding success, D.W. Cutting, Engineering Support for Rockwell International, performed a review of recent weld radiography to better understand the nature of the problem. His findings are included in an internal letter from October 13, 1977, included as App Figure C-2, and quoted as follows:

“At the request of Project Quality Assurance, on Tuesday, October 12, 1977, I investigated the weld defect situation at the B120 Tank Farm. Interest had been aroused by a report which gave the weld rejection rate “approaching 35%.”

Discussion with Seth Bridges, J.A. Jones QA Supervisor, revealed that the rejection rate was based on the number of x-ray films taken, not the amount of welding shot. In an effort to get a better idea of the actual welding situation, I reviewed some 200 x-ray films.

The first 160 feet of welds looked at showed about 3 to 5% defective welding, that is inches defective out of inches inspected, for extensive in line porosity. I didn't attempt to keep track of the lengths of the small occasional defects which were typical of most of the rejected film. But they might add another 1% of rejectable welding. This 160 feet of film had been shot in the last couple of weeks and represented recent welding.

The final 40 feet of film reviewed was shot in early September. Those films showed about 50 or 60% defective welding. The defect was incomplete penetration or fusion of the root and inline porosity coming from the root condition. If this condition had been typical of all the welds I looked at, I would have recommended an immediate stop of all welding pending complete requalification of all welding procedures. However, since this seemed to be the exception, I believe it probably was the result of bad fit up or an incorrect amperage or travel speed setting on the welder.

A look at some of the joints ready for welding showed rusty conditions in the weld joint, particularly on the root lands, and varying root opening conditions. The rust may be responsible for some of the inclusions and porosity, and the irregular root openings may be responsible for the incomplete penetration and inline porosity.

Based on this brief review, my evaluation of the welding situation is as follows: the quality of the welding I looked at was not unusually poor compared to the rest of the

industry for that type of application. I feel that some improvement could and should be made by much closer attention to weld joint conditions (configuration and cleanliness), and by strict adherence to the welding parameters listed on the approved welding procedure.”

Mr. Cutting makes several important observations which serve to put these rejection rates into context. Radiography was performed to analyze one foot long weld sections. Given small defects in the weld section, a complete weld section could be rejected, requiring repair. A required repair does not necessarily indicate that the entire section would have been ground out and re-welded. This point was expressed in an October 18, 1977 letter by C.J. Madewell, Project Manager for American Bridge, in response to criticism regarding weld quality. The letter is included as App Figure C-3 and reads as quoted below.

“Your comments about weld quality are also misleading. For the month of September, the average weld reject rate may be evaluated as follows:

<i>1. X-Ray film rejected</i>	<i>29%</i>
<i>2. Rejected film without duplicates and informational film (non-work items)</i>	<i>23%</i>
<i>3. Rejected film without cosmetic repairs (non-welder items)</i>	<i>18%</i>
<i>4. Weld footage rejected</i>	<i>2%</i>

Any one of these percentages are valid reject rates, but, they are not all indicative of weld quality. We fail to see what positive effect letters of this nature will have upon the project.”

Overall, the percentage of weld films rejected does reflect inadequate pedigree of weld sections, warranting repair. Generally speaking, repeated repair of weld sections outside of the planned welding sequence is suspected to be a contributing cause for primary tank and secondary liner bottom flatness issues. This correlation was discussed in RPP-RPT-54819, *241-SY Tank Farm Construction Extent of Condition Review for Tank Integrity*. For discussion of primary tank and secondary liner bottom flatness, refer to Section 5.3 of this report.

Ultimately, all welds were examined and accepted using the methods described in Table 5-6, and all primary tank welds were stress relieved during the post-weld stress relieving process.

5.1.2 Non-Destructive Examination Methods Utilized

Throughout construction of the primary tank and secondary liner, non-destructive examination (NDE) was required. The level of NDE varied between the primary tank and secondary liner and with elevation on the tank wall. The change in NDE relative to elevation was based on the planned use of the tank to contain waste up to a specific elevation. Table 5-6 provides a summary of the NDE used to ensure the pedigree of the primary tank and secondary liner. Further information regarding NDE use can be found in the construction specification for the primary tank and secondary liner, B-120-C4.

Table 5-6. 241-AW Tank Farm Non-Destructive Examinations Used During Construction⁷

	Primary Tank Inspections	Secondary Liner Inspections
Tank Bottom	<ul style="list-style-type: none"> • 100% radiography • Magnetic particle, where clips, lugs, etc. had been removed and/or repaired and all areas where plate damage had been repaired by filling, welding, grinding, etc. • Liquid penetrant • 100% visual • Hydrostatic leak test 	<ul style="list-style-type: none"> • 100% radiography • Liquid penetrant • 100% visual
Bottom Knuckle	<ul style="list-style-type: none"> • 100% radiography • Magnetic particle, where clips, lugs, etc. had been removed and/or repaired and all areas where plate damage had been repaired by filling, welding, grinding, etc. • Liquid penetrant • 100% visual • Hydrostatic leak test 	<ul style="list-style-type: none"> • 100% radiography • Liquid penetrant • 100% visual
Vertical Wall	<ul style="list-style-type: none"> • 100% radiography, not including the weld of the cylindrical shell to the top knuckle. • Magnetic particle, where clips, lugs, etc. had been removed and/or repaired and all areas where plate damage had been repaired by filling, welding, grinding, etc. • 100% visual • Hydrostatic leak test 	<ul style="list-style-type: none"> • 100% radiography, not including the weld of the cylindrical shell to the top knuckle • 100% visual
Upper Knuckle and Tank Dome	<ul style="list-style-type: none"> • 100% visual 	<ul style="list-style-type: none"> • 100% visual

⁷ Tank NDE inspection reference documents: Specification B-120-C4 and Drawing H-2-70394

5.1.3 Welding in Inclement Weather

Hanford Plant Standard weld procedure, HPS-220-W, paragraph 3.6.d, specifies the following for welding operations:

“d. Protection from Adverse Environment

Protection from direct winds, drafts, air currents, rain, snowfall, etc., shall be mandatory for all welding processes. Special observation of this requirement shall be given where gas shielded welding processes, and submerged arc welding processes not using flux troughs, are involved. The protection provided shall, as a minimum, shield the actual weld zone, the weld equipment, and the operator.”

On several occasions, American Bridge failed to conform to this requirement, leading to the generation of the Nonconformance Reports (NCRs) found in Table 5-7.

Table 5-7. Inclement Weather Welding Nonconformance Reports

NCR #	Tank	Description	Disposition	Disposition Justification
B-120-56	AW-104 secondary bottom plate surfaces	Sub-contractor performed welding operation on Tank 104 secondary bottom while rain was falling with no protection or shelter provided to keep rain off of the actual weld zone. Parts welded were lifting lugs.	Accept As Is	Fabricator is responsible for placement of tank bottom. By virtue of that responsibility he assumes complete integrity of lifting lug welds. Note: Lifting lugs are temporary, construction aid – not part of permanent structure.
B-120-83	AW-105 primary vertical #5 course #2	Subcontractor performed welding operation without providing any protection from falling snow.	Reject	Remove all weld metal placed which was exposed to falling snow by air carbon arc gouging. Replace removed materials and provide adequate operator and weld joint protection. Much care, trouble, and expense have been taken to limit the amount of hydrogen in the weld zone i.e. low hydrogen electrodes E7018, etc. weld rod baking, restricted time of rod exposure to atmosphere, etc. Welding in the presence of H ₂ O causes breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as

Table 5-7. Inclement Weather Welding Nonconformance Reports

NCR #	Tank	Description	Disposition	Disposition Justification
				occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking. As delayed cracking can take place any time from immediately after welding to as long as several months later, this becomes of critical concern.
B-120-86	AW-105 secondary round seam #2	The subcontractor performed welding operations without providing protection from falling rain.	Reject	Remove all weld metal placed which was exposed to falling snow by air carbon arc gouging. Replace removed materials and provide adequate operator and weld joint protection. Much care, trouble, and expense have been taken to limit the amount of hydrogen in the weld zone i.e. low hydrogen electrodes E7018, etc. weld rod baking, restricted time of rod exposure to atmosphere, etc. Welding in the presence of H ₂ O causes breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking. As delayed cracking can take place any time from immediately after welding to as long as several months later, this becomes of critical concern.
B-120-96	AW-101 secondary top knuckle at 0° vertical seam	Subcontractor performed welding operations without providing protection from falling rain, on tank 101	Conditional Accept	Final pass of those affected areas shall be subjected to a liquid penetrant exam, per section 15H, Paragraph 3.B (3) of Specification B-120-C4.

Table 5-7. Inclement Weather Welding Nonconformance Reports

NCR #	Tank	Description	Disposition	Disposition Justification
		secondary top knuckle at 0° vertical seam.		Much care, trouble, and expense have been taken to limit the amount of hydrogen in the weld zone i.e. low hydrogen electrodes E7018, etc. weld rod baking, restricted time of rod exposure to atmosphere, etc. Welding in the presence of H ₂ O causes breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking. As delayed cracking can take place any time from immediately after welding to as long as several months later, this becomes of critical concern.
B-120-106	AW-105 secondary round seam #1 between verticals #5 and #6	On March 8, 1978, the subcontractor performed welding operations without providing protection from falling rain (TK 105S Round Seam #1 between verts 5 and 6 area markers 14 to 19). The disposition of the subsequent NCR (B-120-86) states, to remove all weld metal which was exposed to falling rain and replace. Approximately 3 feet only, of the affected area has been removed and replaced, leaving approximately 2 feet which has not.	Conditional Accept	Perform dye penetrant testing on remaining 2 feet as per section 15H, paragraph 3.B (3) Spec. B-120-C4. Absorbed hydrogen (potentially introduced by water) causes delayed underbead cracking.

Note: NCRs included as App Figure C-4 through App Figure C-8.

As noted in the disposition justifications of NCRs B-120-83, B-120-86, B-120-96, and B-120-106:

“Welding in the presence of H₂O causes breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking.”

It is further explained that this delayed underbead cracking can present itself immediately or as long as months in the future. The delayed nature of this cracking was of critical concern, creating the potential for inspection acceptance of a potentially unacceptable weld. For this reason, J.A. Jones utilized red hold tags on many occasions to stop work by American Bridge, generating the NCRs listed in Table 5-7.

On April 19, 1978, American Bridge responded to the various letters sent and stoppages imposed by J.A. Jones. The letter has been included as App Figure C-9, and is quoted as follows:

“Reference is made to your letters JAJ-932-375, JAJ-932-378, and JAJ-932-384 regarding welding during inclement weather.

Your letters lead one to believe that we have flagrantly abused our contractual responsibilities as outlined by the Specifications. We point out that we have worked over 1,200 welder days in inclement weather and generated six hold tag incidents regarding protection. Obviously, a difference of opinion now exists of what is necessary and adequate.

We first want to go on record as opposed to the extensive replacement welding outlined in your letters. Weld shrinkage caused by reworks of this magnitude can only have a detrimental affect [sic] on the geometry of the final product. The Specification Special Conditions state that work on a nonconformance is not to proceed until its disposition has been determined and received approval. This is your contractual responsibility as outlined in the Specifications. It is a matter of record that the referenced hold tags were removed and work allowed to proceed by the following day of their application. On the dates of your letters, work had proceeded to the point that weld shrinkage can no longer be controlled in the normal matter.

For your information we offer the following:

- 1. In Tank 105 seam C2V5, the welder began welding at location 0 on the day the hold tag was placed. At the time of placement he was welding between increments 1-2. The maximum length of weld considered, therefore, should be two lineal feet.*
- 2. In Tank 105, of the five lineal feet between increments 14-19, in excess of three feet has already been replaced because of defects found by radiography. Again, two lineal feet should be considered.*

3. *In Tank 105 between the increments 29-33, our information indicates that arc gouging in preparation for welding was being performed, but actual welding had not yet begun.*
4. *For Tank 104 knuckle-to-dome weld, the weld backup bar was being tacked to the knuckle side only with 3/16 x 1/2 inch fillet welds when the hold tag was placed. Subsequent weld passes have raised the temperature high enough to allow any entrapped hydrogen in the tacks to escape. There is no standard established in any of our codes, by the way, for the amount of hydrogen acceptable in these materials.*

We suggest that alternate inspection methods be employed to determine the adequacy of the weld metal placed.

We request that you re-evaluate the replacement work you have directed and in view of our objections, reaffirm your instructions. As discussed this date, Tank 104 is being readied for stress relief and should be addressed first.”

In response to the April 19, 1978 letter from American Bridge, J.A. Jones responded on April 21, 1978 to provide the requested instruction. The content of the letter has been quoted below and the original can be found as App Figure C-10.

“With reference to your letter of April 19, 1978, regarding welding during inclement weather, please comply with the following:

Item No. 1 – Tank 105: Accept your two lineal feet of repair, with sufficient supporting documentation.

Item No. 2 – Tank 105: Accept your two lineal feet of repair with sufficient supporting documentation.

Item No. 3 – Tank 105: Accept your statement as is.

Item No. 4 – Tank 104: Removal of weld metal prior to stress relieving will not be required. However, immediately after stress relieving, dye penetrant testing will be done to the effected [sic] area to determine if cracking exists in the weld joint. If cracking does exist, the necessary weld repairs will be made by you to correct this problem.”

Following this exchange of letters and non-conformance reports, Vitro Engineering Corporation issued a letter on July 14, 1978, illustrating their position on welds performed while exposed to inclement weather. The letter has been included as App Figure C-11 and the contents are as follows:

“This letter is to provide Vitro’s position on welds performed and exposed to inclement weather.

All welds which have been made while exposed to wet weather conditions shall have a dye penetrant test performed after a delay period (49 Hours Min.) has transpired. For further information see attachment.

NCR 120-86 and 106 have been dispositioned accordingly. Should other welds be prepared while exposed to wet weather they will also have a similar disposition.”

As is presented in the above correspondence, the approach for dealing with seams welded in inclement weather changed. Initially, direction was provided to gouge out and replace affected weld material. Later, Vitro directed the performance of delayed dye penetrant testing (at least 49 hours after weld performance). Whether a dye-penetrant test conducted 49 hours following weld performance would detect delayed underbead cracking in a seam is unclear. As described previously, underbead cracking might not have presented itself until months had passed. In the past, concern for weld quality was in regard to high weld rejection rates as seen for tank AY-102. In reviewing 241-AW tank farm construction, it is apparent that delayed underbead cracking as a result of inclement weather welding is an additional item of concern with regard to tank weld quality. While many stoppages and repairs occurred as a result of inclement weather welding, those that were documented received ample attention and were dispositioned with the intent to ensure weld quality and tank integrity.

5.1.4 Secondary Liner Damage during Refractory Removal

Construction Specification B-120-C4, section 15H, paragraph 3.A.(1).h, specifies the following regarding general execution of tank erection:

“h. Sharp gouges or deep scratches on all inner surfaces of the primary tank cylindrical section or bottom, and secondary tank bottom will be unacceptable when in excess of 1/32 inch in depth. Fill any imperfections exceeding 1/32 inch in depth with weld metal and inspect in accordance with paragraph 3B(4).”

As supporting information for the above quote, section 15H, paragraph 3.B.(4), of Specification B-120-C4 outlines magnetic particle examination, which was to be performed on all areas where plate damage had been repaired by filing, welding, grinding, etc. See Figure 4-8 for refractory section layout.

As a result of refractory removal and replacement, discussed in Section 5.4, scratches and gouges were inflicted upon the secondary liner bottom of several tanks. Non-conformance reports were written to document the issue as it pertained to both tank AW-101 and AW-106 and correspondence was located to document direction for the repairs. Mention of repairs to the tank AW-102 secondary bottom was also discovered in a letter from J.A. Jones to American Bridge. Detail of these events can be found in the following sub-sections.

5.1.4.1. Tank AW-101

On June 23, 1977, an NCR and three pieces of correspondence were generated regarding scratches and gouges in the tank AW-101 secondary bottom. NCR B-120-62, included as App Figure C-12, reads as follows:

“Sufficient care was not exercised by the contractor while removing the insulating concrete refractory in area “D” grid of the secondary tank bottom, resulting in numerous scratches and gouges in tank 101 exceeding the maximum depth of 1/32”.”

With this discovered issue noted, correspondence was sent on June 23, 1977, within J.A. Jones, between Vitro and ARHCO, and finally from J.A. Jones to American Bridge to provide direction.

Internal correspondence to J.A. Jones in a memorandum, included as App Figure C-13, states, in part, the following:

“This memo is being written to confirm the agreement made yesterday (June 22, 1977) by the Project B-120 Team members in regards to the chipping out gun gouges in segment D of Tank 101 secondary bottom. These gouges occurred during removal of the insulating refractory from this segment by J.A. Jones Construction Company...It was decided to treat the gouges in the following manner:

- 1. Grind out those that are less than [sic] 1/32” deep.*
- 2. Repair those that exceed 1/32” depth in accordance with Specification (B-120-C4, Sect. 15H, PP. 3.A.(1)H).*
- 3. For gouges that are on the weld, grind the reinforcement flush with the base metal and further evaluate the gouge at that point.*

It should be noted that Item 1 is not addressed in the Spec., and is, therefore outside the scope of the Spec.”

Vitro Engineering also provided comment on the June 22, 1977, meeting via a memorandum to ARHCO, included as App Figure C-14, and quoted as follows:

“This letter is to confirm discussions held in the JAJ 241-AW construction trailer on the afternoon of June 22nd with regard to gouges in the 241-AW-101 secondary tank bottom that were made during the course of removing the “D” section of the initial concrete pour...

It was understood that these gouges were made by a jackhammer that was being used to breakup [sic] the cast-in-place insulating concrete.

- Gouges with depth exceeding 1/32”: Repair in accordance with paragraph 3.A.(1)h of Section 15H of construction specification B-120-C4.*
- Gouges with depth equal to or less than 1/32”: Grind sharp edges smooth.”*

With the method for repair defined, NCR B-120-62 was dispositioned as follows:

“Repair and inspect in accordance with paragraph 3.A.(1)h of Section 15H of construction specification B-120-C4. Gouges with depth of 1/32” or less shall have sharp edges ground smooth.”

Lastly, J.A. Jones provided direction to American Bridge for repair and inspection of the affected area via a letter, included as App Figure C-15, and quoted, in part, as below.

“We request that you make the necessary repairs on the surface of Secondary Tank No. 101 in the area where the insulating concrete was removed. The Vitro inspector has marked the area to be ground, or welded, ground and magnetic particle inspected.”

On June 27, 1977, a response letter from American Bridge was sent to J.A. Jones. This letter documents completion of the repairs to the tank AW-101 secondary bottom and is included as App Figure C-16. Relevant detail has been quoted below:

“The repair work of the steel secondary bottom in Tank 101 you requested American Bridge to make on June 23, 1977 (JAJ-932-200) was accomplished on June 23, 1977.”

5.1.4.2. Tank AW-102

The refractory slab for tank AW-102 was also completely replaced with LW70 following initial placement of LW50 and, while not well documented, minor note of secondary liner repair was discovered in a letter from J.A. Jones to American Bridge. This letter, dated July 14, 1977, is included as App Figure C-17 and reads as follows:

“The administration has removed Sections A and E which were originally intended to be left in place. Please repair bottom plate areas as marked by the Vitro inspector. The repairs are to be accomplished by the same methods used in Tank 101 (Ref: JA Jones letter of June 23, 1977).”

While extensive information was not discovered documenting scratches and gouges in the tank AW-102 secondary liner bottom, it should be noted that similar methods would have been utilized as were employed for tank AW-101 for refractory removal (i.e. jackhammers, chain saws, etc.), which led to the required repairs.

5.1.4.3. Tank AW-106

On June 28, 1977, an interoffice correspondence documents concern for the tank AW-106 secondary liner bottom during refractory removal operations. This correspondence has been included as App Figure C-18 and is quoted as follows:

“During our Weekly Construction Meeting on May 4, 1977, Mr. D. D. Ritter, (ARCHO) [sic], observed Mr. J. Murphy (VERTECS), using a chain saw to remove slabs of insulating refractory from Tank 106. Mr. Ritter stated that he was very concerned about the damage that could occur if the saw blade came in contact with the steel secondary bottom. He demanded that the operation be stopped.”

On October 3, 1977, NCR B-120-71 was originated to document numerous gouges in the tank AW-106 secondary bottom. This NCR has been included as App Figure C-19 and the description reads as follows:

“Sufficient care was not exercised by the contractor while removing insulating refractory in secondary tank bottom #106, resulting in numerous gouges on the tank bottom.

**NOTE: None of the gouges are deeper than 1/32”.*”

Disposition of NCR B-120-71 was provided, directing the following:

“Gouges shall have sharp edges ground smooth.”

5.2 POST-WELD STRESS RELIEVING

During post-weld stress relieving of the 241-AW tanks, there were five instances of the maximum temperature differential of 200° F in the tanks being exceeded and certain thermocouples in the tanks not reaching the specified stress relieving temperature of 1000° F. In each of these tanks, the thermocouples that did not reach the specified temperature were located near the bottom center of the tank. This failure was thought to be a malfunction due to excessive moisture in the refractory. These data call into question whether the primary tank bottoms in tanks AW-102 through AW-106 reached the specified stress relieving temperature of 1000° F. However, the NCRs documenting these instances were dispositioned “Accept As Is” and expressed that reviews of all of the temperature data in these tanks indicated that the primary tanks had experienced successful stress relief operations. These NCRs are included as App Figure C-20 through App Figure C-24.

5.3 TANK BOTTOM FLATNESS

Specification B-120-C4, as was identified for other tank farm construction projects, required that primary tank bottoms and secondary liner bottoms could have no root-to-crown slopes (bulges) greater than 3/8 in. per ft. and a maximum root-to-crown height of 3 in. or less. Issues with tank bottom flatness are discussed in the following sections.

5.3.1 Secondary Liner Bottom Flatness

5.3.1.1. Tank AW-102

Initial surveys of the AW-102 secondary liner bottom indicated that there were four areas not within the 3/8 in. per ft. tolerance. NCR B-120-57 (App Figure C-25) was generated to record the out-of-tolerance issue on May 2, 1977.

As a result of the out-of-tolerance tank bottom, American Bridge attempted to flatten one of the bulges by dropping a wide flange beam on it several times in an attempt to flatten it. A May 2, 1977, letter from D. R. Olney to J. E. Parsons (App Figure C-26) explains the event.

“On the afternoon of Friday April 29, 1977, two red tags were placed on the ‘bumps’ in the Tank 102 secondary bottom...

...American Bridge had checked the Tank 102 secondary bottom for flatness tolerance, and had found two areas where the slope of the bottom exceeded that which was allowed by the Specifications... Prior to the red tags being placed, I had personally witnessed American Bridge personnel measuring these out of tolerance areas. I also witnessed them gently place two pieces of a 36” wide flange beam on one of the bumps in an attempt to flatten it out (one piece of beam was placed on top of the other)...

...After I had returned to the office (approximately 20 minutes later)...J.H. Parrish presented us with copies of the red tags. Parrish also informed us that the beams were being ‘dropped’ on that bump...”

NCR B-120-55 was generated to record this event. It is noted in NCR B-120-55 (App Figure C-27) that the sub-contractor dropped the beam about six times directly on one of the out-of-tolerance bumps. The disposition of this NCR is as follows.

“Method used to attempt to reduce out-of-tolerance condition is unacceptable; however, what has been done will be accepted on condition that visual and magnetic particle inspection reveals no apparent damage to plate in vicinity of impact.”

On June 1, 1977, it is noted in the QA log:

“...Performed MT [Magnetic Particle Testing] in accordance with the disposition to NCR #55 [B-120-55] on the tank 102 secondary bottom...”

There was no further discussion about the acceptance or rejection of the magnetic particle inspection in the QA log.

A letter regarding the four out-of-tolerance bulges from J.A. Jones to American Bridge on May 17, 1977, (Appendix B, App Figure C-28) states the following. :

“You have been notified, verbally, on several occasions, that the secondary bottom for Tank 102 has several areas that do not meet the slope requirement of 3/8” per foot as specified in Specification B-120-C4, Section 15H, Appendix B, Paragraph 3, page 27; and from our recent conversations, it appears that American Bridge chooses to interpret the specifications different from the Administration. I feel obligated to inform you that Vitro has written an NCR (B-120-57, 932-18), recording this condition. Vitro’s Engineering Department has been unable to come up with justification for accepting the ‘out of tolerance’ condition ‘as is’ and will require corrective action on the part of the subcontractor, which can be comprised of any of the following items:

- 1. Demonstrate, through analytical means, that the above areas cannot be stressed more than specification allowances.*
- 2. Implement a repair procedure which will correct the ‘out of tolerance’ conditions.*

Please note that a repair procedure will be subject to approval by the Administration. From a Project standpoint, this item does materially affect your overall schedule.”

NCR B-120-57 was accepted as is on May 31, 1977, based on the following disposition and justification:

“An engineering evaluation of the out-of-specified tolerance conditions in the 241-AW-102 secondary tank bottom was made; and the conditions are determined to be acceptable as-is. This evaluation included a review of two analytical reports prepared by Battelle Northwest [“Recommended Bottom Flatness Tolerance for Million Gallon Waste Storage Tanks” and “Analysis of Stresses Due to the Flattening of Bumps in the Bottom and Knuckle Regions of Million Gallon Waste Storage Tanks”] for ARHCO. These reports indicate that bump slopes up to 3/4” per foot are acceptable in bottom plates. This is double the specified slope tolerance of 3/8” per foot. Only one of the bumps, included in this NCR, has a slope of 3/4” per foot.

A review of the BNW analytical reports with their analyst, JR Friley, revealed the following considerations that rendered [sic] the acceptance of these out-of-tolerance bumps reasonable and yet conservative:

- A. The BNW analytical approach itself was conservative. The assumption was made that tank bottom bumps completely flattened out under operational loading conditions- -actually, it is inconceivable that bottom bumps will ever completely flatten out under actual operational loading.*
- B. Compressive stresses indicated in the reports will not vary significantly as a function of plate thickness. This is important because the 3/4” per foot tolerance stated above was determined for 1/2” plate rather than for 3/8” plate as used in the 241-AW-102 secondary tank bottom.*
- C. The BNW analysis was based on yield strength of plate material at 350°F (39,000 psi); whereas, the secondary tank bottom operating temperature will probably be closer to 200°F maximum (44,000 psi). This will reduce the potential of building-in residual stresses through full loading cycles.”*

Following the acceptance of this out-of-tolerance condition, a letter, included as App Figure C-29, was sent from J.A. Jones to American Bridge on June 8, 1977, which stated:

“Reference is made to our letter dated May 17, 1977 regarding the out of tolerance condition of the Tank 102 secondary bottom. As you are aware, the Administration has decided to disposition this Nonconformance to accept ‘as is’. The requirement for American Bridge to provide an analysis or a repair procedure is waived...”

5.3.1.2. Tank AW-106

At least 19 different locations on the tank AW-106 secondary bottom exceeded the 3/8 in. per ft. specification. Figure 5-1 shows the location of each of these out-of-tolerance areas.

NCR B-120-72 was generated as a result of the out-of-tolerance conditions in the tank AW-106 secondary bottom. The bulges were later accepted using the disposition in NCR B-120-72 (Appendix B, App Figure C-30), which stated:

“An engineering evaluation of the out-of-specified tolerance conditions in the 241-AW-106 secondary tank bottom was made; and the conditions are determined to be acceptable as-is. This evaluation included a review of two analytical reports prepared by Battelle Northwest [“Recommended Bottom Flatness Tolerance for Million Gallon Waste Storage Tanks” and “Analysis of Stresses Due to the Flattening of Bumps in the Bottom and Knuckle Regions of Million Gallon Waste Storage Tanks”] for ARHCO. These reports indicate that bump slopes up to 3/4” per foot are acceptable in bottom plates. This is double the specified slope tolerance of 3/8” per foot. Only one of the bumps, included in this NCR, has a slope of 3/4” per foot.

A review of the BNW analytical reports with their analyst, JR Friley, revealed the following considerations that rendered [sic] the acceptance of these out-of-tolerance bumps reasonable and yet conservative:

- A. The BNW analytical approach itself was conservative. The assumption was made that tank bottom bumps completely flattened out under operational loading conditions- -actually, it is inconceivable that bottom bumps will ever completely flatten out under actual operational loading.*
- B. Compressive stresses indicated in the reports will not vary significantly as a function of plate thickness. This is important because the 3/4” per foot tolerance stated above was determined for 1/2” plate rather than for 3/8” plate as used in the 241-AW-106 secondary tank bottom.*
- C. The BNW analysis was based on yield strength of plate material at 350°F (39,000 psi); whereas, the secondary tank bottom operating temperature will probably be closer to 200°F maximum (44,000 psi). This will reduce the potential of building-in residual stresses through full loading cycles.”*

Figure 5-1. Tank AW-106 Secondary Bottom Out-of-Tolerance Locations

5.3.2 Primary Tank Bottom Flatness

Tank AW-106 primary bottom was surveyed and found to be acceptable per Meeting of Work Minutes on July 5, 1978 (Appendix B, App Figure C-31). There was no further information located with respect to primary bottom flatness.

5.3.3 241-AW Tank Farm Bottom Flatness Issues Summary

The principal issue with unsupported bulges in the secondary liner is that the bulges compress under the weight of a filled primary tank. The refractory may then crack due to a lack of strength in shear, leaving portions of the primary bottom unsupported.

Tanks AW-102 and AW-106 had bulging in the secondary liner bottom. The bulging in the secondary liners of tanks AW-102 and AW-106 is similar to the bulging noted in RPP-ASMT-53793 for tank AY-102. In this 241-AW tank farm instance, each secondary liner was accepted as is, following engineering evaluation to determine any risk to tank structural integrity.

No indication of bulging in any of the primary tank bottoms was found.

5.4 REFRACTORY

5.4.1 Weak Refractory Compressive Strength

The original specification for the refractories in the 241-AW farm called for either Kaolite 2000 or Lite Wate 50; American Bridge chose to use Lite Wate 50. When the first two refractories were placed in tanks AW-105 and AW-106, NCR B-120-46 (see App Figure C-32) was written to call attention to deviations from approved procedure for the placement of insulating concrete. Compressive strength tests for the concrete that was placed in these two tanks showed low strength and the refractories were deemed unacceptable. It was discovered that the LW50 that was used in tanks AW-105 and AW-106 contained an air entrainment agent instead of the air dispersing agent that had been specified in the approved procedures. According to a letter from Pryor-Giggey, the manufacturers of LW50, the air entrainment agent would have weakened the concrete by introducing minute air bubbles throughout the concrete, making it highly porous (see App Figure C-33). American Bridge was instructed to remove the low strength concrete from tanks AW-105 and AW-106 and to demonstrate a successful refractory installation procedure before proceeding with any other refractory work.

The demonstration showed that correct mixing and placement procedures could produce satisfactory results and American Bridge was directed to perform a supervised placement of LW50 in tank AW-101. Four of the five sections in the tank AW-101 refractory were satisfactory, but section D was rejected due to low compressive strength. This section was removed and replaced with LW50 that was enriched with Ciment Fondu⁸, a calcium aluminate binder commonly used in refractory cement (see App Figure C-34). This increased the compressive strength of the refractory without significantly increasing the k factor, or thermal conductivity, of the cement (see App Figure C-35). The replaced section was approved.

The enriched blend of LW50 was used for the refractory in tank AW-102 and had a satisfactory compressive strength. However, when leak detection slots were cut in the refractory, laminations were found and it was deemed unacceptable. The laminations were likely due to placement of the concrete when the outside temperatures were too high. Future pours were conducted during cooler hours to minimize the likelihood of more such laminations. Pryor-Giggey suggested the use of LW58 to improve the compressive strength margin of the refractory, but later suggested the use of LW70 instead (see App Figure C-36 and App Figure C-37). The AW-102 refractory was replaced with LW70 and found to be satisfactory.

⁸**Fondu** is a registered trademark of Ciment Lafarge Corporation.

LW70 was used successfully for the refractories in tanks AW-103 and AW-104, and it was subsequently used to replace the unacceptable LW50 that was initially placed in tanks AW-105 and AW-106.

5.4.2 Steaming during Stress Relieving

Reviewed Vitro job logs, kept during stress relief activities, show that steam was present during heating of tanks AW-105 and AW-106. They further indicate that it was caused by retained moisture in the refractory. These notes have been incorporated into the Appendix A table of key construction events for June 7, 1978, and June 15, 1978, respectively. These tanks are the only two in the 241-AW tank farm for which notes of steaming were discovered, with no mention of it in any other reviewed documentation.

5.4.3 Water Overflow into Annulus

On April 12, 1978, during the hydrostatic testing of tank AW-102, the primary tank was overfilled and water poured into the annulus and out of the access in the secondary liner. No NCR was written, but the daily logbook notes that American Bridge was directed to attempt to prevent similar overflow occurrences in the future.

The daily logbook states that on June 29, 1978, crews completed filling tank AW-104 with water. The hydrostatic testing of this tank was completed on May 26, 1978, and there is no daily logbook entry regarding the reason it was being filled again. On July 5, 1978, the daily logbook notes that crews pumped water out of the tank AW-104 annulus, but there is no discussion of when or how the water was introduced. This may have been an overflow of water from the primary tank into the annulus if water was being used to support the concrete dome pour. There is no other mention of the introduction of water into the annular spaces of these two tanks.

Laboratory tests were conducted to study the effects of heating and water saturation on the compressive strength and thermal conductive properties of LW70. Results showed varying compressive strengths and thermal gradients among all samples, including field cast cylinders and lab-mixed cylinders. The thermal gradients of the cylinders showed that they would keep the secondary liner well below the specified 500° F. Compressive strength tests showed that both heat exposure and water saturation affected the compressive strength of the concrete; however, all of the samples tested performed well above the 130 psi threshold. For details of the testing procedures used, see RPP-19097, *Evaluation of Insulating Concrete in Hanford Double-Shell Tanks*, Attachment 10. For test result data, see App Figure C-38, App Figure C-39, and App Figure C-40.

Similar tests were conducted on samples of LW50 taken from the first refractories poured in tanks AW-105 and AW-106. The refractories in these tanks were deemed unacceptable and replaced with LW70, but the LW50 that was used in tank AW-101 was considered acceptable and allowed to remain. The results of the tests on the AW-105 and AW-106 refractories showed that specimens that were exposed to higher temperatures or water soak tended to exhibit lower compressive strength values than those that had been held under ambient conditions (see App Figure C-41). There are no data available on enriched LW50.

5.4.4 241- AW Tank Farm Refractory Issues Summary

The use of LW50 for the refractories in the 241-AW tanks produced low strength concrete due to deviations from procedure, despite the successful use of LW50 in the 241-SY farm. Most of the LW50 that had been poured in the 241-AW tanks was removed and replaced with LW70 due to inadequate compressive strength. Only tank AW-101 retained any LW50, having four of its five sections made of regular LW50 and one section made of enriched LW50. Laminations in the enriched LW50 poured in tank AW-102 caused crews to begin pouring during cooler weather.

Steam was noted in Vitro job logs during stress relief activities in tanks AW-105 and AW-106 and was attributed to moisture in the refractory. No further documentation on the subject was found.

Water was introduced into the annular spaces of AW-102 and AW-104 after stress relieving, though it was only mentioned in passing in the daily logbooks. The water was removed and no further documentation on the subject was found.

5.5 ISSUES UNIQUE TO 241-AW TANK FARM

5.5.1 Surface Defects and Plate Laminations

Surface defects and suspected plate laminations of plate steel were discovered and documented with American Bridge NCRs on many occasions. These defects were suspected to be the result of transportation as well as fit-up activities, which often required temporarily welding equipment to the plate surface. Defects were repaired in accordance with approved specifications.

Table 5-8 provides an overview of American Bridge NCRs related to these conditions. The piece mark number, along with the heat and slab number, provide the necessary information to locate a particular piece of steel in the tank. The piece mark number is not unique to a particular tank, only identifying placement in a general tank design. Heat and slab numbers, when combined with the piece mark number, constitute a unique set of information. This identifies a particular plate location in a particular tank.

Information to follow will highlight the approach used to qualify and accept use of the material during construction.

Table 5-8. American Bridge Surface Defect Nonconformance Reports

NCR #	Tank	Piece Mark	Description	Disposition
77-1	AW-103 Secondary Bottom	102B011	See attached sketch (included with App Figure C-42). Heat No. 1G5823. Slab No. 1400B.	<p>Relocate to bottom fabrication area.</p> <ol style="list-style-type: none"> 1) Make repair per Welding Procedure Specification WLD-1-A. 2) Insure complete removal of defect using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual. 3) Grind as-deposited weld metal flush with parent material. 4) Perform Magnetic Particle Inspection as defined in the Construction Department Quality Assurance Manual – Section 8. <p>This repair procedure has been technically reviewed and evaluated to be non-detrimental to the plate.</p>
77-2	AW-105 Secondary Bottom	102B01	Surface defect located by visual inspection. Heat No. 2G1138. Slab No. 0600C.	Same as for 77-1.
77-3	AW-103 Secondary Bottom	102B08	Surface defect located by visual inspection. Heat No. 2G1142. Slab No. 2300C.	Same as for 77-1.
77-4	AW-106 Secondary Bottom	102B05	Two gouges in the surface located by visual inspection. Heat No. 2G1138. Slab No. 0900C.	Same as for 77-1.
77-5	AW-106 Secondary Bottom	102B09	Surface defect located by visual inspection. Piece is part of Tank 106-S bottom and is located next to seam BRS #2 and film identification #54. Heat No. 2G1142. Slab No. 1700C.	<ol style="list-style-type: none"> 1) Make repair per Welding Procedure Specification WLD-1-A. 2) Insure complete removal of defect using magnetic particle inspection as defined in Section 8 of

Table 5-8. American Bridge Surface Defect Nonconformance Reports

NCR #	Tank	Piece Mark	Description	Disposition
				<p>the Construction Department Quality Assurance Manual.</p> <p>3) Grind as-deposited weld metal flush with parent material.</p> <p>4) Perform Magnetic Particle Inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.</p> <p>This repair procedure is approved by Engineering, and provides a repaired plate equivalent to a plate not requiring repair.</p>
77-9	AW-104 Secondary Bottom	102B010	Surface defect located by visual inspection. Piece is part of Tank 104-S (bottom plate) and is located 7-1/2" (ab't) west of Weld Seam BNS #5, between film markers 2 and 3.	Same as for NCR 77-5.
77-10	AW-104 Secondary Bottom	102B08	Surface defect located by magnetic particle. Piece is part of Tank 104-S (Bottom Plate) and is located 2" (ab't) west of Seam BNS #1, between film markers 1 and 2. Heat No. 2G1142. Slab No. 2100A.	Same as for NCR 77-5.
77-11	AW-102 Primary Bottom	201B05	Surface defect located by visual inspection. Piece is part of Tank 102-P (Bottom Plate) and is located 1" (Ab't) west of Seam BNS#2 and between film markers 5 and 6. Heat No. D05379. Slab No. 06034.	Same as for NCR 77-5.
77-13	AW-103 Secondary Bottom	102B011	Surface defect located by dye penetrant inspection. Heat No. 1G5823. Slab No. 1400B.	Same as for NCR 77-5.

Table 5-8. American Bridge Surface Defect Nonconformance Reports

NCR #	Tank	Piece Mark	Description	Disposition
77-18	AW-101 Secondary Shell	501M1	Surface defect located by visual inspection. Tank 101 – Secondary Tank – 1 st course shell plate. Heat No. 1G4720. Slab No. 1600C.	Same as for NCR 77-5.
78-2	AW-103 Secondary Shell	501M1	Surface defect located by visual inspection. Tank 103-S. Course No. 2. Heat No. 1G5826. Slab No. 0800A.	Same as for NCR 77-5.
78-3	AW-103 Secondary Shell	501M1	Surface defect located by visual inspection. Tank 103-S. Course No. 2. Heat No. 1G5826. Slab No. 2200A.	Same as for NCR 77-5.
78-4	AW-101 Secondary Shell	F501M1	Surface defect located by visual inspection. Tank 101-S. Course No. 2. Heat No. 1G5826. Slab No. 1700A.	Same as for NCR 77-5.
78-5	AW-102 Secondary Shell	F501M1	Surface defect located by visual inspection. Tank 102-S. Course No. 2. Heat No. 2G1142. Slab No. 0800A.	Same as for NCR 77-5.
78-8	AW-106 Secondary Shell	F501M1	Surface defect located by visual inspection. Tank 106-S. 2 nd Course Shell Plate. Heat No. 1G5826. Slab No. 0400A.	<ol style="list-style-type: none"> 1) Make repair per Welding Procedure Spec WLD-1-A. 2) Insure complete removal of defect by using Magnetic Particle Inspection as defined in Section 8 of the Construction Department Quality Assurance Manual. 3) Grind as-deposited weld metal flush with parent metal. 4) Perform inspection as in 2, above. <p>Note: This repair procedure is approved by Engineering and</p>

Table 5-8. American Bridge Surface Defect Nonconformance Reports

NCR #	Tank	Piece Mark	Description	Disposition
				provides a repaired plate equivalent to a plate not requiring repair.
78-9	AW-103 Secondary Shell	F501M1	Surface defect located visual inspection. Tank 103-S. 4 th Course Shell Plate. Heat No. 1G5824. Slab No. 2800A.	Same as for NCR 78-8.

Note: NCRs are included as App Figure C-42 through App Figure C-57.

Table 5-9. Surface Defect NCR Tank Location Summary

Tank	Primary Bottom	Secondary Bottom	Primary Shell	Secondary Shell
AW-101	-	-	-	2
AW-102	1	-	-	1
AW-103	-	3	-	3
AW-104	-	2	-	-
AW-105	-	1	-	-
AW-106	-	2	-	1

While the majority of surface defects found, documented, and dispositioned by American Bridge with their NCR process, in two instances, Vitro also produced NCRs to document defects found in plates upon arrival to the field. These two instances were with reference to American Bridge NCRs 77-1 and 77-5.

A daily logbook note (App Figure C-58) from January 16, 1977, documents the generation of the first Vitro NCR (B-120-36, included as App Figure C-59) relative to the discovery and documentation in American Bridge NCR 77-1. It reads as follows:

“Jim Parrish placed a red tag (#0312) on the piece of plate that had a lamination problem (a red tag had been applied by A.B. when it arrived at the jobsite). Parrish stated that an NCR will be written in order to formally receive the NCR that A.B. had written. Parrish was informed that this was beyond the scope of the contract and that A.B. would probably refuse to give them a copy of their NCR.”

Despite being beyond the scope of the contract, as identified in the above note, NCR B-120-36 was indeed generated by Jim Parrish and has been included as App Figure C-59. It referenced American Bridge NCR 77-1 and provided the following disposition and justification:

“Allow American Bridge to proceed with repairs in accordance with their own proposed disposition, per attached American Bridge NCR; however, American Bridge must provide

assurance that the plate, as repaired, conforms to ASTM 537, Class 1 and ASTM A20 with supplementary requirement S12, as specified by the Construction Specification B-120-C3.

If adequate assurance is provided, the repaired plate can be considered equivalent to a similar plate not requiring repairs.”

On February 14, 1977, Vitro Sr. Field Inspection, Jim Parrish, originated another NCR to document a discovered defect next to the BRS #2 seam in the tank AW-106 secondary bottom. Vitro NCR B-120-37, included as App Figure C-60, describes the issue as follows:

“Discrepancy:

There is a surface defect located in the 3/8” bottom plate of Tank #105 as shown on the attached sketch.”

Disposition Justification:

Repair by first removing the defect by grinding. Magnetic particle or liquid penetrant testing shall then be utilized to assure complete removal of the defect. Reweld and grind smooth the repaired area and then test the completed repair weld with magnetic particle testing. All welding and nondestructive testing shall be performed in accordance with the applicable approved procedures.

Justification:

ASTM 20 allows weld repairs of material with customer approval. Also, Specification B-120-C4 Section 15H, paragraph 3A.(1)h defines repairs of surface defects.”

It was not until the generation of Vitro NCR B-120-37 that American Bridge NCR 77-5 was developed, addressing the discovered defect. Detail of NCR 77-5 can be found in Table 5-8.

As is repeatedly described in the dispositions of these non-conformances, plates that were repaired using the Engineering-approved repair procedure were deemed equivalent to undamaged plates. Given the information discovered, adequate attention and disposition was given to ensure plate quality and tank integrity.

5.5.2 Tank Bottom Lifting

As mentioned in Section 4.2, some of the secondary bottom liners, such as tank AW-105, were built over the concrete foundation of a neighboring tank. In this case, the tank AW-105 secondary liner bottom was fabricated over the tank AW-103 concrete foundation. Therefore, the secondary liner bottom had to be lifted and moved over to the tank AW-105 concrete foundation and lowered into place. Prior to performing this work, American Bridge had to submit a procedure to Vitro for acceptance.

There was concern with the procedure submitted by American Bridge from the beginning. Once American Bridge submitted their procedure, additional information was requested prior to accepting the procedure. It is noted in the *Summary of Procedure for Lowering Tank Bottoms*, (see App Figure C-61):

1. *“On November 18, 1976, we received copies of American Bridges’ erection drawing DE-3, which itemized procedure for lowering tank bottoms. This was reviewed and returned ‘Approve with Exception’ on December 8, 1976. Exceptions are as follows:*
 2. *‘American Bridge should submit strength analysis for bottom plate lifting loads. Analysis should cover bottom plates, lugs, shackles and wire rope strength.*
 3. *Define appropriate procedure for removal of lifting lugs.*

Please Resubmit.’

2. *On January 13, 1977, American Bridge resubmitted their erection procedure and design calculation as requested on the first submittal.*
3. *During the process of review, Vitro determined that additional information was required on the analysis performed by American Bridge. This additional information was hand-delivered February 9, 1977 to Dr. Chang with subsequent formal transmittal on February 11.*
4. *Upon review of this additional information, Vitro determined that the method of analysis in the area of the lifting lugs was inadequately covered and requested a different method of calculation.*
5. *JAJ requested this additional information from American Bridge, verbally and was informed that American Bridge was satisfied with the analysis as it stood, and that they felt they had already supplied more information than was contractually required and that it was up to the Administration to inform them if they wanted American Bridge to do any more work. This information was passed on to Vitro.”*

The revised lifting stress calculations can be seen in Appendix C, App Figure C-62.

American Bridge attempted to lift the tank AW-105 secondary liner bottom on February 18, 1977. A Surveillance Report from February 18, 1977, included as App Figure C-63, states:

“ABD attempted to lower the 105 secondary tank bottom on 2/18/1977. (Extent of lift was probably 6” off of tank support scaffolding.)

After several attempts by ABD it was obvious that there were not enough lifting lugs (or supports) on the tank bottom to lift it without excessive distortion of the bottom. (Note: Distortion – inelastic buckling between outer lifting lugs).

ABD stoped [sic] the lifting procedure. ABD contacted their engineering department for further analysis of their lifting (lowering) procedure. Possible resolution to the situation will be to add additional lifting lugs or ‘strongbacks’ to bottoms.”

A letter sent after the initial tank AW-105 bottom lift failure from A.W. Akerson to J.A. Jones on February 25, 1977, clarifies the concern J.A. Jones and Vitro had with the lifting procedure

submitted and subsequently used by American Bridge. The letter, included as App Figure C-64, states:

“... Vitro’s initial review of the analysis submitted... revealed that membrane stresses had been inadequately addressed. Rather than formally disapproving and suffering the time delays of a formal resubmittal, you agreed to have Vitro’s Dr. Chang communicate directly wiah [sic] American Bridge to resolve analysis short comings. Dr. Chang did indeed communicate [sic] directly with American Bridge; convinced them of the need for additional analysis...; and subsequently received, informally, additional analysis...”

...Dr. Chang found that the analysis model used by American Bridge for the vicinity of the lifting lugs was not realistic... discussions with American Bridge, however, indicated that they were unwilling to do any further analysis...

...American Bridge expressed confidence in their analysis in its present state... American Bridge indicated their intent to proceed with the lifting operation; and Vitro Title III applied a red hold tag to prevent lifting... Later in the day, Vitro elected to allow American Bridge to proceed at their own risk, on the basis of the confidence expressed in their letter... and with the understanding that if Vitro’s checking analysis of the lifting lugs proved that problem did exist, American Bridge would repair or replace the relocated bottom...”

After initial attempts to lift the tank AW-105 secondary bottom failed, American Bridge began to add stiffeners to the tank bottom. On February 28, 1977, it is noted in the QA daily logbook:

“Received and started welding together the angle stiffeners for lifting tank 105 secondary bottom.”

The next day on March 1, 1977, the QA daily logbook states:

“Completed welding the stiffeners and completed the installation of them on tank 105 secondary bottom. Re-installed lifting rigging on the tank 105 secondary bottom and attempt to lift the bottom (still had sag). Bottom was set back down...”

American Bridge then fabricated additional lifting beams for lowering the tank AW-105 secondary liner (QA daily logbook on March 2, 1977), and on March 4, 1977, American Bridge successfully lifted, travelled, and lowered the tank AW-105 secondary bottom onto its foundation (QA daily logbook on March 4, 1977).

No records of tank bottom distortions were located for the remaining tanks. See Table 4-1 and Table 4-2 for a listing of which tank bottoms were lifted and walked into place.

5.5.3 Tank Dome Distortions

Tank AW-101 was the first in the 241-AW tank farm to be post weld stress relieved beginning on March 3, 1978. After stress relieving, it was noted in NCR B-120-88 that the AW-101 dome exhibited reverse curvature and flat spots near the risers that were used for the stress relief

burners (see Table 5-10 for details). The NCR also notes that several other areas on the tank dome exhibited reverse curvatures or flat spots, but none of these were as severe as those around the risers.

In order to resolve the dome deformation in tank AW-101, American Bridge performed magnetic particle testing of the outside welds on the 42 in. risers where deformation had occurred; no indication of fracture was found. American Bridge also installed twice the number of J bolts as originally called for in order to preclude buckling in the deformed areas of the dome during operational loading conditions (see App Figure C-66).

On March 21, 1978, a pre-stress relief meeting was held for tank AW-102. The purpose of this meeting was to discuss ways to prevent dome distortion due to post-weld stress relieving, such as the distortion seen in tank AW-101. During the meeting, it was decided that the contractor, American Bridge, would seal gaps around the burners to attain 3 in. of water pressure, insulate air tubes to one foot below the roof line, place thermocouples on the burner and damper penetrations, and soak the tank at 1000° F for 3 hours.

A letter from the Assistant Director Engineer at American Bridge in Los Angeles to the Project Manager for the 241-AW tank farm expressed the company's opinion that, although 3.5 in. of water was the optimum internal pressure in the tank, the reduced internal pressure in tank AW-101 during stress relieving was not harmful to the tank (see App Figure C-67). This letter also addressed the issue of creep possibly causing the distortions in the dome of tank AW-101. It was noted that during post-weld stress relieving, tank AW-101 had been kept at or above 1000° F for 9 hours. In order to reduce distortions due to creep, it was decided that the temperature and the time at or above 1000° F could be substantially reduced. Tank AW-102 was kept at or above 1000° F for about 7 hours and the dome showed a very substantial reduction in distortion. Reverse curvatures and flat spots in the tank AW-102 dome were noted in NCR B-120-91, which recommended a disposition of "Accept As Is" because the deformations were not severe (see Table 5-10 for details). The deformed areas were located near the 42 in. construction risers, which had housed the stress relieving burners.

Areas of reverse curvature and flat spots were also observed on the domes of tanks AW-103 and AW-104 and noted in NCRs B-120-95 and B-120-94, respectively. All of the deformations in these two tanks were located near the 42 in. construction risers, which had housed the stress relieving burners. The recommended disposition for NCR B-120-95 was "Accept As Is," while the recommended disposition for NCR B-120-94 was "Conditional Accept," based on American Bridge's ability to reduce the chance of the deformations getting any worse. Like tank AW-102, tanks AW-103 and AW-104 were stress relieved at the lower temperature of 1000° F and the deformations in these tanks were significantly less severe than those in tank AW-101. There were no further mitigating actions documented for the distortions in these three tanks. See Table 5-10 for details on these NCRs and their dispositions.

Table 5-10. Tank Dome Reverse Curvature NCRs

NCR #	Description	Disposition	Disposition Justification
B-120-88	<p>Tank 101-AW dome exhibits reverse curvature and/or flat spots in the following approximate locations:</p> <ol style="list-style-type: none"> 1. Riser #5 at 90° 2. Riser #5 at 270° 3. The two 24-inch risers located at 0° and 180° that the subcontractor installed to facilitate stress relieving <p>Note:</p> <ol style="list-style-type: none"> 1. These are the tank risers that the burners were stationed on during the stress relieving operation. 2. There are several other areas on the dome exhibiting reverse curvatures and/or flat spots that are not as severe as the locations mentioned above. 	Conditional Accept	<p>Conditional Accept, if American Bridge, in their capacity of having design responsibility for the steel tanks, can provide adequate analyses to support a position that the after-stress relief configuration of the Tank 101-AW steel dome will not...</p> <ol style="list-style-type: none"> 1. Be overstressed during the subsequent placing of the concrete dome, and... 2. Create localized overstressing conditions in the dome concrete after the supporting water is removed from the tank <p>Repair, if above conditions for acceptance cannot be met. The repairs, such as addition of external bracing, must be such that the gross steel tank dome deformations will maintain their configuration with up to a 7-foot head of water internal pressure (pressure reached during placement of concrete dome).</p>
B-120-91	<p>Tank #102 Dome exhibits areas of reverse curvature and/or flat spots.</p> <p>Note: P.W.H.T. completed</p>	Accept As Is	Curvatures and flat spots are not severe.
B-120-94	<p>Tank Dome #104 reveals areas of reverse curvature and a flat spot around riser #5 located at 90° and 270°.</p> <p>Reference #1 – Add PDT 932-13.J1</p> <p>Reference #2 – Add Letter to Proj. Mgt. Team from AW Akerson</p>	Conditional Accept	<p>The reverse curvatures and flat spots are acceptable if American Bridge takes appropriate action to reduce the possibilities of the curvatures and flat spots getting worse.</p> <p>Per Vitro inspection, deviation of areas of reverse curvature and flat spot is less than 1.5 inches. Tanks 102 and 103 exhibited similar deviations, up to 1.92 inches, which were acceptable. Therefore, these deviations are acceptable for tank 104.</p> <p>As NCRB-120-94 Tank 104 this is an</p>

Table 5-10. Tank Dome Reverse Curvature NCRs

NCR #	Description	Disposition	Disposition Justification
			evaluation based on engineering judgement [sic]. Ref. #1 – As per Amer. Bridge ltr, dated 6/2/78, Item – Transient local stresses produced during construction are not a substantial fraction [sic] of yield forces, and may be ignored.
B-120-95	<p>The dome on Tank #103 exhibits areas of reverse curvature and/or flat spots.</p> <p>Note:</p> <ol style="list-style-type: none"> 1. The areas of reverse curvature are confined mainly to the dome circumferential weld seams. 2. The areas of flat spots are located primarily around the 42” risers and one of the additional 24” risers used for stress relieving. 	Accept As Is	Reverse curvatures and flat spots are not critical enough to cause a structural problem during subsequent construction and operational loading conditions.

Note: NCRs included as App Figure C-65, App Figure C-68, App Figure C-69, and App Figure C-70.

5.5.4 Deflector Tubes

The daily log from March 27, 1978, notes that when the burners were removed from tank AW-102 after stress relieving, it was discovered that three of the four deflector tubes had dropped to the bottom of the tank during stress relieving, causing unknown damage. The insulation around the lower portion of each burner caused the metal to crystallize. Small dimples (1 in. deep) were also discovered around the burner penetrations. NCR B-120-92 states that the deflector tubes burned off at approximately 800° F and fell to the primary tank floor. The deflector tubes are made of 3/16 in. steel plate and measure approximately 8 in. in diameter; their lengths vary from 8 ft. to 13 ft. The recommended disposition for this NCR was “Accept As Is” and the justification for this disposition is as follows:

“No damage found after close examination. Any stresses developed as a result of impact energy were subsequently relieved from the steel by the heating operation. This NCR has been created to document an unusual occurrence.”

5.5.5 Concrete Foundation Spalling

NCR B-120-19 documented out-of-specification finishes and tolerances on the concrete foundation of tank AW-102; its disposition was to repair the foundation in accordance with approved procedure. NCR B-120-23 stated that the contractor had begun to patch and repair the surface of the tank AW-102 foundation without an approved procedure; its disposition was to submit a procedure and repair the concrete in accordance with that procedure. After repairs were complete, NCR B-120-50 was written to document some spalling that was found on the repaired concrete surface, as well as the fact that repairs had been done without an approved repair procedure. The spalled areas were repaired with grout and the secondary tank bottom was lowered into place on the foundation once the repairs were finished. NCR B-120-50 had a recommended disposition of “Accept As Is,” and the disposition justification was as follows:

“E.A. Goakey, Vitro Civil/Structural Engineer for this project, inspected the in-process repairs, repair procedure utilized (actual procedure used, not a documented procedure), and patching material used; and he, in his technical judgment, has determined that the repair action taken is technically adequate for this specific application. Some of the factors taken into consideration in arriving at his judgement [sic] are...

- *Size of repaired areas (surface area and/or depth) approach insignificance.*
- *Grout patching will continue to cure with the secondary tank resting on them.*
- *Grout had not taken any initial set prior to placement of the secondary tank on the foundation which will result in...*
 - a) *Confining of the patches.*
 - b) *Conforming of the patches to minor deformations of the tank bottom—*
 - c) *Protecting the patch while it cures.*
- *Grouted surfaces were leveled between existing approach surfaces which should remove requirement for verification of elevation of patched areas.”*

5.5.6 Primary Tank Pitting

Following removal of hydrostatic test water, an inspection of tank AN-107 led to the discovery of in-tank pitting. This discovery prompted inspection of tank AW-104 on November 12 and 13, 1980. Tank AW-104 was the only tank in the 241-AW tank farm that had not already been put into service at the time of pitting discovery in tank AN-107. Inspection methods used for tank AW-104 were the same as those employed during tank AN-107 inspection. The same 20 to 25 ft² areas (~10% of the tank bottom and lower wall) were marked for detailed inspection.

During the detailed inspection of the marked areas in the tank AW-104 primary interior, pitting was noted. There were a total of 73 pits found, with the largest measuring 50 mils deep. All other pits were in the 7 to 34 mil range, with an average depth of 23 mils, as noted in a November 28, 1980, letter included as App Figure C-75. The letter also states:

“All pits were irregular shaped and appeared to be due to a galvanic reaction between the mill scale and bare steel...”

Figure 5-2 and Figure 5-3 show sample areas of pitting in the AW-104 primary tank.

Figure 5-2. Tank AW-104 Primary Bottom Pitting (Photo 93632-13cn) (Taken 11/13/1980)

Figure 5-3. Tank AW-104 Primary Lower-Wall Pitting (Photo 93632-20cn) (Taken 11/13/1980)

Following tank completion, stress relief, and hydrostatic testing, untreated hydrostatic test water remained in tank AW-104 from May 23, 1978, to January 31, 1979, or approximately 8 months. This storage is thought to be a contributing factor to the discovered pitting because the water contained no inhibitors. While inspections following hydrostatic test water removal were not discovered for any other tanks in the 241-AW tank farm, Table 4-5 shows that all tanks in the farm stored untreated test water for extended periods of time. As a result, this pitting is assumed to be present, to varying degrees, among the other tanks as well.

Following analysis of the gathered pitting data for tank AW-104, the following statement from the November 28, 1980, letter (App Figure C-75) was made with regard to the integrity and capability of the tank:

“Assuming a normal distribution of pits, and the fact that no pits were found $\geq 1/16$ inch, we can state with 99 percent confidence level that the average concentration of 1/16 inch deep or greater defects in Tank 104-AW is <0.53 per 50ft^2 . Based upon the results of this inspection, I feel the integrity of Tank 104-AW is sound, and the tank is capable of meeting the criteria to which it was designed and fabricated.

6.0 CONCLUSION

The leak assessment report for AY-102, RPP-ASMT-53793, identified first-of-a-kind construction difficulties and trial-and-error repairs as major contributing factors in the failure of that tank. To determine whether improvements in DST construction continued and whether similar or other difficulties were present, a review and evaluation of the construction records for the 241-AW tank farm were completed.

After a review of the construction history of the 241-AW tank farm, it is concluded that, during construction of the 241-AW tank farm, there were fewer construction difficulties. Table 6-1 and Table 6-2 include a summary comparison of the issues seen in tank AY-102 and the 241-AW tank farm, focusing on the critical difficulties that were identified in RPP-ASMT-53793.

The 241-AW tank farm experienced high primary tank bottom weld rejection rates ranging between 24% and 34%. High weld rejection rates and subsequent repairs are thought to be a contributor to out-of-tolerance distortions, or bulges, found during previous tank farm tank construction, such as in the 241-AY and 241-SY tank farms. In the 241-AW tank farm, only tanks AW-102 and AW-106 were noted as having out-of-tolerance distortions in the secondary liner bottoms, with no primary tank bottoms noted as having out-of-tolerance distortions. All rejected welds were eventually approved, following acceptable repair, and post-weld stress relief of the primary tank was accepted as successfully completed.

Several work stoppages occurred as a result of welding being performed while unprotected from inclement weather (e.g., rain or snow). These stoppages were enforced because the high temperatures at the weld site can break apart water molecules and produce atomic hydrogen. Hydrogen is readily absorbed into carbon steel at the elevated temperatures of welding and this is known to be the primary cause of delayed underbead cracking.

This delayed cracking can take place any time from immediately after welding to as long as several months later, thus this cracking was of critical concern at the time. Several stoppages, examinations, and repairs occurred as a result of inclement weather welding. Those incidents that were documented received ample attention and were dispositioned with the intent to ensure weld quality and tank integrity.

Initial placement of castable refractory proved to be troublesome in the 241-AW tank farm. Lite Wate 50 castable refractory was first placed in tanks AW-105 and AW-106. It was then placed in tank AW-101. Compressive strength test results of core samples from each tank were well below the specified 130 psi. As a result, a design change from LW50 to LW70 was specified to correct the deficiency. The refractory for tank AW-102, originally comprised of enriched LW50, was completely replaced with LW70. The tank AW-101 refractory is comprised of LW50 for the majority of the pad, with Section D of the tank having been chipped out due to low compressive strength and replaced with enriched LW50. The enriched LW50 consisted of one bag of Ciment Fondu added to the mixture. Tanks AW-103 and AW-104 utilized LW70, and tanks AW-105 and AW-106 were chipped out and replaced with LW70 castable refractory. While refractory material compressive strength deficiency was discovered using LW50, repair and replacement of the defective material with LW70 was completed to ensure an adequate base for the primary tank bottoms.

As a result of refractory removal and replacement, scratches and gouges were inflicted upon the secondary liner bottom of several tanks. Non-conformance reports were written to document the issue as it pertained to both tanks AW-101 and AW-106. Mention of repairs to the tank AW-102 secondary bottom was also discovered. The construction specification provided direction for repair of such defects and it was applied satisfactorily in the discovered and documented instances.

Other issues, unique to 241-AW tank farm, were noted. Various surface defects discovered during receipt of material were noted and dispositioned to be repaired. These defects were assumed to have likely occurred during shipment to the field or fit-up of the material in the field. Challenges with tank bottom lifting and transport occurred early on during construction activities, but modifications to the method were made and success was later achieved.

Following post-weld stress relief, tank dome distortions were observed around the risers that had housed the burners. This condition presented itself in tanks AW-101, AW-102, AW-103, and AW-104 as was documented in several discovered nonconformance reports. The condition was accepted as is in all cases. Also related to stress relieving, three of the four deflector tubes fell from their suspended location and impacted the bottom of tank AW-102 during stress relief. Discovered documentation indicates that no damage was done as a result of the impact and any induced residual stress would have been subsequently relieved during the remainder of the stress relief operation.

Following hydrostatic testing of the tanks in the 241-AW tank farm, the uninhibited test water was stored in the tanks for extended durations, between 6 to 9 months. Later inspection of tank AW-104 in November of 1980 led to the discovery of pitting corrosion. This same condition is likely present in the all tanks within the farm, since similar conditions were experienced. This corrosion was analyzed and the tank was determined to be capable of meeting the criteria to which it was designed and fabricated.

The 241-AW tank farm was the fourth DST farm constructed; American Bridge, a new contractor, was chosen to construct the tank farm. Construction issues similar to those discovered during tank AY-102 construction review were noted. While tank bottom bulging, refractory material quality, and post-weld stress relieving were improved, primary tank bottom weld rejection in the 241-AW tank farm experienced similar challenges when compared to tank AY-102. While these issues, along with others that were judged to be minor (e.g. surface defects and pitting), leave room for uncertainty of long-term tank integrity, the overall condition of the 241-AW tank farm following construction is judged to be better than that of tank AY-102.

Table 6-1. Summary Comparison 241-AW Tank Farm Tanks 101 – 103 Construction to Tank AY-102

Tank	AY-102	AW-101	AW-102	AW-103
Evaluation Document	RPP-ASMT-53793, <i>Tank 241-AY-102 Leak Assessment Report</i>	RPP-RPT-55981, <i>241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity</i>		
Construction Order	1 st DST constructed	1 st Tank, 4 th DST Farm	2 nd Tank, 4 th DST Farm	3 rd Tank, 4 th DST Farm
Construction Contractor	Pittsburgh-Des Moines (PDM) Steel Company	American Bridge Division of US Steel Corporation		
Secondary Bottom Material	0.25-in. plate, ASTM A515, Gr 60	0.375-in. plate, ASTM A537 Class 1		
Secondary Liner Bottom Bulges	Excessive distortion and bulges noted throughout. Maximum slope noted as much as 1-in./ft. 22 places exceed 2-in. peak-to-valley tolerance.	No bulges identified.	Four bulges identified. All slopes less than 3/4-in./ft.	No bulges identified.
		All 241-AW tank farm bulges were accepted based on an engineering evaluation of the 241-SY Bottom Flatness Study authored by Battelle Northwest.		
Primary Bottom Material	0.375-in. plate, ASTM 515, Gr 60	0.50-in. plate, ASTM A537 Class 1		
Primary Bottom Weld Rework	33.8%	30%	31%	27%
	Ultimately, all welds were accepted and stress relieved, although problems with that process were noted.	Ultimately, all welds were accepted and stress relieved.	Ultimately, all welds were accepted and stress relieved.	Ultimately, all welds were accepted and stress relieved.
Primary Liner Bottom Bulges	Primary bottom flatness described as “generally good.”	No bulges identified.	No bulges identified.	No bulges identified.
Stress Relieving Process	Required 2 days to remove all the water in the refractory and temperature recorder just prior to initiating 3 hour hold time was 915°F (accepted as being 1000°F).	One hour hold at 1100°F.	Three hour hold at 1000°F.	Three hour hold at 1000°F.
Refractory	Kaolite 2200-LI	Lite Wate 50 and Enriched Lite Wate 50	Lite Wate 70	Lite Wate 70

Tank	AY-102	AW-101	AW-102	AW-103
Refractory Protection	Allowed to saturate with rain water, not protected from freezing.	Refractory was placed in the warmer months between March and October.		
Refractory Condition	After hydro test, refractory found to be degraded, extensively cracked, and spalled. Samples showed excessive carbonation.	No reports on post-hydrostatic test inspection were found.		
Refractory Repair	21 inches of perimeter removed and replaced with concrete and rebar.	Lite Wate 50 was used initially. Section “D” was chipped out and replaced with Enriched Lite Wate 50.	None reported.	None reported.
Other Issues	Unsupported areas of primary bottom filled with foam.	Surface defects and laminations found on plates. Reverse curvature and flat spots on dome after post-weld stress relieving.	Surface defects and laminations found on plates. Concrete foundation had spalling.	Surface defects and laminations found on plates. Reverse curvature and flat spots on dome after post-weld stress relieving.
Overall Conclusion on Construction Difficulties	Difficulty with liner fabrication and the castable refractory left the tank with unsupported areas in the tank bottom and unexpected residual stresses in the tank bottom that probably contributed to failure.	Initial refractory construction had many issues with weak compressive strength and laminations of the refractory. The refractory material was then changed from Lite Wate 50 to Lite Wate 70 at which time all construction issues related to refractory were solved. The 241-AW tank farm saw an improvement in tank bottom flatness, with only a few weather protection issues. However, high weld rejection was still an issue during 241-AW tank farm tank construction.		

Table 6-2. Summary Comparison 241-AW Tank Farm Tanks 104 – 106 Construction to Tank AY-102

Tank	AY-102	AW-104	AW-105	AW-106
Evaluation Document	RPP-ASMT-53793, <i>Tank 241-AY-102 Leak Assessment Report</i>	RPP-RPT-55981, <i>241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity</i>		
Construction Order	1 st DST constructed	4 th Tank, 4 th DST Farm	5 th Tank, 4 th DST Farm	6 th Tank, 4 th DST Farm
Construction Contractor	Pittsburgh-Des Moines (PDM) Steel Company	American Bridge Division of US Steel Corporation		
Secondary Bottom Material	0.25-in. plate, ASTM A515, Gr 60	0.375-in. plate, ASTM A537 Class 1		
Secondary Liner Bottom Bulges	Excessive distortion and bulges noted throughout. Maximum slope noted as much as 1-in./ft. 22 places exceed 2-in. peak-to-valley tolerance.	No bulges identified	No bulges identified	19 bulges identified, all bulges less than 3/4 in./ft. and accepted as is.
		All 241-AW tank farm bulges were accepted based on an engineering evaluation of the 241-SY Bottom Flatness Study authored by Battelle Northwest.		
Primary Bottom Material	0.375-in. plate, ASTM 515, Gr 60	0.50-in. plate, ASTM A537 Class 1		
Primary Bottom Weld Rework	33.8%	34%	31%	24%
	Ultimately all welds were accepted and stress relieved, although problems with that process were noted.	Ultimately all welds were accepted and stress relieved.	Ultimately all welds were accepted and stress relieved.	Ultimately all welds were accepted and stress relieved.
Primary Liner Bottom Bulges	Primary bottom flatness described as “generally good.”	No bulges identified	No bulges identified	No bulges identified
Stress Relieving Process	Required 2 days to remove all the water in the refractory and temperature recorder just prior to initiating 3 hour hold time was 915°F (accepted as being 1000°F).	Three hours at 1000°F.	Three hours at 1000°F. Heavy steaming was noted.	Three hours at 1000°F. Steaming was noted.
Refractory	Kaolite 2200-LI	Lite Wate 70	Lite Wate 70	Lite Wate 70

Tank	AY-102	AW-104	AW-105	AW-106
Refractory Protection	Allowed to saturate with rain water, not protected from freezing.	Refractory was placed in the warmer months between March and October.		
Refractory Condition	After hydro test, refractory found to be degraded, extensively cracked, and spalled. Samples showed excessive carbonation.	No reports on post-hydrostatic test inspections were found.		
Refractory Repair	21 inches of perimeter removed and replaced with concrete and rebar.	None reported.	Lite Wate 50 was used initially; it was later chipped out and replaced with Lite Wate 70.	Lite Wate 50 was used initially; it was later chipped out and replaced with Lite Wate 70.
Other Issues	Unsupported areas of primary bottom filled with foam.	Surface defects and laminations found on plates. Pitting discovered following hydrostatic test water removal. Other tanks were placed in service before pitting inspection initiated.	Buckling of the secondary liner bottom was noted during an attempted lift of the liner bottom.	Surface defects and laminations found on plates.
Overall Conclusion on Construction Difficulties	Difficulty with liner fabrication and the castable refractory left the tank with unsupported areas in the tank bottom and unexpected residual stresses in the tank bottom that probably contributed to failure.	Initial refractory construction had many issues with weak compressive strength and laminations of the refractory. The refractory material was then changed from Lite Wate 50 to Lite Wate 70 at which time all construction issues related to refractory were solved. The 241-AW tank farm saw an improvement in tank bottom flatness, with only a few weather protection issues. However, high weld rejection was still an issue in 241-AW tank farm tank construction.		

7.0 REFERENCES

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APPENDIX A 241-AW FARM KEY EVENT TABLE

Number	Date	Tank	Comment	Event Type
1.	8/10/1976	-	Aldrich & Hedman continued backfilling foundations.	CM
2.	8/16/1976	101	Aldrich & Hedman worked on backfilling and compacting tank 101 foundation.	CM
3.	8/20/1976	-	Aldrich & Hedman is having problems meeting compaction requirements.	CI
4.	8/24/1976	102	Aldrich & Hedman finished grading and compacting tank 102, and Vitro Title III accepted tank 102 backfill compaction.	CM
5.	8/24/1976	104	Backfilling was started on tank 104.	CM
6.	8/25/1976	104	Backfilled and compacted foundation for tank 104.	CM
7.	8/26/1976	102, 103, 104, 105	Compacted tank 104 foundation and backfilled and compacted tank 105. Vitro Title III ran sand cone density tests on tanks 102, 103, 104, and 105. Results indicated the compaction is satisfactory.	CM
8.	8/27/1976	101, 102, 103, 104	Vitro Title III has accepted tank 101 and 102 foundation compaction. Worked on grading tanks 103 and 104. Inland rebar set rebar template in tank 101.	CM
9.	8/30/1976	101, 102, 103, 104, 105, 106	Vitro Title III accepted compaction and grading of foundations for tanks 103 and 104. Tank 104 foundation fine graded and compacted. Backfill and compaction was performed on tank 105 foundation. Backfill performed on tank 106 foundation. Installation of bottom rebar mat for tank 101. Bottom mat templates were laid out for tank 102 and 103. Part of the bottom mat for tank 102 was laid out.	CM
10.	8/31/1976	101, 102, 103, 104, 105, 106	Vitro Title III accepted bottom mat for tank 101. Compacted and fine graded tank 105 foundation. Backfilled spread and compacted tank 106 foundation. Bottom mat for tank 102 was started. Part of the bottom mat for tank 103 was installed. The template for tank 104 was installed.	CM
11.	9/1/1976	101, 102, 103, 104, 105, 106	Completed compaction and fine grading tank 105 foundation. Work continued on compaction and fine grading tank 106 foundation. Completed bottom mat on tank 102 and worked on bottom mats of tanks 103 and 104. The top mat of tank 101 was completed. Worked on installing conduit for thermocouples in tank 101. Vitro Title III accepted compaction of tank 105 foundation and the top mat of rebar in tank 101.	CM
12.	9/2/1976	101, 102, 103, 104, 106	Completed compaction and fine grading tank 106 foundation and started setting forms around tank 101. Completed bottom mats on tank 103 and 104. Worked on top mats of tanks 102, 103 and 104. Installed conduit in tank 102. Vitro Title III accepted compaction and fine grading of tank 106 foundation.	CM

Number	Date	Tank	Comment	Event Type
13.	9/3/1976	101,102, 103, 104, 105, 106	Continued placing rebar in the top mats of tank 103 and 104. The top mat in tank 102 was finished. The templates for the bottom mats of tanks 105 and 106 were laid out and forming for tank 101 was finished.	CM
14.	9/7/1976	101, 102, 103, 104, 105, 106	Fabricated deeper drain slot (DFC B-120-12) for tank 101. Forms were set for tank 102. Completed top mats for tank 103. Work continued on tops mat of tank 104 and work started on the bottom mats for tank 105 and 106.	CM
15.	9/8/1976	101, 104, 105, 106	Began installing the drain slots in tank 101. Completed the bottom mat on tank 105 and worked on the top mats of tanks 104 and 105 as well as the bottom mat for tank 106.	CM
16.	9/9/1976	105, 106	Completed the top mats on tanks 105 and 106.	CM
17.	9/13/1976	103, 104	Installed thermocouple conduit in tanks 103 and 104.	CM
18.	9/14/1976	101, 105, 106	Completed installation of drain slot forms in tank 101. Installed thermocouple conduit in tanks 105 and 106.	CM
19.	9/15/1976	102	Started setting drain slot forms in tank 102. Vitro Title III placed red tag on bottom rebar mat of tank 102. They say it is short 13 splice bars	CI/CM
20.	9/16/1976	102	Installed missing splice bars in bottom mat of tank 102.	CI/CM
21.	9/20/1976	102	Vitro Title III generated three NCRs on rebar placement in tank 102.	CI
22.	9/21/1976	101, 102	Grades were checked and adjusted on tank 101 and 102 in preparation for concrete placement.	CM
23.	9/22/1976	102	Vitro survey checked grades and alignment on tanks 102.	CM
24.	9/23/1976	101, 102, 103, 104, 105, 106	Grades and alignment were rechecked in tanks 101 and 102 prior to concrete placement. NCRs 7, 11, 12, 13, and 14 were transmitted to Aldrich & Hedman with dispositions.	CI/CM
25.	9/24/1976	101	Vitro Title III placed red tag on tank 101 foundation due to Aldrich & Hedman using sluicing to remove high spots in sub-base.	CI
26.	9/28/1976	102, 104	Untied and removed top mat re-steel in a 20 ft. radius in tank 104. Aldrich & Hedman is loosening and vacuuming backfill from tank 102.	CI
27.	9/29/1976	101, 102, 103, 104	Completed removing top and bottom mats for a 20 ft. radius in tank 104. Started untying rebar in tank 103. Started removing 1-1/2" of excess backfill in tank 104. Removal of the excess backfill was continued in tank 102. Vitro Title III performed two sand cone tests in the sluiced sections of tank 101 and both passed.	CI

Number	Date	Tank	Comment	Event Type
28.	9/30/1976	102, 103, 104, 106	Removed rebar mats from tank 103 and started removing mats in tank 106. Removed 1-1/2" of excess backfill in tank 104 and continued on removing excess backfill from tank 102. Radiation monitoring surveyed areas on slopes of excavation where seepage was detected.	CI
29.	10/1/1976	102, 103, 104, 105, 106	Removed rebar mats from tanks 105 and 106. Removed excess backfill from tanks 102, 103, and 104.	CI
30.	10/4/1976	101	Vitro survey rechecked grades in tank 101.	CM
31.	10/5/1976	103, 104, 105, 106	Vitro survey checked the sub-grade elevations in tanks 103-106.	CM
32.	10/6/1976	102	Completed removal of the excess 1-1/2" of backfill in tank 102.	CI
33.	10/7/1976	101, 103, 104	Compacted tank 104. Excavated excess backfill from tank 103. Removing silt from tank 101.	CI
34.	10/8/1976	101, 102	Completed pre-pour alignment in tank 102. Electricians relocated the misplaced instrumentation conduit in tanks 101 and 102. All conduit was secured to the rebar.	CI/CM
35.	10/11/1976	102	All rebar clearances in tank 102 were checked and adjusted as needed.	CI/CM
36.	10/12/1976	102	Placed 355 yds. of concrete in tank 102 foundation	CM
37.	10/13/1976	101,102	Loosened and stripped drain slot forms in tank 102. Checked and adjusted grades in tank 101.	CM
38.	10/14/1976	101, 104	Graded and sub-graded in tanks 101 and 104.	CI/CM
39.	10/18/1976	101, 102	Placed 340 yds. of concrete in the tank 101 foundation. Edge forms on tank 102 were stripped and cleaned.	CM
40.	10/19/1976	101, 102	Stripped drain slot forms in tank 101. Work continued in grinding off high spots along the edges of the drain slots in tank 102.	CI/CM
41.	10/20/1976	104	Completed excavation of 1-1/2" excess backfill in tank 104. Vitro Title III performed sand cone density test on subgrade of tank 104.	CI
42.	10/21/1976	104, 105	Re-installing the center rebar for tank 104. Installed edge forms for tank 104 and started removing excess backfill in tank 105. Sand cone tests taken yesterday in tank 104 passed the compaction requirements.	CI/CM
43.	10/22/1976	103	Completed excavation of excess backfill in tank 103. Vitro Title III performed a sand cone density test on tank 103 subgrade.	CI

Number	Date	Tank	Comment	Event Type
44.	10/23/1976	101, 103, 104	Rebar re-installed in tank 103. Drain slots were laid out in tank 104 and edge forms were removed from tank 101. Sand cone density test run on the subgrade of tank 103 passed.	CI/CM
45.	10/26/1976	103	Completed re-installation of rebar in tank 103	CI/CM
46.	10/27/1976	103, 104, 105	Completed excavation of excess backfill in tank 105. Some loose dirt was removed from tank 103. Leveled rebar mats in tank 104 and started installing rebar in tank 105. Sand cone density test was performed on the subgrade of tank 105.	CI/CM
47.	10/28/1976	103, 106	Installed edge forms on tank 103. Excavated excess backfill in tank 106.	CI/CM
48.	10/29/1976	102, 105	Grinding and patching concrete in tank 102. Completed re-installation of rebar in tank 105.	CI/CM
49.	11/1/1976	102, 103, 104	Performing final pre-pour checkouts and adjustments on tank 104. Installing drain slot forms in tank 103. Vitro Title III placed a red tag on tank 102 for patching concrete without an approved procedure.	CI/CM
50.	11/2/1976	101	Grinding off high spots on foundation of tank 101.	CI
51.	11/3/1976	103, 104	Placed 355 yds. of concrete in tank foundation 104. Performed pre-pour checkouts on tank 103 foundation.	CM
52.	11/4/1976	103, 104	Placed 360 yds. Of concrete in tank 103 foundation. Stripped drain slot forms in tank 104.	CM
53.	11/5/1976	103, 104	Stripped edge forms from tank 103 and 104.	CM
54.	11/8/1976	101, 104, 105, 106	Grinding high spots on tank 104 foundation. Installing edge forms on tank 105. Laid out slide plates on tank 101. Re-installing rebar in tank 106. Vitro performed sand cone density test on the subgrade of tank 106. The test passed at 95.5%.	CI/CM
55.	11/9/1976	102, 103, 104, 106	Grinding off high spots on tank 103 and 104 foundations. Locating high and low spots in concrete surface of tank 102. Re-installed rebar in tank 106.	CI/CM
56.	11/10/1976	102, 103, 105	Started setting drain slot forms in tank 105. Grinding and patching on tanks 102 and 103 foundations. Prepping for backfilling.	CI/CM
57.	11/11/1976	105	Completed setting drain slot forms in tank 105. Installing perimeter angle on tank 105.	CM
58.	11/12/1976	102, 106	Setting edge forms on tank 106. Bushing high spots on tank 102.	CI/CM
59.	11/16/1976	103	Setting and welding slide plates on tank 103.	CM
60.	11/17/1976	105	Placed 378 yds. of concrete in tank 105 foundation and covered the finished slab with insulation.	CM

Number	Date	Tank	Comment	Event Type
61.	11/18/1976	102, 104	Patched tank 102 foundation in areas where slide plate is to be installed and started doing the same on tank 104.	CI/CM
62.	11/19/1976	102, 106	Placed 368 yds. of concrete in tank 106 foundation. Welding slide plate on tank 102.	CM
63.	11/22/1976	104, 105, 106	Stripped drain slot forms and edge forms on tank 105 foundation. Stripped edge forms on tank 106 foundation. Patched concrete surface on tank 104 foundation where slide plate is to be set.	CI/CM
64.	11/23/1976	105, 106	Stripped drain slot forms on tank 106 foundation. Grinding high spots on tank 105 foundation.	CI/CM
65.	11/24/1976	104	Welded tank 104 slide plates.	CM
66.	11/29/1976	106	Patched surface of tank 106 foundation.	CI
67.	11/30/1976	105	Grinding and patching concrete surface of tank 105.	CI
68.	12/1/1976	106	Ground high spots on tank 106 foundation.	CI
69.	12/2/1976	104, 105	Completed welding the tank 104 slide plates. Started welding tank 105 slide plates.	CM
70.	12/6/1976	101, 102, 103, 104, 105	Placed load bearing backfill around tanks 101, 102, 103, and 104. Patched on tank 105 foundation.	CI/CM
71.	12/8/1976	103, 104, 105, 106	Marked high spots on tank foundation 105 and 106. Ground down high spots on tank foundation 103 and 104. Completed welding slide plates on tank 105.	CI/CM
72.	12/9/1976	105, 106	Ground high spots on the concrete on tank foundation 105 and 106. Welded the slide plates on tank 106.	CI/CM
73.	12/16/1976	103, 104	Tank foundations 103 and 104 were covered with plywood prior to setting staging.	CM
74.	12/20/1976	101, 102, 103, 104, 105, 106	Foundations were surveyed at the 38 ft. 9 in. radius. Title III inspection has reviewed the survey notes and stated that tank foundations 103 and 106 appear to be acceptable. Point 32E on tank 102 is 1/8 in. out of tolerance.	CI/CM
75.	12/21/1976	103, 104	Installing staging on tank 103 foundation. Title III inspection stated that tank foundation 104 appeared to be acceptable.	CM
76.	12/27/1976	104	Installing staging on tank 104 foundation.	CM
77.	12/28/1976	102, 103, 105, 106	1/3 of the secondary bottom for one tank on the staging set up on tank 103. Vitro survey shot elevations around the 38 ft. 9 in. radius on tanks 101, 102, 105, 106.	CM
78.	12/29/1976	103	Completed setting one secondary tank bottom on the tank 103 staging.	CM
79.	1/3/1977	103	Tack welding the secondary bottom on the tank 103 staging.	CM

Number	Date	Tank	Comment	Event Type
80.	1/5/1977	103	Began production welding on the secondary bottom set up on tank 103 staging.	CM
81.	1/11/1977	103, 104	Continued production welding on the secondary bottom set up on tank 103 staging. Erected staging on tank 104 foundation.	CM
82.	1/12/1977	101, 102, 103, 104, 105, 106	Suspended work due to weather conditions.	CI
83.	1/14/1977	103, 104	Continued production welding on the secondary bottom set on the tank 103 staging. Set flat plate for another secondary bottom on the tank 104 staging. Received lower secondary knuckles by truck.	CM
84.	1/18/1977	103, 104	Continued production welding on the secondary bottom set on the tank 103 staging. Fitted and shimmed the secondary bottom on the tank 104 staging.	CM
85.	1/19/1977	103, 104	Continued production welding on the secondary bottom set on the tank 103 staging. Installed temporary key plates on the underside of the secondary bottom on the tank 104 staging.	CM
86.	1/21/1977	103	Continued production welding on the secondary bottom set on the tank 103 staging. Fitting up lower secondary knuckle segments on the tank 103 staging.	CM
87.	1/25/1977	104	Started production welding on secondary bottom set on tank 104 staging.	CM
88.	1/26/1977	103, 104	Continued production welding on the secondary bottoms on the tank 103 and 104 staging. Continued welding lower secondary knuckle segments together on the tank 103 staging.	CM
89.	1/27/1977	103, 104, 105, 106	Performed weld repairs on the tank 105 secondary bottom (on the tank 103 staging). Continued production welding on the tank 106 secondary bottom on the tank 104 staging.	CM
90.	2/4/1977	105, 106	Continued welding lower secondary knuckles on tank 105. Continued welding flat seams on the tank 106 secondary bottom. Set the tank 106 lower secondary knuckles on the staging.	CM
91.	2/7/1977	105, 106	Continued welding lower secondary knuckles on tanks 105 and 106.	
92.	2/8/1977	105, 106	Continued welding lower secondary knuckles on tank 105 (knuckle to bottom) and tank 106 (knuckle to knuckle). Repairs to the root pass of welds on tank 106 are being repaired.	CM
93.	2/14/1977	105	Installed centering post rings on tank 105 secondary bottom.	CM

Number	Date	Tank	Comment	Event Type
94.	2/15/1977	105	Liquid penetrant examination of the knuckle to bottom (secondary) weld seams on tank 105. Installed insulating concrete retention ring in tank 105.	CM
95.	2/16/1977	105, 106	Performed dye penetrant tests on the tank 105 secondary bottom weld seams. Repaired welds on the tank 106 secondary bottom. Continued welding lower secondary knuckle segments together on tank 106.	CM
96.	2/17/1977	105, 106	Continued welding secondary knuckle segments on tank 106. Repaired welds on tank 106. Performed liquid penetrant tests on the tank 105 secondary bottom.	CM
97.	2/18/1977	102, 105, 106	Continued welding lower secondary knuckle segments together on tank 106. Installed lifting beams and other gear on the tank 105 secondary bottom and attempted to lift the bottom. The bottom deflected more than what had been calculated and lift was called off. Patched the low spot on tank 102 foundation	CI/CM
98.	2/22/1977	106	Started trimming tank 106 secondary bottom to fit the lower secondary knuckles. Continued welding the tank 106 lower secondary knuckle segments. Performed weld repairs on tk. 106.	CM
99.	2/23/1977	105, 106	Continued trimming the tank 106 secondary bottom to fit the knuckle. Tested the modified lifting arrangement on tank 105.	CI/CM
100.	2/24/1977	105, 106	Continued with repairs to welds on the tank 106 secondary bottom. Continued trimming and prepping the edge between the bottom and knuckle on tank 106 secondary. Tack welded the knuckles to the plate.	CM
101.	2/25/1977	102, 106	Installed plywood and staging on tank 102 foundation. Started circumferential knuckle to bottom weld on tank 106 secondary bottom. Continued repairing welds on tank 106 secondary bottom.	CM
102.	2/28/1977	102, 105, 106	Set steel and started installing key plates for the tank 102 secondary bottom. Received and started welding together the angle stiffeners for lifting the tank 105 secondary bottom. Repaired welds on the tank 106 secondary bottom.	CM
103.	3/1/1977	102, 105, 106	Continued installing key plates on the tank 102 secondary bottom. Continued welding circumferential knuckle to bottom seam (secondary) on tank 106. Repaired welds on the tank 106 secondary bottom. Completed welding angle stiffeners and completed the installation of them on the tank 105 secondary bottom. Re-installed the lifting rigging on the tank 105 secondary bottom and attempt to lift the bottom (still had sag). Bottom was set back down and dogged off.	CI/CM

Number	Date	Tank	Comment	Event Type
104.	3/2/1977	102, 105, 106	Tack welded all North-South seams on the tank 102 secondary bottom. Continued welding circumferential lower knuckle to plate seam on the tank 106 secondary bottom. Fabricated additional lifting beams for lowering the tank 105 secondary bottom.	CI/CM
105.	3/3/1977	102, 105, 106	Continued welding lower knuckle to plate on tank 106 secondary bottom. Continued repairing welds on tank 106 secondary bottom. Started production welding of North-South seams on the tank 102 secondary bottom. Re-rigged the tank 105 secondary bottom (using additional spreaders), lifted the bottom and started walking with it. West side roadway was too uneven and the bottom was returned to the staging.	CI/CM
106.	3/4/1977	102, 105, 106	Lifted, travelled, and lowered the tank 105 secondary bottom onto its foundation. Completed welding the circumferential lower knuckle to plate seam on tank 106 (secondary). Continued with weld repairs on tank 106 secondary bottom. Continued production welding of tank 102 secondary bottom. Began liquid penetrant examination of welds on tank 106 (secondary). Removing lifting lugs from tank 105 secondary bottom.	CI/CM
107.	3/5/1977	105	Performed magnetic particle examination of welds and attachment areas in tank 105 secondary bottom. Ground and filled with weld where required.	CM
108.	3/6/1977	105	Completed magnetic particle examination of secondary bottom	CM
109.	3/7/1977	101, 102, 103, 105	Started setting steel for the tank 101 secondary bottom on tank 103 staging. Completed North-South production weld and two East-West seams on the tank 102 secondary bottom. Started installing thermocouple conduits on the tank 105 secondary bottom.	CM
110.	3/8/1977	101, 106	Completed setting flat plate for the tank 101 secondary bottom. Continued liquid penetrant examination of tank 106 secondary bottom.	CM
111.	3/10/1977	101, 102, 103, 104, 105, 106	At noon, all but four Boilermakers walked off the job (cause unknown).	CI
112.	3/11/1977	101, 102, 105	Began weld repair on tank 102 secondary bottom. Tank 102 lower secondary knuckles set on staging. Tack welded and started production welding of North-South seams of the tank 101 secondary bottom. Started installing air distribution piping in the tank 105 secondary bottom.	CM
113.	3/14/1977	102	Fitted and tacked lower secondary knuckle segments and repaired welds on the tank 102 secondary bottom.	CM

Number	Date	Tank	Comment	Event Type
114.	3/16/1977	102, 105, 106	Continued weld repair and liquid penetrant examination of the tank 106 secondary bottom. Lifting lugs were installed on the tank 106 secondary bottom. Started welding tank 102 (secondary) lower knuckle segments together. Installed forms in the tank 105 secondary bottom.	CM
115.	3/18/1977	104, 105, 106	Removed lifting lugs and started magnetic particle examination of the seams on tank 106 secondary bottom. Started setting flat plate for tank 104 secondary bottom on tank 104 staging. Wrapped air distribution piping with plastic in preparation for insulating concrete placement in tank 105 secondary bottom.	CM
116.	3/21/1977	101, 102, 104, 105, 106	Repaired welds and performed liquid penetrant examination of welds on the tank 102 secondary bottom. Repaired welds and continued welding of East-West seams on tank 101 secondary bottom. Completed setting flat plate and started installing key plates on the tank 104 secondary bottom. Installed thermocouple conduit in the tank 106 secondary bottom. Placed insulating concrete in the tank 105 secondary bottom.	CM
117.	3/22/1977	101, 102, 104, 105, 106	Started trimming the flat plate of the tank 102 secondary bottom to fit the knuckle segments. Continued weld repair and welding of East-West seams on the tank 101 secondary bottom. Installed key plates and tacked the North-South seams on the tank 104 secondary bottom. Stripped forms from yesterday's pour in tank 105. Installing air distribution piping in tank 106 secondary bottom.	CM
118.	3/23/1977	101, 102, 105	Set lower secondary knuckles for tank 101 on the staging. Welded tank 102 lower secondary knuckle segments together. Continued trimming the tank 102 secondary bottom plate to fit the knuckles. Placed insulating concrete in the last segment of tank 105.	CM
119.	3/24/1977	101, 105, 106	Started welding on the lower secondary knuckle segments on the tank 101 secondary bottom. Completed installation of air distribution piping in tank 106 secondary bottom. Laid out slots on the surface of the tank 105 insulating concrete.	CM
120.	3/25/1977	104, 105, 106	Started production welding of the North-South seams on the tank 104 secondary bottom. Ground high spots on the tank 105 insulating concrete. Installed forms in tank 106 secondary bottom.	CM
121.	3/26/1977	101	Performed liquid penetrant examination of the weld seams on the tank 101 secondary bottom.	CM
122.	3/27/1977	101	Completed liquid penetrant examination of the weld seams on the tank 101 secondary bottom.	CM

Number	Date	Tank	Comment	Event Type
123.	3/28/1977	101, 102	Continued liquid penetrant examination of the tank 102 secondary bottom. Continued weld repair and started trimming the flat plate to fit the lower knuckle segments on the tank 101 secondary bottom. Continued grinding the surface of the insulating concrete.	CM
124.	3/29/1977	106	Placed insulating concrete in the center and two edge strips of tank 106.	CM
125.	3/30/1977	101, 102, 106	Started tack welding the circumferential seam on the tank 102 secondary bottom. Continued welding lower knuckle segments together, and prepping flat plate for plate to knuckle segment weld on the tank 101 secondary bottom. Placed insulating concrete in tank 106.	CM
126.	3/31/1977	101, 105, 106	Started welding of circumferential seam on the tank 101 secondary bottom. Placed insulating concrete in the last segment of tank 106. Started cutting slots in the tank 105 insulating concrete.	CM
127.	4/1/1977	101, 105	Continued liquid penetrant examination, weld repair, welding lower knuckle segments together, welding of the circumferential knuckle to plate seam all on the tank 101 secondary bottom. Continued cutting slots in the tank 105 insulating concrete.	CM
128.	4/4/1977	101, 104	Welded root pass on the East-West seams of the tank 104 secondary bottom. Laid out and started installing lifting lugs on the tank 101 secondary bottom.	CM
129.	4/5/1977	101, 102, 105, 106	Performed liquid penetrant examination of the touch-up (welding) areas, continued weld repair, installed lifting lugs on the tank 101 secondary bottom. Started welding the circumferential lower knuckle segments to plate seam on the tank 102 secondary bottom. Completed cutting slots in the tank 105 insulating concrete. Grinding off high spots on the tank 106 insulating concrete.	CM
130.	4/6/1977	105	Worked on the tank 105 insulating concrete to bring it into tolerance.	CM
131.	4/7/1977	105	Continued patching the tank 105 insulating concrete. Took three core samples of the tank 105 insulating concrete slab for testing. Samples were compression tested and the results ranged from 173.75 psi to 190.3 psi.	CM

Number	Date	Tank	Comment	Event Type
132.	4/8/1977	101, 104, 105, 106	Continued weld repair and liquid penetrant examination and installed the stiffening ring on the tank 101 secondary bottom. Welded the root pass on East-West seams of the tank 104 secondary bottom. Removed soft areas (where segregation had occurred) of the insulating concrete and continued grinding on tank 105. Core drilled insulating concrete slabs in tank 105 and 106.	CI/CM
133.	4/11/1977	101, 102, 105	Continued weld repair and PT, and installed center rings on the tank 101 secondary bottom. Weld repair and welding lower knuckle segments together on the tank 102 secondary bottom. Chipping out soft segregated areas on the tank 105 insulating concrete. Patched core holes.	CI/CM
134.	4/12/1977	106	Grinding insulating concrete slab of tank 106 to bring it into tolerance.	CI/CM
135.	4/13/1977	101, 104	Continued welding the East-West seams and fitted the lower knuckle segments on the tank 104 secondary bottom. Rigged, lifted, travelled, and lowered the tank 101 secondary bottom onto its foundation.	CM
136.	4/14/1977	101, 102, 103, 104	Continued weld repair and welding lower knuckle segments together on the tank 102 and 104 secondary bottoms. Removed lifting lugs and started magnetic particle examination of the weld seams and attachment areas on the tank 101 secondary bottom. Re-arranged the staging on tank 103 foundation to accommodate a primary bottom. Core drilled tank 106 insulating concrete slab.	CM
137.	4/15/1977	101, 102, 104	Installed insulating concrete retainer ring and completed magnetic particle examination of the weld seams and attachment areas on tank 101 secondary bottom. Continued weld repair and welding lower knuckle segments together on tank 102 and 104 secondary bottoms. Set and started fitting the tank 101 primary bottom.	CM
138.	4/19/1977	101, 102, 104, 105	Laid plywood and staging on tank 105 insulating concrete. Welded North-South seams and started East-West seam welding on tank 101 primary bottom. Installed angle stiffening ring on tank 102 secondary bottom. Continued cutting the flat plate to fit the lower knuckle segments on tank 104 secondary bottom. Continued installation of air distribution piping in tank 101 secondary bottom. Patched and re-cut slots as needed in the tank 105 insulating concrete. Core drilled tank 105 insulating concrete.	CI/CM
139.	4/20/1977	101, 102	Installed center ring and rigged the lifting apparatus on the tank 102 secondary bottom. Continued welding on tank 101 primary bottom. Installed insulating concrete forms in tank 101 secondary bottom.	CM

Number	Date	Tank	Comment	Event Type
140.	4/25/1977	102, 104, 105	Erected staging on tank 105 insulating concrete. Completed removal of lifting lugs and installed the concrete retainer ring on tank 102 secondary bottom. Performed weld repair and welded the circumferential seam on the tank 104 secondary bottom.	CM
141.	4/28/1977	101, 102, 104	Started liquid penetrant examination of the weld seams, and installed stiffener angles on the tank 104 secondary bottom. Continued welding East-West seams, and welded lower knuckle segments together on the tank 101 primary bottom. Completed installation of air distribution piping in tank 102 secondary bottom.	CM
142.	4/29/1977	101, 103, 104	Installed centering rings and lifting lugs on the tank 104 secondary bottom. Welded the North-South seams on the tank 103 secondary bottom. Welded lower knuckle segments together and repaired welds on the tank 101 primary bottom. Performed several demonstration pours of insulating concrete at various water contents.	CI/CM
143.	5/2/1977	101, 104	Continued installing centering rings and lifting lugs and continued liquid penetrant examination of the weld seams on the tank 104 secondary bottom. Welded lower knuckle segments together on the tank 101 primary bottom. Cylinders from Friday's demonstration pours were tested today.	CI/CM
144.	5/4/1977	101, 104	Continued penetrant testing of weld seams and repairs on the tank 104 secondary bottom. Continued welding lower knuckle segments together and repairing welds on tank 101 primary bottom.	CM
145.	5/5/1977	104	Set the tank 104 secondary bottom on its foundation.	CM
146.	5/6/1977	101, 103, 104	Continued weld repair, welding lower knuckle segments together, and penetrant testing on the tank 101 primary bottom. Continued welding East-West seams and set and fit the lower knuckles on the tank 103 secondary bottom. Removed lifting lugs and performed magnetic particle examination of the weld seams and attachment areas on the tank 104 secondary bottom.	CM
147.	5/9/1977	101, 103, 104	Started welding the lower knuckle segments together on the tank 103 secondary bottom. Continued magnetic particle inspection of weld seams and attachment areas, and started installing plywood and erecting scaffolding in the tank 104 secondary bottom. Continued weld repair and prepped circumferential lower knuckle to plate seam on the tank 101 primary bottom.	CM

Number	Date	Tank	Comment	Event Type
148.	5/11/1977	103, 104, 106	Completed East-West seams on the tank 103 secondary bottom. Laid plywood and started erecting staging on tank 106 for the tank 104 primary bottom. BNW compression tested the dry; post stress relieved insulating concrete cylinders.	CI/CM
149.	5/12/1977	101, 102, 104, 106	Welded circumferential knuckle to plate seam on the tank 101 primary bottom. Set, fitted, and welded clips to the underside of the flat plate for tank 102 primary bottom. Erected staging on tank 106 for the tank 104 primary bottom. BNW compression tested the wet post stress relieved insulating concrete cylinders.	CI/CM
150.	5/13/1977	101, 102	Completed welding the circumferential lower knuckle to plate seam on the tank 101 primary bottom. Started welding the North-South seams on the tank 102 primary bottom.	CM
151.	5/23/1977	101	Worked on grinding off the lugs on the underside of the tank 101 primary bottom and started magnetic particle examination on the underside.	CM
152.	5/25/1977	101, 102, 104	Installed lifting lugs on the tank 101 primary bottom. Continued welding lower knuckle segments on the tank 102 primary bottom. Completed North-South seams and started welding East-West seams on the tank 104 primary bottom. Welded the round seam on the tank 102 secondary bottom. Under direct supervision of Pryor-Giggey, insulating concrete was placed in the center section of tank 101.	CI/CM
153.	5/26/1977	101, 103	Performed PT and weld repair on the tank 103 secondary bottom. Under direct supervision of Pryor-Giggey, placed insulating concrete in tank 101.	CI/CM
154.	5/27/1977	101, 102, 104	Performed MT on the bottom of the tank 101 primary bottom. Continued welding lower knuckle sections together and started trimming flat plate to fit lower knuckles on the tank 102 primary bottom. Set and fit lower knuckle segments and continued welding East-West seams on the tank 104 primary bottom under direct supervision of Pryor-Giggey, completed placement of insulating concrete in tank 101.	CI/CM
155.	5/31/1977	102, 103, 104	Began repairing welds on the tank 102 primary bottom. Repaired welds on the tank 104 primary bottom. Performed PT on the tank 103 secondary bottom.	CM

Number	Date	Tank	Comment	Event Type
156.	6/1/1977	101, 102,	Touched up grinder scars on the underside of the tank 101 primary bottom. Continued prepping circumferential lower knuckle to plate seam, performed weld repair, and ground off fit up tacks on the underside of the tank 102 primary bottom. Performed MT in accordance with the disposition to NCR # 55 on the tank 102 secondary bottom. Replaced damaged thermocouple conduits in tank 102. Worked on the tank 101 insulating concrete slab.	CI/CM
157.	6/2/1977	101, 102, 103	Welded circumferential lower knuckle to plate seam on the tank 102 primary bottom. Performed PT on the tank 103 secondary bottom. Under direct supervision of Pryor-Giggey, placed insulating concrete in segments "A" and "E" of tank 102. Work was also performed on the tank 101 slab to bring it into tolerance.	CI/CM
158.	6/3/1977	101, 102, 104	Performed re-PT of seams on the tank 101 primary bottom. Completed welding East-West seam on the tank 104 primary bottom. Completed fabrication of spreader. Under direct supervision of Pryor-Giggey, placed insulating concrete in approximately 1/5 of the center section in tank 102.	CI/CM
159.	6/6/1977	102	Under direct supervision of Pryor-Giggey, completed placement of insulating concrete in the "C" segment of tank 102	CI
160.	6/7/1977	101, 102	Under direct supervision of Pryor-Giggey, completed placement of insulating concrete in the "B" segment and started on the "D" segment of tank 102. Also continued cutting slots in the tank 101 refractory. The thermocouple conduits on the 21 ft. radius are interfering with the slots in the refractory. Drawings show less than 1 in. clearance between conduit and slot.	CI
161.	6/8/1977	102	Started placing insulating concrete in the "D" segment of tank 102. However, the pump shaft broke after mixing a few batches.	CI
162.	6/9/1977	101, 102	Completed cutting slots in tank 101 and started sanding off high spots on tank 102 (segments "A" and "B")	CI
163.	6/10/1977	101, 102	Under direct supervision of Pryor-Giggey, completed placement of insulating concrete in section "D" of tank 102. Continued grinding high spots on tank 102. Completed removal of the two 5 ft. outer ring sections in section "D" of tank 101.	CI
164.	6/13/1977	101	Under the supervision of Pryor-Giggey, replaced areas of section "D" in tank 101 with new insulating refractory.	CI
165.	6/15/1977	101	Performed PT on the tank 101 primary bottom.	CM

Number	Date	Tank	Comment	Event Type
166.	6/20/1977	101, 102	Continued grinding and cutting slots in the tank 102 insulating concrete. Started removing the insulating concrete in segment "D" of tank 101.	CI
167.	6/22/1977	101	Completed removal of the insulating concrete in segment "D" of tank 101. It was decided to repair chipping gun gouges in segment "D" of the tank 101 secondary bottom as follows (A) less than 1/32 in. deep - grind out. (B) Over 1/32 in. deep - repair per spec. (C) on weld, grind reinforcement flush and then evaluate gouge.	CI
168.	6/23/1977	101	Repaired gouges in segment "D" of the tank 101 secondary bottom.	CI
169.	6/24/1977	102	Completed work on the tank 102 insulating concrete.	CI
170.	6/27/1977	101, 102	Installed rigging and demonstrated the lifting procedure on the tank 101 primary bottom. Placement of refractory in segment "D" of tank 101 was cancelled by Pryor-Giggey. A meeting was held to discuss the lamination of the insulating refractory in tank 102 and the steps to be taken to assure an acceptable finished product.	CI/CM
171.	6/28/1977	103	Installed thermocouple conduit in tank 103.	CM
172.	6/29/1977	101	Under the supervision of Pryor-Giggey, placed enriched insulating concrete in segment "D" of tank 101.	CI
173.	6/30/1977	101	Ground high spots and cut slots in segment "D" of tank 101.	CI
174.	7/1/1977	102	Started removing insulating concrete in segment "B" of tank 102	CI
175.	7/5/1977	102	Removed segment "B" and half of segment "D", tank 102 insulating concrete.	CI
176.	7/6/1977	102	Completed removal of insulating concrete in segment "D" and 1/3 of segment "C" of tank 102.	CI
177.	7/7/1977	101	Completed grinding high spots on segment "D", tank 101 insulating concrete. The slab was turned over for acceptance.	CI/CM
178.	7/8/1977	102	Completed removal of insulating concrete from segment "C" of tank 102.	CI
179.	7/12/1977	101, 102, 103, 104	Performed PT on tank 101 primary bottom. Performed PT and installed stiffening angle on tank 103 secondary bottom. Welded circumferential lower knuckle to flat plate seam on tank 102 primary bottom. Welded lower knuckle segments on tank 104 primary bottom. Cut inner and outer insulating concrete retainer rings to match air slots on tank 101. Started removing insulating concrete from segments "A" and "E" in 102.	CI/CM

Number	Date	Tank	Comment	Event Type
180.	7/13/1977	101, 102, 103	Welded temporary thermocouples to the underside of the tank 101 primary bottom. Continued weld repair and PT on the tank 103 secondary bottom. Complete removal of insulating concrete from segments "A" and "E", tank 102. Thermocouple conduits in tank 102 are to be re-installed to conform to D/FC #50	CI/CM
181.	7/14/1977	101, 103	Moved the 101 primary bottom onto its foundation and started removing lifting lugs. Performed PT on tank 103 secondary bottom.	CM
182.	7/15/1977	101, 103	Removed lifting lugs from the 101 primary bottom. Removed staging from tank 103.	CM
183.	7/18/1977	103	Installed centering posts and installed lifting lugs on the 103 secondary bottom. Re-arranged thermocouple conduits in tank 102 to conform to D/FC # 50. Shipment of Lite Wate 70 received.	CI/CM
184.	7/19/1977	101, 102	Set first course of primary shell plate on tank 101. Performed PT on 102 primary bottom. Repair and testing of 102 secondary bottom was done on 7/15/1977.	CI/CM
185.	7/20/1977	103, 104	Lowered the 103 secondary bottom onto its foundation. Removed rigging, started removing lifting lugs, prepped seams for MT. Continued weld repair and welding lower knuckle segments together on 104 primary bottom.	CM
186.	7/21/1977	102, 103, 104	Repaired scarfed areas and started removing stiffening ring on the 103 secondary bottom. Performed PT, cut hole for centering post and installed centering post on 102 primary bottom. Trimmed flat plate to fit knuckle segments on 104 primary bottom.	CM
187.	7/22/1977	101, 102, 103,	Performed MT on the 103 secondary bottom. Performed MT on 101 primary bottom. Tacked verticals on 101 primary shell. Performed PT on 102 primary bottom. Installed forms for placement of LW70 in segment "A", tank 102.	CI/CM
188.	7/25/1977	101, 102, 103, 104	Repaired plate surface where lifting lugs were removed on 101 primary bottom. Continued welding dollar plate on 102 primary bottom. Started welding circumferential lower knuckle segments to flat plate seam on 104 primary bottom. Re-arranged thermocouple conduits in tank 103 (D/FC). Installed air distribution piping in tank 103.	CM
189.	7/26/1977	101, 102, 105	Continued MT and repair of scarfs on 101 primary bottom. Re-arranged staging on tank 105 to accommodate a primary bottom. Placed insulating concrete forms in 102 secondary bottom.	CI/CM

Number	Date	Tank	Comment	Event Type
190.	7/27/1977	101, 102, 103, 105	Covered the 101 primary bottom with plywood and started welding verticals on 101 primary shell. Continued PT on 102 primary bottom. Set and fit steel for 103 primary bottom on 105 staging.	CM
191.	7/28/1977	102, 103	Performed weld repair and PT on the 102 primary bottom. Welded North-South seam on 103 primary bottom.	CM
192.	7/29/1977	101, 102	Welded verticals and trimmed top of lower knuckle on 101 primary tank. Performed PT and MT on 102 primary bottom. Placed demonstration slab of LW70 in segment "A" tank 102	CI/CM
193.	8/1/1977	102	Installed insulating concrete forms for segments "C" and "E" tank 102.	CI
194.	8/2/1977	101, 102, 103, 104	Prepped top of lower knuckle to first course of shell seam on 101 primary tank. Continued weld repair on 102 primary bottom. Continued welding circumferential lower knuckle segments to flat plate seams and started PT on 104 primary bottom. Welded East-West flat seams on 103 primary bottom. Placed LW70 insulating concrete in segment "C" tank 102 last night. Core drilled the demonstration slab of LW70 (segment "A" tank 102).	CI/CM
195.	8/3/1977	102	Started installing lifting lugs on 102 primary bottom. Placed LW70 in segments "B" and "E", tank 102 last night with Pryor-Giggey supervision.	CI
196.	8/4/1977	101, 102, 103	Continued welding verticals and tacked the round seam on the 101 primary shell. Continued installing lifting lugs on 102 primary bottom. Continued welding East-West seam on 103 primary bottom. Performed PT on 104 primary bottom.	CM
197.	8/5/1977	101, 102, 103	Welded the circumferential knuckle to shell seam on 101 primary tank. Set and fit lower knuckles on 103 primary bottom. Placed LW70 in segment "D", tank 102 last night. On Thursday "A", "C", and "E" had been formed in tank 103.	CI/CM
198.	8/8/1977	102	Started cutting slots in tank 102 refractory.	CI/CM
199.	8/9/1977	103, 104	Tacked lower knuckle joints on 103 primary bottom. Made repairs on 104 primary bottom.	CM
200.	8/10/1977	102, 104	Set lifting beams and gear on 102 primary bottom. Ground fit-up sears on underside of 104 primary bottom.	CM
201.	8/11/1977	102, 103	Cut 102 retainer ring to match slots. Completed cutting slots in the 102 refractory. Scheduled pour in tank 103 ("A", "C", and "E") for midnight.	CM

Number	Date	Tank	Comment	Event Type
202.	8/12/1977	101, 102, 103, 104	Placed the 102 primary bottom on the 102 refractory. Continued welding knuckle to shell seam on 101 primary tank. Made repairs to the 104 primary bottom. Continued welding lower knuckle segments together on 103 primary bottom. Placed LW70 in segments "A", "C", and "E", tank 103 last night with Pryor-Giggey.	CM
203.	8/15/1977	101, 102, 103, 104	Removed rigging from 102 primary bottom. Removed staging and plywood from 104. Shook out steel for second course of 101 primary shell. Stripped forms from tank 103.	CM
204.	8/16/1977	102, 104	Scarfed off lifting lugs and repaired scarfs; started MT of seams on 102 primary bottom. Installed insulating concrete retainer ring in 104 secondary bottom. Placed LW70 in segments "B" and "D", tank 103 with Pryor-Giggey.	CM
205.	8/17/1977	101, 102, 103, 104	Installed scaffolding and alignment clips on the 101 primary shell in preparation for erecting the second course. Continued repairs of scarfs and MT of seams on the 102 primary bottom. Cut hole for, installed, and tacked the centering post on 104 primary bottom. Made weld repairs and continued welding lower knuckle segments together on 103 primary bottom. Started cutting drain slots on the tank 103 refractory. Installed air distribution piping in tank 104, and installed thermocouple conduit in tank 104.	CM
206.	8/18/1977	101, 102, 103, 104	Set and fit the second course of shell on 101 primary tank. Trimmed top of knuckle on 102 primary bottom. Trimmed flat plate to meet knuckle segments and continued welding lower knuckle segments together on 103 primary bottom. Continued welding centering post on 104 primary bottom. Installed forms for segments "A", "C", and "E", tank 104. Completed installation of thermocouple conduit in tank 103.	CM
207.	8/19/1977	101, 102, 103, 104	Continued welding second course verticals on 101 primary shell. Completed trimming top of knuckle on 102 primary bottom. Completed cutting flat plate to fit knuckle sections, repaired welds and performed PT of shop seams on 103 primary bottom. Continued cutting slots in tank 103 refractory, set forms and wrapped air distribution pipe in tank 104.	CM
208.	8/20/1977	103, 104	Completed cutting slots in tank 103 refractory. Completed wrapping pipe in tank 104.	CM

Number	Date	Tank	Comment	Event Type
209.	8/22/1977	102, 103, 104	Laid plywood protection on 102 primary bottom. Trimmed and prepped circumferential lower knuckle to flat plate seam and continued weld repair and PT of shop seams on 103 primary bottom. Started installing lifting lugs on 104 primary bottom. Placed LW70 insulating refractory in segments "A", "C", and "E", tank 104.	CM
210.	8/23/1977	102, 103, 104	Erected and fit the first course of shell plate on 102 primary tank. Welded circumferential to flat plate seam, continued PT and weld repair on 103 primary bottom. Placed LW70 in segments "B" and "D", tank 104.	CM
211.	8/24/1977	101, 104	Welded round seam number 2 on the 101 primary shell. Cut slots in tank 104 refractory.	CM
212.	8/25/1977	102, 104	Continued welding verticals on 102 primary shell. Welded lifting lugs and laid out for temporary thermocouples on the underside of the 104 primary bottom.	CM
213.	8/26/1977	101, 103, 104	Performed weld repair on 101 primary shell. Continued welding circumferential lower knuckle segment to flat plate seam, made weld repairs and ground fit-up scars on the underside of the 103 primary bottom. Completed cutting slots in tank 104 refractory.	CM
214.	8/29/1977	104	Moved the 104 primary bottom onto its foundation.	CM
215.	8/31/1977	102, 103, 104, 105	Continued welding verticals and tacked the round seam on the 102 primary shell. Continued PT and weld repair, laid out for lifting lugs on the 103 primary bottom. Scarfed off lugs and repaired some on the 104 primary bottom. Set flat plate for 105 primary bottom.	CM
216.	9/1/1977	101, 102, 103, 104, 105	Removed door sheet and set out third course steel for 101 primary shell. Continued welding round seam on 102 primary shell. Continued weld repair and PT, and installed lifting lugs on 103 primary bottom. Performed MT of seams, trimmed top of knuckle on 104 primary bottom. Installed fit-up gear on 105 primary bottom.	CM
217.	9/2/1977	102, 103, 105	Welding primary bottom tank 105. Welding round seam on tank 102 primary shell. Performed testing on inaccessible weld seam on primary 103 bottom prior to setting it in place.	CM
218.	9/6/1977	104	Set first lift sheet plate tank 104.	CM
219.	9/7/1977	101	Welding vertical on third course shell primary tank 101.	CM

Number	Date	Tank	Comment	Event Type
220.	9/8/1977	101, 102, 104, 105	Setting up to weld round seam on third course of primary shell tank 101. Repairing welds on round seam first course primary tank 102. Welding vertical seams and preparing to weld round seam on first course of primary shell tank 104. PT testing, welding bottom and setting knuckle section on primary bottom tank 105.	CM
221.	9/9/1977	103, 105	Set primary bottom tank 103. Cleaning staging from tank 105. Welding knuckle section on bottom primary tank 105.	CM
222.	9/12/1977	101, 103, 104, 105	Moving and placing dome steel inside tank 101 for dome fabrication. Repairing welds on round seam number one primary shell tank 101. Welding seams on primary shell first course tank 104. Shooting elevations on top primary knuckle tank 103 and trimming. Welding knuckle and doing PT on primary bottom tank 105.	CM
223.	9/13/1977	101, 102, 104, 105	Fabricating primary dome shell tank 101. Repairing welds on round seam number one primary shell tank 102. Welding vertical seams and preparing for welding on round seam number one primary shell tank 104. Removing refractory from tank 105.	CI/CM
224.	9/14/1977	101, 102, 103, 104	Fabrication primary shell dome and making weld repairs to round seam number three primary shell tank 101. Erected second course primary shell tank 102. Preparing to set first course primary shell tank 103. Started welding round seam number one primary shell tank 104.	CM
225.	9/15/1977	102, 103, 104, 105	Welding vertical seams second course primary shell and repairing welds on round seam number one primary shell tank 102. Set first course primary shell tank 103. Welding round seam number one primary shell tank 104. Removing refractory from tank 105.	CI/CM
226.	9/19/1977	101, 103, 104, 105	Raised Scaffolding in order to erect the fourth course on the 101 primary shell. Welding outer dome sections and attempting to fit inner dome sections on tank 101. Welding verticals on first course of 103 primary shell. Welding first round seam (top of knuckle to shell) on 104 primary shell. Prepping circumferential lower knuckle segments to flat plate seam on 105 primary bottom. Set insulating concrete forms in tank 105. Re-arranged thermocouple conduit (D/FC)	CI/CM

Number	Date	Tank	Comment	Event Type
227.	9/20/1977	101, 102, 103, 104, 105	Completed raising scaffolding and erected fourth course of plate on the 101 primary shell. Continued welding vertical seams on second course on 102 primary shell. Continued welding outer course and fitting inner course of the 101 primary dome. Continued welding vertical seams on 103 primary shell. Made repairs to round seam number one on 104 primary shell. Laid out for lifting lugs, performed PT and started welding the circumferential lower knuckle segment to flat plate seam on 105 primary bottom. Placed LW70 in segments "A", "C", and "E" of tank 105.	CI/CM
228.	9/21/1977	101, 102, 103, 105	Started welding the fourth course vertical seams on 101 primary shell. Welded round seam number two on 102 primary shell. Repaired scarfs and performed MT of seams on 103 primary bottom. Cut hole for, installed, and started welding dollar plate and continued PT on 105 primary bottom. Placed LW70 in segments "B" and "D", tank 105.	CI/CM
229.	9/22/1977	105	Magnetic particle test welds 105 primary bottom.	CM
230.	9/26/1977	103, 104, 105	Fitted round seam number one for welding on 103 primary shell. Set and fitted second course of shell plate on 104 primary shell. Made weld repairs and welded lifting lugs on 105 primary bottom. Continued cutting slots and making repairs to the tank 105 refractory.	CI/CM
231.	9/27/1977	102, 105	Performed weld repair on round seam number two on the 102 primary shell. Laid out and installed temporary thermocouples on 105 primary bottom.	CM
232.	9/28/1977	105	Results of the compressive test on the 105 refractory test cylinders in the before stress relief condition (both dry and wet) yielded breaks that exceeded 1000 psi.	CI
233.	9/29/1977	101, 102, 103, 104, 105, 106	Continued welding fourth course vertical seams on 101 primary shell. Continued welding and fitting the 101 dome. Continued repairs to round seam number two on the 102 primary shell. Continued welding round seam number one on 103 primary shell. Continued welding second course vertical on 104 primary shell. Lowered the 105 primary bottom onto its foundation. Started removing staging from tank 106.	CM
234.	9/30/1977	101, 105, 106	Scarfed off lifting lugs, started cleaning seams and started MT of seams on 105 primary bottom. Continued welding and grinding off fit-ups on 101 dome. Started removing LW50 from tank 106.	CI/CM
235.	10/1/1977	106	Completed removal of refractory.	CI

Number	Date	Tank	Comment	Event Type
236.	10/3/1977	106	Repaired chipping gun gouges on 106 secondary bottom. Re-arranged thermocouple conduit in tank 106 (D/FC). Boilermakers walked off job.	CI
237.	10/4/1977	105, 106	Completed MT work and started setting staging on tank 105 primary bottom (106 primary bottom to be built on it). Completed repairs to the 106 secondary bottom. Installed forms for segments "A", "C", and "E" in tank 106.	CI/CM
238.	10/5/1977	101, 102, 103, 104, 105, 106	Welded round seam number four on 101 primary shell. Trimmed outer course to fit middle course and set in dollar plate on 101 dome. Continued weld repairs and started erecting third course shell plate on 102 primary shell. Performed MT on 103 primary bottom. Prepped round seam number two for welding on 104 primary shell. Completed setting staging on 105 primary bottom on which to build 106 primary bottom. Placed LW70 in segments "A", "C", and "E" of tank 106.	CI/CM
239.	10/6/1977	101, 102, 103, 106	Tacked and prepped circumferential outer segments to middle segments seam on 101 dome. Welded third course vertical seams on 102 primary shell. Set and fitted second course of shell plate on 103 primary shell. Placed LW70 in segment "B" and "D" of tank 106.	CI/CM
240.	10/7/1977	106	Started setting and fitting flat plate for 106 primary bottom. Started cutting slots in the tank 106 refractory.	CI/CM
241.	10/12/1977	106	Boilermakers on strike. Completed cutting slots in tank 106 refractory.	CI/CM
242.	10/13/1977	106	Boilermakers on strike. Completed grinding high spots on the tank 106 refractory.	CI/CM
243.	10/17/1977	101, 102, 103, 104, 105, 106	Boilermakers on strike.	CI
244.	10/21/1977	106	Boilermakers on strike. Tank 106 refractory was accepted by Vitro Title III	CI/CM
245.	10/31/1977	101, 102, 103, 104, 105, 106	Boilermakers on strike.	CI
246.	11/1/1977	101, 102, 103, 104, 106	Made weld repairs to the 101 primary shell. Welded middle seam and continued fitting dollar plate on 101 dome. Trimmed the 101 lower secondary knuckles. Set supports for the 102 dome. Set plywood in the 103 primary bottom. Welded round seam number two on the 104 primary shell. Continued fitting and tacking flat plate for the 106 primary bottom.	CM

Number	Date	Tank	Comment	Event Type
247.	11/2/1977	104, 106	Covered 104 primary bottom with plywood. Welding North-South seams on 106 primary.	CM
248.	11/3/1977	101, 102, 106	Continued welding middle circumferential seam and installed back-up bar for the inner circumferential seam on 101 dome. Set and started fitting 102 dome sections. Started welding East-West seams on 106 primary bottom.	CM
249.	11/7/1977	101, 103, 104, 106	Re-aligned fourth course vertical seams and continued installing scaffolding on the 101 primary shell. Welded second course vertical seams on 103 primary shell. Made weld repairs and continued MT of pick-ups on 104 primary shell. Set and fitted lower knuckle segments on 106 primary bottom.	CM
250.	11/8/1977	101, 102, 106	Installed fit-up clips on the top of the fourth course and started erecting upper knuckle on 101 primary shell. Completed welding and continued grinding off fit-up gear on 101 dome. Made repairs to round seam number three on 102 primary shell. Started welding lower knuckle segments together on 106 primary bottom.	CM
251.	11/9/1977	101, 102, 104	Completed setting upper knuckles on 101 primary shell. Started welding outer radius seams on 102 dome. Set third course of shell plate on 104 primary shell.	CM
252.	11/10/1977	101, 102, 103, 104, 106	Started welding upper knuckle segments and fitted round seam number five. Continued grinding off fit-up gear on 101 dome. Made weld repairs to round seam number two on 102 primary shell. Continued welding outer radial seams on 102 dome. Continued welding round seam number two on 103 primary shell. Welded third course vertical seams on 104 primary shell. Continued welding lower knuckle segments and performed PT of shop welds on 106 primary bottom.	CM
253.	11/11/1977	101, 102, 104	Set first course on 101 secondary shell. Laid out penetrations on 101 dome. Set inner segments and continued welding outer radial seams on 102 dome. Set first course and cut access hole in 104 secondary shell.	CM
254.	11/14/1977	101, 102, 103, 104	Welded round seam number five on 101 primary shell. Laid out studs on 101 dome. Installed fit-up clips for the fourth course on 102 primary shell. Made repairs to round seam number two on 103 primary tank. Fit round seam number three on 104 primary shell.	CM

Number	Date	Tank	Comment	Event Type
255.	11/15/1977	101, 102, 104, 106	Installed penetrations on 101 dome. Erected and started welding fourth course vertical seams on 102 primary shell. Fitted round seam number one on 104 secondary shell. Cut, trimmed and prepped the flat plate to fit knuckle segments and continue PT of flat seams on 106 primary bottom.	CM
256.	11/16/1977	101, 102, 103, 104, 106	Continued welding upper knuckles on 101 primary shell. Continued prepping and fitting round seam number one on 101 secondary shell. Continued installing penetration on 101 dome. Continued fitting and started welding middle segments of 102 dome. Made weld repairs to 103 primary shell. Made weld repairs on 104 primary shell. Continued fitting round seam number one and trimmed shell plate on 104 secondary shell. Started welding circumferential lower knuckle segments to flat plate seam on 106 primary bottom. Completed installation of stud on 101 dome.	CM
257.	11/17/1977	101, 102, 103	Welding upper knuckles on 101 primary shell. Started welding round seam number one on 101 secondary shell. Started prepping round seam number four on 102 primary shell. Erected third course and started welding vertical seams on 103 primary shell.	CM
258.	11/18/1977	102, 104	Started welding round seam number four on 102 primary shell. Started trimming middle segments of 102 dome. Made weld repairs on 104 primary shell.	CM
259.	11/21/1977	106	Laid out lifting lugs on 106 primary bottom.	CM
260.	11/22/1977	101, 102, 103, 104, 106	Continued installing penetrations on 101 dome. Continued welding the 102 dome. Continued welding third course vertical seams on 103 primary shell. Trimmed top of lower knuckle on 103 secondary bottom. Made repairs to 102 primary shell, 104 primary shell, and 106 primary bottom.	CM
261.	11/23/1977	101, 102, 104, 106	Completed installation of penetrations on 101 dome. Made repairs to 101 secondary shell. Made repairs to 102 primary shell. Made repairs to 104 primary and secondary shells. Ground off fit-up gear on underside and performed MT of same on 106 primary bottom.	CM
262.	11/28/1977	101, 102, 103, 104, 106	Made repairs to the 101 primary shell and knuckles. Made repairs on 101 dome. Made repairs to 102 primary shell. Continued welding 102 dome. Continued welding third course vertical seams and made repairs on 103 primary shell. Made repairs and jumped scaffolding on 104 primary shell. Continued welding 104 secondary shell. Continued welding circumferential lower knuckle segments to flat plate seam, made repairs, installed lifting lugs and cut hole for dollar plate in 106 primary bottom.	CM

Number	Date	Tank	Comment	Event Type
263.	11/29/1977	102, 103, 106	Set dollar plate, trimmed middle segments and continued welding 102 dome. Started welding round seam number three on 103 primary shell. Continued installing lifting lugs and welded dollar plate, performed PT of round seam and ground off fit-up gear on the underside of the 106 primary bottom.	CM
264.	11/30/1977	103, 104	Started setting staging inside 103 primary tank for the 103 dome. Erected fourth course and started welding vertical seams on 104 primary shell.	CM
265.	12/1/1977	101, 102, 103, 104, 106	Continued welding round seam number one on 101 secondary shell. Continued repairs to the 102 primary shell. Continued welding the 102 dome. Continued welding round seam number three on 103 primary shell. Continued setting staging for the 103 dome. Continued welding fourth course vertical seams and made repairs to 104 primary shell. Continued PT of round seam and continued grinding off fit-up gear on the underside of the 106 primary bottom.	CM
266.	12/2/1977	102, 103, 104, 106	Continued grinding off fit-up gear on round seam number four on 102 primary shell. Continued grinding off fit-up gear and completed welding 102 dome. Started setting 103 dome segments. Continued welding fourth course vertical seams on 104 primary shell. Installed lifting gear and moved the 106 primary bottom to the 106 primary foundation.	CM
267.	12/5/1977	103, 104, 105, 106	Started setting first course of 103 secondary shell. Started welding round seam number four on the 104 primary shell. Dismounted staging in tank 105. Scarfed off lifting lugs and started cleaning seams for MT on 106 primary bottom.	CM
268.	12/6/1977	101, 103	Continued to remove inside scaffolding for dome erection, welding of plates for lifting of dome, and weld repair of first course secondary on tank 101. Continued weld work on third course on 103 primary shell. Continued welding of outside plate of dome, and welding of first course secondary on tank 103.	CM
269.	12/7/1977	105	Squaring off of 105 primary lower knuckles.	CM
270.	12/8/1977	101, 102, 106	Preparing for 101 dome lift. Laid out studs for 102 dome and set scaffolding in preparation for setting 102 primary upper knuckles. Finished setting first course and started welding vertical seams on 106 primary shell.	CM
271.	12/9/1977	101, 102	Tank 101 dome was erected and secured. Layout of 102 dome studs completed.	CM
272.	12/12/1977	101, 102	Tank 101 dome round seam welding. Setting top knuckle on 102 primary shell.	CM

Number	Date	Tank	Comment	Event Type
273.	12/15/1977	101, 102, 103, 105, 106	Continued fitting the 101 dome to knuckle seam. Erected second course and started welding vertical seams on 101 secondary shell. Started welding upper knuckles on 102 primary shell. Laid out penetrations, and started cutting, and laid out studs on 102 dome. Welded round seam number one on 103 secondary shell. Continued welding 103 dome. Erected first course and started welding vertical seams on 105 primary shell. Made repairs to first course vertical seams and tacked round seam number one on 106 primary shell.	CM
274.	12/16/1977	102, 103, 104	Set first course on 102 secondary shell. Set fourth course on 103 primary shell. Made repairs to 104 primary and secondary shells.	CM
275.	12/19/1977	101, 102, 103, 104, 105, 106	Removed falsework from the interior of the 101 primary tank. Worked on back-up bars for dome to knuckle seam. Welded second course vertical seams on 101 secondary shell. Continued installing penetrations on 102 dome. Welded first course vertical seams on 102 secondary shell. Continued welding 103 dome. Welded fourth course vertical seams on 103 primary shell. Made repairs to 104 secondary shell. Continued welding first course vertical seams on 105 primary shell. Continued welding round seam number one on 106 primary shell. Continued welding upper knuckles on 102 primary shell. Red tag placed on 101 dome to stop work. Penetration being cut and placed on 102 dome. Set first course on 102 secondary shell.	CI/CM
276.	12/22/1977	101, 103, 104	Continued welding the 101 dome to knuckle seam. Fitted round seam number four on 103 primary shell. Started setting staging for 104 dome.	CM
277.	12/23/1977	103	Continued fitting and tacking round seam number four on 103 primary shell. Welded outer segments to middle segments seam on 103 dome.	CM
278.	12/27/1977	101	Clean up inside of tank 101.	CM
279.	12/28/1977	101, 103	Welded round seam number two on 101 secondary shell. Prepped round seam number four on 103 primary shell. Set second course on 103 secondary shell.	CM
280.	12/29/1977	101, 102, 103, 104, 105, 106	No work due to weather (snow).	CI/CM
281.	1/5/1978	101, 103	Continued to set scaffolding and to melt ice on 101 primary bottom. Welding dome plates, and dollar plate in position on 103 dome.	CI/CM

Number	Date	Tank	Comment	Event Type
282.	1/6/1978	101, 102, 103, 104, 105, 106	Removing plywood protective cover off 101 primary bottom. Survey of 102 dome. Vertical and round seam welding and repair being done on fourth course primary and second course secondary tank 103. Continued welding 103 dome plates. Finished setting dome staging and began to set plates for dome 104. Welding round seam one on 105 primary shell. Preparing for second course 106 primary shell. Weld repair of first course on 106 primary shell.	CM
283.	1/9/1978	101, 102, 103, 104	Made repairs to 101 secondary shell. Made repairs to the 102 secondary shell. Continued welding dollar plate on 103 dome. Installed outer segments of tank 104 dome. Started welding studs on 102 dome.	CM
284.	1/10/1978	101, 102, 104, 106	Continued welding the 101 dome to knuckle seam. Continued welding the upper knuckles on the 102 primary shell. Continued fitting the 104 dome. Set second course on 106 primary shell.	CM
285.	1/11/1978	102, 104	Made repairs to the upper knuckles on 102 primary shell. Made repairs to 102 secondary shell. Set second course on 104 secondary shell and started welding vertical seams. Continued installing studs on the 102 dome.	CM
286.	1/12/1978	101, 103, 105, 106	Removed scaffolding and brackets from the exterior of the 101 primary shell. Welded round seam number two on 103 secondary shell. Welded round seam number one on 105 primary shell. Set second course on 106 primary shell. Set first course on 106 secondary shell.	CM
287.	1/13/1978	101	Starting work to relocate penetration number five on the 101 dome. Ground off fit-ups on 101 secondary shell.	CI/CM
288.	1/17/1978	101	Re-installed plate in 101 dome where miss-located penetration number five had been. Set third course on 101 secondary shell.	CI/CM
289.	1/18/1978	101, 102, 103, 104	Re-installed penetration number five on 101 dome. Started welding third course vertical seams on 101 secondary shell. Installed staging for erection of the second course on 102 secondary shell. Ground off fit-ups on 102 and 103 domes. Set and fit middle segments on 104 dome.	CI/CM
290.	1/20/1978	101, 102, 104, 106	Continued to relocate penetration number five on dome, also welded third course vertical seams on 101 secondary shell. Second course set on 102 secondary shell. Round seam welding on round seam number two on 104 secondary shell. Welding continued on second course vertical seams on 106 primary shell.	CI/CM
291.	1/23/1978	101	Continued to finish penetration relocation.	CI

Number	Date	Tank	Comment	Event Type
292.	1/24/1978	101, 103	Removed plywood from inside of tank 101. Layout of studs and penetrations on 103 tank dome.	CM
293.	1/25/1978	101, 103	Continued welding round seam number three on 101 secondary shell. Grinding joint penetrations on tank 101. Cutting penetration in 103 dome.	CM
294.	1/26/1978	101, 102, 103, 104, 105, 106	Cleaned interior of 101 primary tank. Welded round seam number three on 101 secondary shell. Fitted round seam number two on 102 secondary shell. Welded third course vertical seams on 103 secondary shell. Installed penetrations on 103 dome. Continued welding 104 dome. Prepared 105 secondary lower knuckle in order to set first course of secondary shell. Continued welding round seam number two on 106 primary shell.	CM
295.	1/27/1978	101, 102, 103	Continued welding back up bars on 101 and 102 domes. Continued installing back up bars on the upper knuckles of 102 primary shell. Set and started welding upper knuckles on 103 primary shell.	CM
296.	1/30/1978	102, 103, 105.	Rigged, lifted, and set the 102 dome. Continued installing penetration on tank 103 dome. Welded knuckles on 103 primary shell. Erected and started welding vertical seams on second course of 105 primary shell.	CM
297.	1/31/1978	102, 103, 105	Fitted 102 dome to knuckle seam. Started welding round seam number two on 102 secondary shell. Ground off fit-ups on 103 dome. Erected first course shell on 105 secondary.	CM
298.	2/1/1978	101, 102, 104	Completed welding back-up bars on 101 dome. Continued removal of staging from tank 102. Set dollar plate and continued welding on 104 dome.	CM
299.	2/2/1978	101, 102, 103, 104, 105, 106	Continued repairs to 101 secondary shell. Installed door sheet on first course of 101 primary shell. Continued removal of staging from the interior of tank 102. Continued welding round seam number two on 102 secondary shell. Continued installing penetrations on 103 dome. Continued fitting dollar plate and welding the 104 dome. Continued welding second course vertical seams on 105 primary shell. Made repairs to 106 primary shell.	CM

Number	Date	Tank	Comment	Event Type
300.	2/3/1978	101, 102, 103, 104, 105, 106	Started welding the door sheet in tank 101 primary. Continued repairs to 101 secondary shell. Continued cleaning interior of tank 102 primary, made repairs to 102 secondary shell. Welded upper knuckle sections on 103 primary shell. Welded round seam number three on 103 secondary shell. Continued installing penetrations and lifting lugs on 103 dome. Continued fitting dollar plate on 104 dome. Continued fitting 102 dome to knuckle seam. Continued welding second course vertical seams on 105 primary shell. Welded first course vertical seams on 105 secondary shell. Made repairs to 106 primary shell.	CM
301.	2/6/1978	101, 104	Set fourth course and started welding vertical seam on 101 secondary shell. Removed fit-up gear and continued welding 104 dome. Set third course on 104 secondary shell.	CM
302.	2/7/1978	102, 104	Started welding the 102 dome to knuckle seam. Set staging brackets on 104 primary shell.	CM
303.	2/8/1978	101, 102, 106	Continued welding door sheet in the 101 primary shell. Started welding round seam number four on 101 secondary shell. Made repairs to welds on 102 secondary shell. Made repairs to round seam number two on 106 primary shell. Leveled areas for stress relieving propane tanks and equipment.	CM
304.	2/9/1978	102, 105	Continued welding the 102 dome to knuckle seam. Completed cleaning the interior of tank 102. Tacked round seam number one on 105 secondary shell.	CM
305.	2/10/1978	102, 103, 104, 106	Installed, fit and started welding the door sheet in the 102 primary shell. Continued welding the upper knuckles on 103 primary shell. Laid out for studs and penetrations and started cutting holes for penetrations on the 104 dome. Started erecting staging for the 106 dome.	CM
306.	2/11/1978	101	Finished welding door sheet in the 101 primary shell. Continued final repairs to round seam number four on 101 secondary shell.	CM
307.	2/13/1978	104, 106	Started installing penetrations and erected upper knuckle on 104 primary shell. Preparation for welding round seam number one on 106 secondary shell, and initial prep work for dome assembly.	CM
308.	2/14/1978	102, 103, 104, 106	Making repair welds to 102 dome round seam. Welding top primary knuckle on 103 primary shell. Finished erecting knuckle and began vertical seam welding knuckle segments on 104 primary shell. Setting perimeter ring for 106 dome assembly.	CM
309.	2/15/1978	101, 102, 103, 104, 105, 106	Boilermakers walk off	CI

Number	Date	Tank	Comment	Event Type
310.	2/16/1978	101	Continued installing insulation on tank 101. Boilermaker strike.	CI/CM
311.	2/17/1978	101, 102, 103, 104, 105, 106	Performed minor grinding and completed visual inspection of the dome to knuckle seam on the 101 primary tank. Made repairs to second course welds on 102 secondary shell. Continued welding upper knuckles on 102 primary shell. Continued welding upper knuckles on 104 primary shell. Welded third course vertical seams on 104 secondary shell. Continued installing penetrations and installed lifting lugs on the 104 dome. Made repairs to round seam number two on 105 primary shell. Made repairs to and continued welding round seam number one on 106 secondary shell. Started erection of falsework for the 106 dome. Continued installing insulation on tank 101.	CI/CM
312.	2/21/1978	101, 102, 106	Made repairs to the 101 dome to knuckle seam. Continued welding door sheet on 102 primary shell. Erected third course on 106 primary shell.	CM
313.	2/22/1978	101, 102, 103	Continued insulating up to the dome on 101 primary. Set third course on 102 secondary shell. Welding round seam between upper knuckle and shell on 103 primary shell. Set dome outer plates and began to put on back-up bars. Round seam number five between dome and knuckle on both tank 101 and 102 have been accepted by Vitro.	CM
314.	2/23/1978	101, 104	Continued to insulate tank 101 dome and risers. Stud welding and installing dome penetrations and welding upper knuckle on 104 primary shell. Welding round seam number 3 on 104 secondary shell.	CM
315.	2/24/1978	102, 103, 104	Started running the gas line from the propane tanks to the excavation. Continued welding third course vertical seams on 102 secondary shell. Continued welding upper knuckles on 103 and 104 primary shells. Completed installation of insulation.	CM
316.	2/27/1978	102, 104, 106	Fitted round seam number three on 102 secondary shell. Continued welding round seam number three on 104 secondary shell. Continued welding third course vertical seams on 106 primary shell. Continued welding penetration on the 104 dome.	CM
317.	2/28/1978	102, 106	Welded round seam number three on 102 secondary shell. Fitted and tacked round seam number three on 106 primary shell. Continued welding outer segments on 106 dome.	CM

Number	Date	Tank	Comment	Event Type
318.	3/1/1978	101, 102, 106	Completed welding round seam number three on 102 secondary shell. Set fourth course on 102 secondary shell. Trimmed and welded last vertical seam on third course of 106 primary shell. Installed burners, gas lines, instrumentation, etc. on tank 101 for stress relieving.	CM
319.	3/3/1978	101, 102, 103, 104, 106	Continued welding fourth course vertical seams and tacked round seam number four on 102 secondary shell. Made repairs to upper knuckles of 103 primary shell. Performed grinding, testing, and made repairs to weld on upper knuckles of 104 primary shell. Erected second course and started welding vertical seams on 106 secondary shell. Started stress relief operation of tank 101 at 4:35 p.m.	CM
320.	3/4/1978	101	Stress relief of tank 101 continued. 600° F reached at approximately at 5:00 a.m. and held to approximately 8:00 p.m. Burners then adjusted to raise temperature to 1100° F. Delays occurred when two of the burners flamed-out. These burners were restarted.	CM
321.	3/5/1978	101	Stress relief of tank 101 continued. Soak temperature of 1100° F attained at 7:30 a.m. (High-1165F, Low-1105F). Came out of soak at 8:30 a.m. (High-1175° F, Low-1125° F)	CM
322.	3/6/1978	101, 102, 104, 105, 106	Removed burners and air feed piping from tank 101. Started welding round seam number four on 102 secondary shell. Made repairs to 104 dome. Continued welding round seam number one on 105 secondary shell. Continued welding second course vertical seams on 106 secondary shell. Continued welding 106 dome.	CM
323.	3/7/1978	101, 104	Installed back-up bars for dome to knuckle weld on 104 primary shell. Made repairs to welds on 104 secondary shell. Removing insulation from tank 101.	CM
324.	3/8/1978	102, 103, 104	Made repairs to welds and ground off fit-ups on 102 secondary shell. Installed rigging and prepared to erect 103 dome. Continued installing back-up bars on 104 primary shell. Installed back-up bars on 103 primary shell. Continued repairs to welds on 104 secondary shell.	CM
325.	3/9/1978	101, 103, 104	Continued removing insulation from tank 101. Finished welding back-up bars to upper knuckle on 104 primary shell. Dome 103 was erected, fit-up, and tacked. Dome 104 was erected, fit-up, and tacked in place.	CM
326.	3/10/1978	101, 102, 103, 104, 105	Started MT of the 101 primary bottom. Made repairs to 102 and 103 secondary shells. Scarfed off lifting lugs and started welding dome to knuckle seam on tank 103 and 104. Raised scaffolding on 105 primary shell in preparation for third course.	CM

Number	Date	Tank	Comment	Event Type
327.	3/13/1978	102, 103, 104, 106	Cleaned the tank 102 annular space and attached thermocouples to the 102 primary tank. Dismantled the dome fabrication staging in tank 103. Continued welding knuckle to dome seams on 103 and 104 primary shells. Erected third course and started welding vertical seams on 106 primary shell. Started installing insulation on tank 102.	CM
328.	3/14/1978	101	Continued MT of the seams on the 101 primary bottom.	CM
329.	3/15/1978	102, 103, 106	Continued installation of insulation on tank 102. Repairing welds on round seam number four on 102 secondary shell. Tack welding of round seam number three on 103 secondary. Continued welding 106 dome, and installed the dollar plate for fit-up. Also set fourth course primary on tank 106.	CM
330.	3/16/1978	101, 102, 103, 105	Vitro surveyed tank 101 primary bottom. Continued installation of insulation on tank 102. Continued to weld dome round seam and hung primary shell door sheet on tank 103. Welding round seam number three on 105 primary and some vertical seams on second course on 105 secondary shell. Continued welding dome and vertical seam welding fourth course on 106 primary shell.	CM
331.	3/17/1978	102	Finished insulating tank 102.	CM
332.	3/20/1978	101, 103, 105, 106	Blue chalked welds on the 101 primary shell. Welded door sheet and removed upper exterior staging on 103 primary shell. Welded third course vertical seams on 105 primary shell. Welded round seam number two on 105 secondary shell. Welded fourth course vertical seams on 106 primary shell. Continued welding 106 dome. Erected support angle for fabrication of the 105 dome.	CM
333.	3/21/1978	101, 102, 103, 104, 106	Erected fourth course and started welding vertical seams on 103 secondary shell. Ground off fit-ups from knuckle to dome seam on 104 primary shell. Erected third course on 106 secondary shell. Started installing pipe for tank 101 hydro test. Installed burners and piping for tank 102 stress relief. Pre-stress relief meeting held - (1) seal gaps around burners to attain 3 inches of water pressure. (2) Insulate air tubes to one foot below roof line. (3) Place thermocouple on burner and damper penetration. (4) Soak 3 hours at 1000° F. If deformations occur on tank 102 (similar to those on tank 101), an analysis and proposed corrections will be required prior to proceeding on tank 103.	CI/CM
334.	3/22/1978	101, 102, 106	Started filling tank 101 with water. Fitted and tacked round seam number four on 106 primary shell. Stress relief of tank 102 started at 6:30 p.m.	CM

Number	Date	Tank	Comment	Event Type
335.	3/23/1978	101, 102, 104, 105	Filling of tank 101 continued. Dome fabrication staging was removed from tank 104. Started setting and fitting the outer segments of the 105 dome. Stress relief of tank 102 continued. Soak started at 6:30 p.m. and completed at 9:30 p.m. Internal air pressure was 3.4 inches of water.	CM
336.	3/24/1978	101, 103, 104, 105	Re-chalked some seams on 101 primary shell. Welded round seam number four on 103 secondary shell. Continued welding door sheet in 103 primary shell. Cleaned interior of tank 104. Made repairs to welds on 105 secondary shell.	CM
337.	3/27/1978	102, 104, 105, 106	Installed and started welding the door sheet in 104 primary shell. Erected and fitted fourth course on 104 secondary shell. Made repairs to welds on 105 primary and secondary shells. Started welding round seam number four on 106 primary shell. Removed burners and air supply piping from tank 102. During stress relief of tank 102, three of the four deflector tubes dropped to the bottom of the tank causing unknown damage. This was discovered when the burners were removed. Apparently, the insulation around the lower portion of the burner caused the metal to crystallize. Also discovered were small (1" deep) dimples around the burner penetration.	CI/CM
338.	3/28/1978	101, 103, 104, 105, 106	Completed filling tank 101 with water. Completed erection of staging on exterior of 101 secondary shell. and started erecting upper secondary knuckles. Continued welding door sheet on 103 primary shell. Welded fourth course vertical seams on 104 secondary shell. Continued welding door sheet in 104 primary shell. Continued fitting and welding outer segments of the 105 dome. Fitted and tacked round seam number three on 106 secondary shell. Made repairs and laid out penetrations on 106 dome.	CM
339.	3/29/1978	102, 103	Chalked seams on 102 primary shell. Installed temporary thermocouple on 103 primary shell. Started fabrication of the wall rebar cages.	CM
340.	3/31/1978	103, 105	Boilermakers walked off the job at 10:00 a.m. Installed insulation on tank 103. Continued tying rebar mats for the wall curtains. At noon, a reduced crew of boilermakers returned to work. Attached fit-up gear for erection of the fourth course on 105 primary shell	CM
341.	4/3/1978	101, 103, 105, 106	Continued welding upper knuckles on 101 secondary shell. Erected fourth course and started welding vertical seams on 105 primary shell. Laid out studs and penetrations on the 106 dome. Continued installing insulation on tank 103.	CM

Number	Date	Tank	Comment	Event Type
342.	4/4/1978	102, 104, 105	Started installing the skirt around 102 secondary liner. Continued welding round seam number four on 104 secondary shell. Continued welding fourth course vertical seams on 105 primary shell. Continued welding the outer segments of the 105 dome. Erected water line on tank 102 for hydro.	CM
343.	4/6/1978	101, 102, 104, 105, 106	Continued welding the upper knuckles on 101 secondary shell. Continued installation and welding of the skirt plate on 102 secondary shell. Continued welding the door sheet in 104 primary shell. Continued welding fourth course vertical seams on 105 primary shell. Set, fit, and started welding the middle segments on the 105 dome. Cut holes for and installed penetrations on 106 dome.	CM
344.	4/7/1978	102	Completed installation of the skirt plate on 102 secondary shell. Continued MT of the 102 primary bottom.	CM
345.	4/10/1978	102, 103, 104, 105, 106	Completed MT of the 102 primary bottom. Continued welding the door sheet in 104 primary shell. Fitted and tacked round seam number four on 104 primary shell. Started erection of the third course on 105 secondary shell. Continued welding middle segments on the 105 dome. Continued installing penetrations on the 106 dome. American Bridge Division wants to add four 24 inch nozzles for the burners for tank 103 stress relief.	CI/CM
346.	4/11/1978	101, 102, 103, 105	Continued welding the upper knuckles on 101 secondary shell. Ran water in tank 102 for the hydro test. Installed four new 24 inch diameter nozzles for the burners on the 103 dome. Completed erection of the third course on 105 secondary shell.	CI/CM
347.	4/12/1978	102, 104, 105	Started welding third course vertical seams on 105 secondary shell. Continued welding the middle segments on 105 dome. Laid out and installed lifting lugs on the 106 dome. Installed insulation on tank 104. Water for filling tank 102 was not turned off last night. The primary tank was overflowed into the annulus and out the access in the secondary shell.	CI/CM
348.	4/13/1978	101, 103, 104	Continued welding the upper knuckles and laid out penetrations on 101 secondary shell. Performed MT of door sheet attachments and installed temporary thermocouples on 104 primary shell. Completed insulation of tank 103 and continued insulating tank 104. Stress relief of tank 103 started at about 6:30 p.m.	CM

Number	Date	Tank	Comment	Event Type
349.	4/14/1978	102, 103, 105	Started re-chalking the seams on tank 102 for the hydro. Continued welding third course vertical seams on 105 secondary shell. Continued welding middle segments on dome 105. Made repairs to welds on 105 primary shell. Stress relief of tank 103 continued. A leak was discovered in the gas lines and the burners were turned off at 6:20 a.m. (temperature of tank was 500F - 600F). Leak repaired and burners were restarted at 9:00 a.m. (temperature of tank was 400F - 500F). Rain at 6:30 p.m. slowed the operation. Soak at 1000° F started at 9:00 p.m. internal air pressure in excess of 3 inches of water. Tank back down to 600° F at approximately 7:00 a.m.	CI/CM
350.	4/17/1978	101, 103, 104, 106	Continued welding the upper knuckles on 101 secondary shell. Erected fourth course on 106 secondary shell. Installed new burner penetration on 106 dome. Removed insulation from tank 103 and continued insulation of tank 104.	CM
351.	4/18/1978	104, 106	Started installation of new burner penetration on 104 dome. Cleaned interior of tank 104. Completed erection and started welding vertical seams fourth course of 106 secondary shell. Continued installation of penetration on 106 dome.	CM
352.	4/19/1978	101, 104, 105, 106	Continued welding upper knuckles on 101 secondary shell. Continued installation of new burner penetrations on 104 dome. Made repairs to weld seams on 105 primary shell. Continued welding RS #3 on 105 secondary shell. Continued welding 105 dome. Continued welding fourth course verticals on 106 secondary shell. Continued installation of penetrations on 106 dome. Installed insulation on tank 104. Installed studs on 106 dome.	
353.	4/20/1978	101, 103	Installed the slide plate and skirt on the 101 secondary bottom. Cut holes for the penetrations in the upper knuckles of 101 secondary shell. Survey the 103 dome and started MT of the 103 primary bottom.	CM
354.	4/21/1978	102	Re-chalked seams on 102 primary shell for the hydro.	CM
355.	4/24/1978	101, 102, 103, 104	Installed penetrations in the upper knuckles and continued installation of the slide/skirt plate on 101 secondary shell. Completed re-chalking the seams for the hydro of 102 primary tank. Installed fit-up clips and prepared to erect upper knuckles on 102 secondary shell. Continued MT of 103 primary bottom. Completed insulation of tank 104.	CM

Number	Date	Tank	Comment	Event Type
356.	4/25/1978	101, 105	Completed installation and started welding the penetrations in the upper knuckles of the 101 secondary shell. Set and fitted the dollar plate, removed fit-up gear and continued welding the 105 dome. Set the fourth course on the 105 secondary shell.	CM
357.	4/26/1978	102, 104	Erected and fit the upper knuckles on the 102 secondary shell. Stress relief of tank 104 started at 8:45 a.m.	CM
358.	4/27/1978	104	Tank 104 stress relief continued. Soak started at 11:30 a.m. with temperature range of 1000° F - 1090° F. Internal air pressure was 3.8 inches of water.	CM
359.	4/28/1978	102	Started welding the upper knuckles on 102 secondary shell.	CM
360.	5/1/1978	104	Removing insulation from tank 104.	CM
361.	5/2/1978	105, 106	Laid out penetrations on the 105 dome. Started setting upper knuckles on the 106 primary shell.	CM
362.	5/3/1978	103, 105, 106	Started cutting holes for penetrations on 105 dome. Completed setting and started welding upper knuckles on 106 primary shell. Installed water line for filling tank 103.	CM
363.	5/4/1978	103	Filled tank 103 with water.	CM
364.	5/5/1978	101, 102, 103, 104, 105, 106	Continued welding penetrations in the upper knuckles of the 101 secondary shell. Continued welding the upper knuckles on 102 secondary shell. Continued filling tank 103 with water. Made repairs on 104 secondary shell. Performed MT of the attachment areas on the interior of 101 secondary shell. Installed penetrations in the 105 dome. Erected upper knuckles on 105 primary shell. Continued welding upper knuckles on 106 primary shell.	CM
365.	5/8/1978	101, 102, 105	Welded in manhole and worked on correction the resultant out of tolerance condition on 101 secondary shell. Started cutting holes for penetrations in the upper knuckles of the 102 secondary shell. Continued erection of the upper knuckles on the 105 primary shell.	CM
366.	5/9/1978	104, 105	Completed erection of the upper knuckles on 105 primary shell. Started MT of the 104 primary bottom.	CM
367.	5/10/1978	103, 104, 105	Started setting slide plate on 103 secondary bottom. Made repairs to weld on 105 secondary and 105 primary shells required by the NCR for welding in the rain. Completed MT of the 104 primary bottom. Laid out lifting lugs and continued installation of penetration on 105 dome.	CM

Number	Date	Tank	Comment	Event Type
368.	5/15/1978	102, 103, 105, 106	Installed penetrations in the upper knuckles of 102 secondary shell. Installed skirt plate on tank 103. Continued welding caps on the burner penetrations on the 103 dome. Continued installation of penetrations on the 105 dome. Continued welding the upper knuckles on 105 primary shell. Completed welding the upper knuckles on 106 primary shell.	CM
369.	5/18/1978	102, 104, 105, 106	Continued welding penetrations in the upper knuckles of 102 secondary shell. Made repairs to welds on the upper knuckles of 105 primary shell. Continued removal of scaffolding and brackets from the interior of the 105 primary and 106 primary shells. Installed back-up bars on the upper knuckles of 106 primary shells. Continued re-installation of the 42 inch risers on the 104 dome.	CM
370.	5/19/1978	105, 106	Erected the tank 106 dome and tank 105 dome.	CM
371.	5/22/1978	101, 105, 106	Steel tank 101 is complete. Welding door sheet on 105 primary shell. Welding dome round seam on tanks 105 and 106.	CM
372.	5/23/1978	102, 103, 104	Placed and tacked flashing on dome of tank 102. Finished filling tank 103 with water. Set secondary upper knuckle on tank 103. Began filling tank 104 with water for hydro test.	CM
373.	5/24/1978	103, 104, 105, 106	Finished setting knuckle and began welding vertical seams on 103 secondary shell. Continued to fill tank 104 for hydro test. Continued welding dome to knuckle on tank 105 and 106. Continued welding in door sheet on 105 primary shell.	CM
374.	5/25/1978	102, 104	Welding on secondary door plate on tank 102. Completed filling tank 104 for hydro test.	CM
375.	5/26/1978	102, 104	Completed welding secondary access plate on tank 102. Completed hydro test of tank 104.	CM
376.	5/30/1978	102, 103, 105	Steel tank 102 is complete. Continued to weld upper knuckle on 103 secondary knuckle. Made repairs to knuckle/dome and installing insulation on tank 105. Continued to weld dome to haunch.	CM
377.	5/31/1978	103, 104, 105, 106	Laying out and cutting penetrations in the upper knuckle of 103 secondary shell. Started installing slide plates on tank 104. Installing insulation on tank 105. Continued to weld 106 dome in place.	CM
378.	6/1/1978	102, 106	Shot additional stud around the 42 inch penetration where dimples occurred on tank dome 102. Installed door sheet in 106 primary shell.	CI/CM

Number	Date	Tank	Comment	Event Type
379.	6/5/1978	101, 104, 105, 106	Began moving rebar curtains into the hole and setting them in place on tank 101. Installing slide plate and skirt on tank 104. Continued installing insulation covering dome of tank 105. Finished welding 106 dome in place.	CM
380.	6/6/1978	101, 103, 104, 105, 106	Continued welding penetrations in the upper knuckles of 103 secondary shell. Installed slide and skirt plate on 104 secondary shell. Made repairs to upper knuckles on 106 primary shell. Continued welding the door sheet in 106 primary shell. Installed temporary thermocouples on 106 primary shell. Installed gas line for stress relief of tank 105. Completed insulation of tank 105. Installed inside rebar curtain on tank 101.	CM
381.	6/7/1978	101, 104, 105, 106	Started to erect the upper knuckles on 104 secondary shell. Stress relief for tank 105 started at 11:00 a.m. Heavy steaming was noted. Installed insulation on tank 106. Installed inside rebar curtains on tank 101.	CM
382.	6/8/1978	101, 103, 105, 106	Scaffolding was dropped in the annulus of tank 103. Complete stress relief of tank 105. Welded door sheet in 106 primary shell. Completed setting the inside rebar curtain and started setting the outside curtain of rebar on tank 101.	CM
383.	6/9/1978	101, 104, 106	Erected upper knuckles on 104 secondary shell. Continued welding the door sheet 106 primary shell. Continued setting the outside curtain of rebar on tank 101.	CM
384.	6/12/1978	101, 102, 104	Welded the upper knuckles on 104 secondary shell. Started work on the concrete forms for tank 101. Completed setting outside rebar curtains on tank 101. Started setting rebar curtains on tank 102.	CM
385.	6/13/1978	101, 103	Installed door sheet in the 103 secondary shell. Prepared to set concrete forms for first lift on tank 101.	CM
386.	6/14/1978	101, 102, 104, 105	Continued welding upper knuckles and skirt plate on 104 secondary shell. Started MT of the 105 primary bottom. Installed concrete forms for this first lift in tank 101. Completed inside curtains of rebar and started setting outside curtains of rebar on tank 102.	CM
387.	6/15/1978	106	Completed insulation of tank 106. Stress relief of tank 106 started at approximately 5:00 p.m. Steam is visible. Moisture in concrete is the cause.	CM
388.	6/16/1978	106	Continued stress relief of tank 106. Soak started at 9:30 a.m. with internal pressure slightly over 4 inches of water.	CM
389.	6/19/1978	101, 102, 104, 105	Continued welding upper knuckles on 104 secondary shell. Made repairs to 105 secondary shell. Completed forming the first lift on tank 101. Started forming the first lift on tank 102.	CM

Number	Date	Tank	Comment	Event Type
390.	6/20/1978	101, 102, 103, 104, 106	Made repairs to welds on the access window and completed removal of staging on 103 secondary shell. Continued welding upper knuckle sections, scarfed off fit-up gear and laid out penetrations on 104 secondary shell. Made repairs to 106 secondary shell. Continued installation of studs on 104 secondary shell. Removed insulation from tank 106. Placed concrete in the first lift on tank 101. Continued forming the first lift on tank 102.	CM
391.	6/21/1978	104, 105	Continued welding upper knuckles, Layout of penetrations and cutting of holes for penetrations on 104 secondary shell. Attached fit-up gear and prepared to erect upper knuckles on 105 secondary shell.	CM
392.	6/22/1978	101, 102, 105, 106	Erected upper knuckles on 105 secondary shell. Completed removal of insulation from tank 106. Stripped forms on tank 101. Continued forming first lift of tank 102.	CM
393.	6/27/1978	101, 102, 104, 105, 106	Welding the upper knuckles and installed the annulus penetrations on 104 secondary shell. Continued welding upper knuckles on 105 secondary shell. Continued filling tank 105 with water. Completed MT of the 106 primary bottom. Sandblasted the construction joint on tank 101. continued to form the second lift on tank 101. Stripped forms from first lift on tank 102.	CM
394.	6/28/1978	101, 103, 105, 106	Completed filling tank 105 for the hydro test. Erected upper knuckles on 106 secondary shell. Continued sandblasting the concrete construction joint on tank 101. Set forms for the second lift on tank 101. Started setting the inside rebar curtains on tank 103.	CM
395.	6/29/1978	101, 102, 104, 105	Completed filling tank 104 with water. Completed hydro test of tank 105 and started adding water to fill to dome. Patched rock pockets on the first lift of tank 101. Started forming second lift on tank 102.	CM
396.	6/30/1978	102, 103, 104, 105, 106	Continued welding upper knuckles and penetrations on 104 secondary shell. Continued welding upper knuckles on 105 secondary shell. Completed filling tank 105 with water. Continued welding upper knuckles on 106 secondary shell. Welded caps on the primary tank risers of tank 104. Laid out studs on 106 secondary shell. Sandblasted concrete construction joint on tank 102. Set and tied the outer rebar curtains on tank 103.	CM
397.	7/5/1978	101, 103, 104	Pumped water out of the 104 annulus. Placed concrete in the second lift on tank 101. Started forming for the first lift on tank 103.	CI/CM

Number	Date	Tank	Comment	Event Type
398.	7/6/1978	103, 105, 106	Started setting penetrations in the upper knuckles of 105 secondary shell. Set slide plate for tank 106. Chalked primary tank weld seams and started filling tank 106 with water. Completed setting the outside rebar curtains on tank 103 and installed rebar ties.	CM
399.	7/7/1978	101, 104, 106	Installed the flashing on the upper knuckles of 104 secondary shell. Continued filling tank 106 for the hydro test. Stripped forms and applied curing compound to the second lift on tank 101.	CM
400.	7/10/1978	101, 102	Completed forming for the second lift on tank 102. Set inside radial curtains for the third lift on tank 101.	CM
401.	7/11/1978	101, 102, 103, 104, 105, 106	Welded the door sheet in 104 secondary shell. Laid out penetration on 105 secondary shell. Welded knuckle round seam and skirt plate on 106 secondary shell. Installed studs on 105 secondary shell. Placed concrete for the second lift on tank 102. Continued forming for the first lift on tank 103. Continued installing inside curtains on the tank 101 haunch.	CM
402.	7/12/1978	101, 102, 104, 105	Completed welding the access opening in the 104 secondary shell. Cut openings for penetrations in the upper knuckles of 105 secondary shell. Sandblasted the construction joint on tank 102. Setting the inside curtain on the tank 101 haunch. Started setting the inside rebar curtain on tank 104.	CM
403.	7/13/1978	102	Stripped forms from the second lift on tank 102.	CM
404.	7/14/1978	101, 103, 105, 106	Installed penetrations in the upper knuckles of 105 secondary shell. Laid out and started cutting penetrations in the upper knuckles of 106 secondary shell. Placed concrete in the first lift on tank 103. Started setting circumferential bars on the tank 101 haunch.	CM
405.	7/17/1978	103, 104, 106	Completed filling tank 106 with water. Stripped forms and applied curing compound on first lift of tank 103. Set the outside rebar curtain on tank 104.	CM
406.	7/18/1978	102, 103, 104	Sand blasted the construction joint and formed the second lift on tank 103. Started setting inside mat radial bars on the tank 102 haunch. Completed setting outside rebar curtains on tank 104.	CM
407.	7/19/1978	101, 103, 104, 105, 106	Continued welding penetrations and the slide plate and installed stud clips on the upper knuckles of 105 secondary shell. Laid out and cut the holes for penetrations in the upper knuckles of 106 secondary shell. Laid out studs on 106 secondary shell. Started setting the bulkhead for the tank 101 haunch pour and patched form tie holes. Continued forming the second lift on tank 103. Started forming the first lift on tank 104.	CM
408.	7/21/1978	103	Placed concrete for second lift on tank 103.	CM

Number	Date	Tank	Comment	Event Type
409.	7/24/1978	101, 102, 103, 104, 106	Started setting the annulus penetrations on 106 secondary shell. Stripped forms from the second lift on tank 103. Continued forming the first lift on tank 104. Installed inside mat circumferential bars on the tank 101 haunch. Installed inside mat circumferential bars on the tank 102 haunch.	CM
410.	7/25/1978	102	Made repairs to concrete on tank 102.	CI/CM
411.	7/26/1978	102, 105	Made repairs to concrete on tank 102. Started setting inside wall curtain on tank 105.	CI/CM
412.	7/27/1978	102, 103, 105	Sand blasted the concrete construction joint on tank 102. Made repairs to concrete on tank 103. Set outside wall curtains on tank 105.	CI/CM
413.	7/28/1978	103, 105	Made repairs to the concrete on tank 103. Started setting forms for first lift on tank 105.	CI/CM
414.	7/31/1978	103, 106	Installed the flashing on 106 secondary shell. Made repairs to concrete on tank 103.	CI/CM
415.	8/1/1978	104, 105	Placed concrete in the first lift on tank 104. Continued forming the first lift on tank 105.	CM
416.	8/2/1978	103, 104	Sand blasted the construction joint on tank 103. Stripped forms and applied curing compound to the first lift on tank 104.	CM
417.	8/4/1978	105	Placed concrete in the first lift on tank 105.	CM
418.	8/7/1978	105	Stripped forms and applied curing compound to the first lift on tank 105.	CM
419.	8/8/1978	101, 103, 104,	Patched form tie holes on tank 104. Formed the second lift on tank 104. Started setting the outside curtain on the tank 101 haunch. Continued setting inside mat circumferential bars on the tank 103 haunch.	CM
420.	8/9/1978	104, 105, 106	Completed forming the second lift on tank 104. Sand blasted the construction joint and stripped the forms from the first lift on tank 105. Set inside wall curtain on tank 106.	CM
421.	8/10/1978	105, 106	Formed the second lift on tank 105. Started setting outside wall curtains on tank 106.	CM
422.	8/11/1978	102, 104, 105	Placed concrete in the second lift on tank 104. Continued forming the second lift on tank 105. Started installing outside mat circumferential bars on the tank 102 haunch.	CM
423.	8/14/1978	101, 104	Stripped forms from the second lift on tank 104. Started setting outside mat radial bars on the tank 101 haunch.	CM
424.	8/15/1978	106	Completed setting outside curtains for first and second lift on tank 106.	CM

Number	Date	Tank	Comment	Event Type
425.	8/16/1978	101, 106	Placing rebar on the dome of tank 101. Began installing forms for first lift of concrete on tank 106.	CM
426.	8/17/1978	105	Placed concrete of the second lift on tank 105.	CM
427.	8/18/1978	101, 103, 106	Patched rock pockets on tank 103. Removed wood strip block-out for polysulfide sealant on tank 103. Formed the first lift on tank 106. Installed dome steel on tank 101.	CM
428.	8/21/1978	101, 105, 106	Started forming the haunch of tank 101. Stripped forms from the second lift on tank 105. Continued forming first lift on tank 106.	CM
429.	8/22/1978	105	Stripped forms from the second lift on tank 105.	CM
430.	8/23/1978	101, 102, 103, 104, 105, 106	Continued forming the haunch on tank 101. Made repairs to concrete and installed scaffolding on tank 105. Continued forming the first lift on tank 106. Replaced defective cad welds on tank 101. Installed dome steel on tank 102. Continued installing middle mat circumferential bars and butt-welded them on tank 103. Cad welded inside mat radial bars on tank 104.	CM
431.	8/25/1978	102	Started forming the haunch on tank 102.	CM
432.	8/28/1978	101, 105	Removed the blockouts for the sealant on tank 101. Completed installing inside mat radial bars on the tank 105 haunch.	CM
433.	8/29/1978	106	Placed concrete for the first lift on tank 106.	CM
434.	8/30/1978	101	Installed polysulfide sealant on tank 101.	CM
435.	8/31/1978	102, 104	Cleaned the construction joint on tank 102. Sand blasted the construction joint on tank 104. Installed dome steel (rebar) on tank 102.	CM
436.	9/1/1978	106	Stripped forms from the first lift on tank 106. Applied curing compound to the concrete and sand blasted the construction joint on tank 106.	CM
437.	9/5/1978	101, 103, 104, 105, 106	Continued forming the tank 101 haunch. Started setting forms for the second lift on tank 106. Continued installing outside mat vertical bars on the tank 103 haunch. Started setting middle mat radial bars and the middle reinforcement plates on the tank 104 haunch. Started installing inside mat circumferential bars on the tank 105.	CM
438.	9/7/1978	101, 106	Made final prep for placing the tank 101 haunch concrete. Making final prep for second lift on tank 106.	CM

Number	Date	Tank	Comment	Event Type
439.	9/11/1978	101, 102, 104, 105, 106	Installed the bulkhead for the tank 102 haunch placement. Placed concrete in the second lift on tank 106. Installed outside mat radial bars on the tank 104 haunch. Installed middle mat circumferential bars on the tank 105 haunch. Excavated to the tank 101 leak detection sump foundation.	CM
440.	9/12/1978	101, 106	Stripped forms from the tank 101 haunch. Applied curing compound to the haunch concrete on tank 101. Installed inside mat radial bars on the tank 106 haunch. Installed the 101 leak detection sump and base.	CM
441.	9/13/1978	101	Applied Kraft paper to the tank 101 leak detection pit sump and spark tested it. Began removal of keyway and clean of material on 101 dome. Installing forms for haunch placement.	CM
442.	9/14/1978	101	Patched rock pockets in haunch of tank 101.	CM
443.	9/15/1978	102, 106	Setting forms and preparing for concrete placement in tank 102 haunch. Continued removing forms from second lift on tank 106.	CM
444.	9/20/1978	102, 103	Placed concrete in the tank 102 haunch. Continued forming the haunch on tank 103.	CM
445.	9/21/1978	102	Installed leak detection sump for tank 102.	CM
446.	9/22/1978	102, 103, 104, 105, 106	Stripped forms and applied curing compound to the haunch on tank 102. Continued forming the haunch on tank 103. Started setting the bulkhead for the haunch pour on tank 104. Installed ties on the tank 102 dome. Continued welding rebar to the upper reinforcement plates on the tank 103 and 104 haunches. Cad welded outside mat radial bars on the tank 105 haunch. Installed and welded inside mat circumferential bars on the tank 106 haunch.	CM
447.	9/28/1978	101, 102, 104, 105, 106	Set in placed screeds for tank 101 dome pour. Continued to remove bulkhead materials from tank 102. Placed the remaining sections of bulkhead on tank dome 104. Placing steel on dome and began placement of bulkhead on tank dome 105. Placing circumferential bars on second mat and began to setup for verticals on third mat on tank 106.	CM
448.	9/29/1978	102, 103	Patched the haunch to wall construction joint and set screeds for the dome pour on tank 102. Placed concrete in the haunch of tank 103. Backfilled tank 102 leak detection sump.	CM
449.	10/2/1978	101, 102, 103, 105, 106	Cleaned construction joints on tank 101 and 102. Stripped forms from the tank 103 haunch. Started installing bulkhead forms for the tank 105 haunch. Patched concrete on the walls on tank 106.	CM

Number	Date	Tank	Comment	Event Type
450.	10/3/1978	101, 102, 106	Removed bulkhead forms and cleaned the construction joint on tanks 101 and 102. Patched the wall concrete on tank 106.	CM
451.	10/5/1978	101, 102	Completed cleaning the construction joint on the tank 101 dome. Continue stripping the bulkhead forms and cleaning the construction joint on tank 102 dome.	CM
452.	10/6/1978	105	Started setting forms for the tank 105 haunch.	CM
453.	10/11/1978	101, 102, 103	Placed concrete on the dome of tank 101. Removed blockouts for polysulfide sealant on tank 102 and 103.	CM
454.	10/12/1978	102, 103, 104, 105, 106	Placed polysulfide sealant on tank 102. Stripped the bulkhead on tank 103 haunch. Removed blockouts for the polysulfide sealant on tanks 104 and 106. Placed concrete in the tank 105 haunch.	CM
455.	10/13/1978	104, 105	Installed polysulfide sealant on tank 104. Excavated for and set the tank 105 leak detection well.	CM
456.	10/16/1978	102, 103, 105	Cleaning construction joint and top of tank 102 dome. Stripping bulkhead off top of haunch and cleaning tank dome 103. Stripped forms from the haunch on tank 105.	CM
457.	10/17/1978	103	Sand blasting construction joint and cleaning bulkhead on tank 103. Also set the tank 103 leak detection sump.	CM
458.	10/19/1978	102, 105	Placed concrete in the dome of tank 102. Stripped the bulkhead on the tank 105 haunch. Backfilled tank 105 leak detection well.	CM
459.	10/20/1978	103, 105, 106	Cleaned the construction joint on the tank 105 haunch. Cleaned the construction joint on Tank 106. Backfilled the tank 103 leak detection sump. Started installation of the tank 105 leak detection drain line.	CM
460.	10/23/1978	103, 104	Installed pan and float on tank 103 for support of the dome during concrete placement. Placed concrete in the tank 104 haunch.	CM
461.	10/24/1978	103, 104	Placed concrete on the tank 103 dome. Started stripping the bulkhead for on tank 104 haunch. Excavated for the tank 104 leak detection sump.	CM
462.	10/25/1978	103, 104, 105, 106	Stripped forms on the tank 104 haunch. Set screeds on the tank 105 dome. Set forms for the tank 106 haunch. Installed the leak detection drain line for tank 103.	CM
463.	10/26/1978	101, 105	Dome support was removed from tank 101. Backfilled the tank 105 leak detection sump and drain.	CM
464.	10/27/1978	103, 104, 106	Stripped the bulkhead on the tank 104 haunch. Completed forming the tank 106 haunch. Started backfilling tank 103 leak detection sump. Started backfilling the tank 104 leak detection sump.	CM
465.	10/30/1978	105	Placed concrete in tank 105 dome.	CM

Number	Date	Tank	Comment	Event Type
466.	10/31/1978	106	Placed concrete in the tank 106 haunch.	CM
467.	11/1/1978	104, 106	Stripped the bulkheads on the tank 104 and 106 haunches. Excavated for tank 106 leak detection sump.	CM
468.	11/2/1978	106	Stripped forms on tank 106 haunch. Applied curing compound to the formed surface on the tank 106 haunch.	CM
469.	11/3/1978	102, 103, 104, 105, 106	Removed the dome support from tank 102. Re-arranged water lines for the dome support on tanks 103 and 105. Performed general clean-up. Completed backfilling the tank 104 leak detection sump and drains. Repaired protective coating on the tank 106 sump and drain and started backfilling it.	CM
470.	11/6/1978	101, 102, 103, 104, 105, 106	Began backfilling around the tanks.	CM
471.	11/7/1978	101, 102, 103, 104, 105, 106	Continued mass backfill of the tank farm.	CM
472.	11/8/1978	101, 102, 103, 104, 105, 106	Patched form tie holes in the walls and performed general clean-up as required to support mass backfilling operations.	CM
473.	11/17/1978	101, 102, 103, 104, 105, 106	Continued backfill of the tanks	CM
474.	11/27/1978	104	Stripped the haunch bulkhead form on tank 104.	CM
475.	11/28/1978	101, 102, 103, 104, 105, 106	Set screeds for tank 104 dome encasement. Continued backfilling the tanks.	CM
476.	11/29/1978	104	Sand blasted the bulkhead on the tank 104 haunch.	CM
477.	11/30/1978	106	Set screeds and stripped bulkhead on the tank 106 dome.	CM
478.	12/1/1978	101, 102, 103, 104, 105, 106	Completed backfilling tank farm at 10:00 p.m. last night. Graded the excavation. Installed piping for pumping out the tanks.	CM
479.	12/5/1978	104	Poured concrete on dome of tank 104.	CM
480.	12/6/1978	106	Placed concrete in the dome of tank 106. Installed protective enclosures for curing.	CM
481.	12/7/1978	106	Placed protective enclosure over the dome of tank 106 and placed heaters inside it.	CM
482.	12/12/1978	105	Surveying tank riser elevations. Cutting off tank caps and risers. Forming for pits and covers continued. Demonstrated backfill procedure for compaction equipment. Pumping water from tank 105.	CM

Number	Date	Tank	Comment	Event Type
483.	12/13/1978	103, 104, 105	Completed pumping water from tank 105. Moved piping to tank 103. Removing concrete weather protection from tank 104.	CM
484.	12/14/1978	101, 102	Scraping out frozen ground and backfilling around tanks 101 and 102. Pumping water from tank 103.	CM
485.	12/15/1978	104, 106	Removing cold weather protection from tanks 104 and 106 domes.	CM
486.	12/19/1978	101	Pumping water from tank 101.	CM
487.	12/22/1978	101, 102, 103	Backfilling west of tank 101 and 103. Moved water disposal line to tank 102.	CM
488.	12/27/1978	102	Pumping water from tank 102.	CM
489.	12/29/1978	104, 106	Pumping water from tanks 104 and 106.	CM
490.	1/11/1979	101, 102	Welding risers to tank 101 and 102.	CM
491.	1/12/1979	101, 102, 103, 104, 105, 106	Coating and installing tank risers	CM
492.	1/17/1979	101, 102	Welding risers to tanks 101 and 102. Welding ventilation risers to tank 101. Coating tank risers.	CM
493.	1/23/1979	102, 103	Welding risers to tanks 102 and 103. Welding vent risers to tank 102.	CM
494.	1/24/1979	103, 104	Welding risers to tanks 103 and 104.	CM
495.	1/29/1979	104, 106	Installing risers on tanks 104 and 106. Pumping water from tank 104.	CM
496.	1/31/1979	104, 106	Completed pumping water from tank 104. Moving pumps and piping to tank 106.	CM
497.	2/1/1979	106	Pumping water from tank 106.	CM
498.	2/6/1979	101, 102, 103, 104, 105, 106	Completed pumping water from all tanks.	CM
499.	2/7/1979	104, 105, 106	Welding risers to tanks 104, 105, and 106.	CM
500.	2/12/1979	101, 102, 103, 104, 105, 106	Grading and compacting existing ground in preparation for backfill.	CM
501.	2/16/1979	106	Welding risers to tank 106.	CM

APPENDIX B SUPPORTING DOCUMENTATION

App Figure B-1. Recommendation for Use of ASTM A-537

Atlantic Richfield Hanford Company
Federal Building
Richland, Washington 99352
Telephone 509 942-7411
April 5, 1976

U. S. Energy Research and
Development Administration
Richland Operations Office
Richland, Washington 99352

Attention: Mr. A. G. Lassila

Subject: PROJECT B-120 - ADDITIONAL HIGH-LEVEL WASTE
STORAGE FACILITIES, USE OF ASTM A-537 STEEL FOR
241-AW TANK FARM CONSTRUCTION

- References:
- (1) ASME Boiler and Pressure Vessel Code,
Section VIII, Division 2, 1974 Edition
 - (2) Structural Evaluation of Proposed 241-AW
Tanks, John A. Blume and Associates,
February 1976
 - (3) Computer Based Structural Investigation
of the SY-103 Storage Tank Which Contains
an Out-of-Tolerance Bump, Battelle
Northwest Laboratories, February 1976

Gentlemen:

The purpose of this letter is to make the recommendation that ASTM A-537 steel be used in the construction of the 241-AW Tanks. The change to A-537 steel will give tanks a higher resistance to stress corrosion cracking (SCC) than the ASTM A-516 steel used for the 241-SY Tanks. The cost difference between the two steels is negligible.

The proposed mechanism for SCC requires that tensile stresses at a discontinuity be of sufficient magnitude to create plastic strain conditions. Therefore, in order to prevent SCC in waste tanks, every effort is made to keep stress levels below the yield strength of the steel.

Under loadings conditions proposed for the 241-AW Tanks, preliminary analysis from John A. Blume and Associates indicates that stresses will be approximately 80 percent of the yield strength of ASTM A-516 steel and 61 percent of the yield strength of ASTM A-537 steel. This analysis does not take into account that allowable stresses may be lowered by thermal cycling and cyclic loading. Information on the impact of thermal cycling and cyclic loading on the steel's allowable strength will not be available until the fabricator has analyzed the tank. In order to

Atlantic Richfield Hanford Company

U. S. Energy Research and
Development Administration
Attention: Mr. A. G. Lassila
Page 2
April 5, 1976

meet the proposed construction schedule, steel for use in the 241-AW Tanks must be purchased prior to completion of the fabricator's analysis.

Past experience with tank farm construction demonstrates that tanks without out-of-flatness conditions are difficult if not impossible to fabricate. Analysis by Battelle Northwest Laboratories indicates that these out-of-flatness conditions in tank bottoms act as stress risers. Other conditions built into tanks that act as stress risers are weld crevices, plate transitions and areas experiencing impact after post weld heat treatment. The magnitude of the stresses at these areas is hard to predict. If any of these areas approach the yield strength of the steel the possibility of SCC exists.

Under the same loading conditions, a tank constructed of a higher strength steel would provide a higher margin of safety against the occurrence of SCC at a stress riser or out-of-tolerance area. For this reason, and because of the possibility of reduced allowable stresses as a result of cyclic considerations, ASTM A-537 steel should be used in the construction of the 241-AW Tank Farm. The yield strength of this steel is approximately 39 ksi at 350°F (the tank design temperature) as opposed to approximately 30 ksi for ASTM A-516 steel at 350°F.

Vitro and Atlantic Richfield Hanford Company welding engineers foresee no unworkable welding problems as a result of the change to ASTM A-537 steel. Discussions with tank fabricators support this statement.

Very truly yours,

J. F. Albaugh
Project Engineer

JFA:jsd

cc: JM Nelson, Jr., ERDA-RL
VD Schrag
HA Zweifel
File
Project File

App Figure B-2. Tank Foundation Design Change Statement of Fact

63202

Subcontract No. JAJ-947 (B-120)
Modification No. 4
Claim No. 12

February 23, 1977

STATEMENT OF FACT

Paragraph SC-7 n., Subcontract No. JAJ-997 (B-120) is quoted as follows:

"n. Basic Survey Data

Basic reference points (with coordinate descriptions) and bench mark, from which the location of tank foundations and leak detection sumps are to be established, as stated in Paragraph GC-16 of the General Conditions."

Subcontract Modification #2, dated September 3, 1976, deleted the installation of a tank drain pipe from the center of the tank foundations. This drain pipe was originally to be installed by the contractor prior to starting the tank foundations. Because of a pipefitter strike at this particular time, alternate construction methods were investigated and it was determined by J. A. Jones Construction Company and Vitro Design that it was feasible to delete this pipe by deepening one of the drain slots using it as a channel to carry any leak to the sump. During discussions with the subcontractor prior to the issuance of Modification #2, it was agreed that since we had deleted the pipe drains which would have established the corrected horizontal location and grade for the center line of each tank, we would now provide this information to the subcontractor and he was requested not to include additional engineering time in Modification #2.

Per the requests of the J. A. Jones Project Engineer on August 17, 1976, the Vitro Survey Party was at the site of the work to establish additional reference points and to check elevations and alignment which had previously been established. On this particular day, the subcontractor had a crew of carpenters and laborers engaged in setting forms for the tank foundation and fine grading sub-grade. To facilitate fine grading and form setting, the Vitro surveyors were requested to establish an elevation on a temporary 4' x 4' stake, which was set in the ground by the subcontractor at approximately the center line of each tank foundation. (For the statement of Vitro's involvement in assisting or working with Aldrich & Hedman - see A&H letter dated October 1, 1976, and A&H letter dated October 20, 1976.) Facts relative to this situation by Aldrich & Hedman and Vitro Engineering were disputed by Vitro correspondence dated October 7, 1976, and Vitro field staff correspondence, dated October 6, 1976.

J. A. Jones Construction Company's effort to resolve the details of the responsibility of the work performed at the jobsite on August 17, 1976 by Vitro is further discussed in J. A. Jones's memo to file, dated October 12, 1976 and October 19, 1976.

The Vitro surveyors completed the work October 17, 1976 and each stake was then sawed off at the elevation established. From this point in time the fine grade was completed and the form work and reinforcing steel was installed using the elevation of the top of 4 x 4's (Blue top). After the reinforcing steel was installed for all the 6 tank foundations, the subcontractor began setting forms for the drain slots. During this operation it was discovered that the top mat of reinforcing steel was approximately 1-1/2" (.14 feet) too high. Further checking revealed that this situation existed on all 6 tank foundations. When the top mat was discovered to be too high, the next step was to check the bottom mat and then the sub grade elevation. As a result of this check, it was discovered that the sub grade was a problem. Extensive re-checks were made by the Vitro

Statement of Fact

Subcontract No. JAJ-947 (B-120)
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Page 2

February 23, 1977

Survey Party and others and it was finally determined that the wrong elevation was used in setting the reference elevations on the temporary 4 x 4 stakes in the center of the tanks.

Several meetings were held to determine the remedial action which would be accepted to assure that the tank foundations would be constructed to the correct elevation. It was finally determined that the only acceptable method would require the removal of the 1-1/2" of earth material throughout the entire sub grade area of each foundation, recompact the earth, then lower the reinforcing steel.

The first method for remedial action - removal of the soil - was attempted by sluicing which caused a red tag to be placed on the work. After additional meetings and delays, the subcontractor elected to remove the bulk of reinforcing steel bars from each foundation, loosen the soil, then remove the soil by means of blowing with compressed air or excavating with small hand tools. This method was inefficient; however, it was less costly than removing all the reinforcing steel and form work to permit the soil removal by conventional excavation methods. After all the remedial work was completed, the subcontractor notified J. A. Jones Construction Company by letter dated October 1, 1976 that it was their position that all of the additional work and the delay resulting from the error in the elevation was not the fault of A&H and a claim for additional cost and performance time would be forthcoming.

APPENDIX C TANK DEFICIENCY DOCUMENTATION

App Figure C-1. October 6, 1977 Letter J.A. Jones to American Bridge - Weld Rejection

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-258

October 6, 1977

American Bridge
Division of United States
Steel Corporation
P.O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) K-9224
Reference: Production Welding

Tracking of the combined X-Ray, Inc. and Vitro radiograph reject rate for the month of September, 1977 indicates the average reject rate to be 30% and the last ten days to be 34% with porosity and slag inclusions being the major problems. We are very concerned that a reject rate of this magnitude, combined with a 20% manpower shortage, will have an adverse impact on your schedule in that welders are being diverted from production welding in order to perform the required repairs. Based on your August 26, 1977 schedule, we can only surmise that this reject rate has contributed to the missed early completion date on the Tank 101 Primary Shell, and the missed early start dates on the Tank 101 Secondary Shell, the Tank 102 Primary Shell and Dome, and the Tank 104 Primary Shell and Dome. Unless substantial improvement in production welding is achieved (as evidenced by a lower reject rate), we foresee schedule impacts on critical items within the next 30 to 60 days. You are requested to take immediate affirmative action to rectify your welding problems and inform this office in writing by October 14, 1977 of the steps that will be taken to achieve this goal. If we may be of any assistance, please do not hesitate to contact us.

Very truly yours,

J. A. JONES CONSTRUCTION

J. J. Flannery
Project Manager

JJF:kw

cc: AW Akerson
JD Galbraith
AG Lassila
BL Moss

App Figure C-2. October 13, 1977 Letter D.W. Cutting to J.D. Galbraith - Weld Rejection

83196
Internal Letter

Rockwell International

Date: . October 13, 1977

No: .

TO: (Name, Organization, Internal Address)
. J. D. Galbraith
. Quality Assurance
. 2704-W, 200-W

FROM: (Name, Organization, Internal Address, Phone)
. D. W. Cutting
. Engineering Support
. 271-T, 200-W
. 2-2173

Subject: . Weld Rejection Rate at B120 Tank Farm

At the request of Project Quality Assurance, on Tuesday, October 12, 1977, I investigated the weld defect situation at the B120 Tank Farm. Interest had been aroused by a report which gave the weld rejection rate at "approaching 35%".

Discussion with Seth Bridges, J. A. Jones QA Supervisor, revealed that the reject rate was based on the number of x-ray films taken, not on the amount of welding shot. In an effort to get a better idea of the actual welding situation, I reviewed some 200 x-ray films.

The first 160 feet of welds looked at showed about 3 to 5% defective welding, that is inches defective out of inches inspected, for extensive in line porosity. I didn't attempt to keep track of the lengths of the small occasional defects which were typical of most of the rejected film. But they might have added another 1% of rejectable welding. This 160 feet of film had been shot in the last couple of weeks and represented recent welding.

The final 40 feet of film reviewed was shot in early September. Those films showed about 50 or 60% defective welding. The defect was incomplete penetration or fusion of the root and inline porosity coming from the root condition. If this condition had been typical of all the welds I looked at, I would have recommended an immediate stop of all welding pending complete requalification of all welding procedures. However, since this seemed to be the exception, I believe it probably was the result of bad fit up or an incorrect amperage or travel speed setting on the welder.

A look at some of the joints ready for welding showed rusty conditions in the weld joint, particularly on the root lands, and varying root opening conditions. The rust may be responsible for some of the inclusions and porosity, and the irregular root openings may be responsible for the incomplete penetration and inline porosity.

Based on this brief review, my evaluation of the welding situation is as follows: the quality of the welding I looked at was not unusually poor compared to the rest of the industry for that type

J. D. Galbraith
Page 2
October 13, 1977

of application. I feel that some improvement could and should be made by much closer attention to weld joint conditions (configuration and cleanliness), and by strict adherence to the welding parameters listed on the approved welding procedure.

Dave Cutting

D. W. Cutting

DWC/skc

cc:

J. F. Albaugh
D. E. Braden
P. B. Fisk
G. Kraft

App Figure C-3. October 18, 1977 Letter American Bridge to J.A. Jones - Weld Rejection

#282

American Bridge

DIVISION
UNITED STATES STEEL CORPORATION
P. O. BOX 1099
RICHLAND, WASHINGTON 99352

October 18, 1977

J. A. Jones Construction Company
P. O. Box 560
Richland, Washington 99352

Attention: Mr. J. J. Flannery
Project Manager

Subject: K-9224 - Subcontract JAJ-932 (B-120)
241-AW Tank Farm

RECEIVED

OCT 26 1977

J. A. JONES
CONSTRUCTION CO.

Gentlemen:

We acknowledge receipt of your letter JAJ-932-258²⁷⁶ dated October 6, 1977. Our comments pertain to the project as it stood at the start of the Boilermaker strike. The present status of each tank is well within the PERT schedule parameters. A review of the project by tank activities reveals the following:

1. Tank 101	Primary shell	+4 weeks slack
	Secondary shell	+6 weeks slack
	Dome	+7 weeks slack
2. Tank 102	Primary shell	+5 weeks slack
	Dome	+6 weeks slack
3. Tank 103	Primary shell	+5 weeks slack
	Dome	+8 weeks slack
4. Tank 104	Primary shell	+9 weeks slack
	Dome	+11 weeks slack
5. Tank 105	Primary bottom	+2 weeks slack
6. Tank 106	Primary bottom	+5 weeks slack

Your allegation of substantial manpower shortage is without substance. The project is presently manned two people less than our estimated manpower requirements. For your information, however, additional personnel have been ordered from the unions. The Boilermaker request has not been filled pending the outcome of contract negotiations.

J. A. Jones Const. Co.
Page 2
October 18, 1977

Your comments about weld quality are also misleading. For the month of September, the average weld reject rate may be evaluated as follows:

1. X-Ray film rejected	29%
2. Rejected film without duplicates and informational film (non-work items)	23%
3. Rejected film without cosmetic repairs (non-welder items)	18%
4. Weld footage rejected	2%

Any one of these percentages are valid reject rates, but, they are not all indicative of weld quality. We fail to see what positive effect letters of this nature will have upon the project.

Yours truly,

C. J. Madewell
C. J. Madewell
Project Manager

CJM:er

App Figure C-4. NCR B-120-56

RL-604 (3-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-56 (932-17)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: HPS-220-W, paragraph 3.6.d Description: Sub-contractor performed welding operation on Tank 104 secondary bottom while rain was falling with no protection or shelter provided to keep rain off of the actual weld zone. Parts welded were lifting lugs.		(1G) DISTRIBUTION ERDA *CW Burger *AG Lassila GS Rokkan ARHCO *JF Albaugh *AJ Larson JAJ LJ Maenpaa *JE Parsons Vitro *AW Akerson IMA Garcia *JH Parrish RR Wyer Central File *Official File *Preliminary Copies
(1E) HOLD TAG NO. 0335	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish/Senior Field Inspector 5-2-77	
(2A) RECOMMENDED DISPOSITION: ☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION Fabricator is responsible for placement of tank bottom. By virtue of that responsibility he assumes complete integrity of lifting lug welds. Note: Lifting lugs are temporary, construction aid - not part of permanent structure.	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. ☒ NO		
(2D) APPROVALS (SIGNATURE AND DATE) DESIGN: <i>Henry Harris</i> 5-9-77 SAFETY: <i>PE Chidsey</i> 5/9/77 QA: <i>IMA Garcia</i> 5/9/77 PROJECT MANAGEMENT: <i>AW Akerson</i> 5-9-77		(2E) CONCURRENCE (SIGNATURE AND DATE) <i>W. Albaugh</i> 5/18/77 <i>J. Salbraith</i> 5/20/77 <i>W. Harris</i> 5/23/77
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED, NCR CLOSED. ☐ OTHER (SPECIFY)		<i>James H. Parrish</i> 5/25/77 ORIGINATOR OR REPRESENTATIVE

ERDA RL OFFICE
RECEIVED

MAY 23 1977

DRO 5/25/77

App Figure C-5. NCR B-120-83

(10) SUBJECT, LOCATION OR W.D. B-120		(11) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(12) NCR NO. B-120-83 (932-36)
(13) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>Reference</u> 1. HPS-220-W, page 12, paragraph 3.6.d 2. N.C.R. B-120-56 (932-17) <u>Description</u> Subcontractor performed welding operation without providing any protection from falling snow. <div style="text-align: center;">RECEIVED MAR 8 1978 J. A. JONES CONSTRUCTION CO.</div>		(14) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA ROCKWELL *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery VITRO *AW Akerson IMA Garcia *JH Parrish LH Smith Central File *Official File	
(15) HOLD TAG NO. #0383		(16) ORIGINATOR, TITLE AND DATE Jim Parrish, Senior Field Inspector 2-1-78 *Preliminary Copies	
(17) RECOMMENDED DISPOSITION ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☒ REJECT ☐ OTHER (SPECIFY): (18) DESIGN CHANGE REQUIRED? ☐ YES NO ☒ NO		(19) DISPOSITION JUSTIFICATION <u>Disposition</u> Vert #5, Course 2 on 105 P shell - West Remove all weld metal placed which was exposed to falling snow by air carbon arc gouging. Replace removed material & provide adequate operator and weld joint protection. <u>Justification</u> Per Jim Parrish, the entire area is to be removed. Much care, trouble & expense have been taken to limit the amount of hydrogen in the weld zone ie low hydrogen electrodes E7018, etc. weld rod baking, restricted time of rod exposure to atmosphere, etc. Welding in the presence of H ₂ O causes a breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking. As delayed cracking can take place any time from immediately after welding to as long as several months later, this becomes of critical concern.	
(20) APPROVALS (SIGNATURE AND DATE) SAFETY IMA Garcia 2/22/78 OBJECT ENGINEER A.W. Akerson 2-22-78		(21) CONCURRENCE (SIGNATURE AND DATE) AG Lassila 2/28/78	
☐ DISPOSITION EFFECTED AS DIRECTED, NOW CLOSED. ☐ OTHER (SPECIFY):		ORIGINATOR OR REPRESENTATIVE:	

App Figure C-6. NCR B-120-86

RL-604 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.D. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-86 (932-39)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REFERENCE</u> 1. HPS-220-W, Revision 2, page 12, paragraph 3.6 d. 2. NCR's B-120-56 (932-17); B-120-83 (932-36) <u>DESCRIPTION</u> The subcontractor performed welding operations without providing protection from falling rain.		(1E) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA RHO *JD Galbraith *PB Fisk <i>MA Cohill</i> JAJ LJ Maenpaa *JJ Flannery Vitro *AW Akerson <i>NR KERR</i> IMA Garcia JH Parrish LH Smith Central File *Official File <i>EM Zdravkovich</i> * Preliminary Copies	
(1E) HOLD TAG NO. Red 0361, 0362, 0363	(1F) ORIGINATOR, TITLE AND DATE <i>J. H. Parrish</i> J. H. Parrish, Senior Field Inspector 3-8-78		
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☒ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION <u>Disposition</u> Remove all weld metal placed which was exposed to rain by air carbon arc gouging. Replace removed material and provide adequate operator and weld joint protection. <u>Justification</u> Much care, trouble & expense have been taken to limit the amount of hydrogen in the weld zone ie low hydrogen electrodes E7018, etc. weld rod baking, restricted time of rod exposure to atmosphere, etc. Welding in the presence of H ₂ O causes a breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking. As delayed cracking can take several months later, this becomes of critical concern. JAJONES NEEDS TO KNOW WHICH TANK & WHICH SEAM Q&Z SECONDARY REPAIR TK 105 Course 2 ver 5 S&P Round Seam # 2		
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO ☒ NO			
(2D) APPROVALS (SIGNATURE AND DATE)		(2E) CONCURRENCE (SIGNATURE AND DATE)	
Design <i>Paul Fisk</i> 3/21/78 QA <i>IMA Garcia</i> 3/21/78 PE <i>A.W. Akerson</i> 3-23-78		Safety <i>R.H. Dennis</i> 3/23/78 <i>J.D. Galbraith</i> 3/29/78 <i>J.V. Fisk</i> 3/29/78 <i>AG Lassila</i> 3/31/78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY) SEE N.C.R. # B-120-106-932-59		ORIGINATOR OR REPRESENTATIVE <i>James H. Parrish</i> 7-26-78 DATE	

App Figure C-7. NCR B-120-96

RL-604 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-96(932-49)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: (1) HPS-220-W, Revision 2, Paragraph 3.6.d. (2) NCR's B-120-56 (932-17), B-120-83 (932-36), B-120-86 (932-39). Description: Subcontractor performed welding operations without providing protection from falling rain, on Tank 101 Secondary top knuckle at 0° vertical seam. NOTE: This NCR supersedes NCR B-120-90 (932-43) which is voided. <i>AWA</i>		(1G) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA RHO *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery Vitro LH Smith *AW Akerson Central File *MC Arntzen, Jr. IMA Garcia Official *KA Lucas File *JH Parrish	
(1E) HOLD TAG NO. 0357	(1F) ORIGINATOR, TITLE AND DATE M.C. Arntzen, Jr., Senior Field Inspector 4/4/78		
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☒ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):		(2B) DISPOSITION JUSTIFICATION <u>Disposition</u> <i>* SEE NOTE BELOW</i> Final pass of those affected areas shall be subjected to a liquid penetrant exam, per section 15H, Paragraph 3.B (3) of Specification B-120-C4. <u>Justification</u> Much care, trouble and expense have been taken to limit the amount of hydrogen in the weld zone, i.e., low hydrogen electrodes E7018, etc. weld rod baking, restricted time of rod exposure to atmosphere, etc. Welding in the presence of H ₂ O causes a breakdown of H & O into atomic H which is readily absorbed by ferrous material at elevated temperatures as occurs in the welding arc and immediate area. Absorbed hydrogen is known to be the primary causing element for delayed underbead cracking. As delayed cracking can take several days to occur, this becomes of critical concern.	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)	
DESIGN <i>Paul Helms 4/21/78</i> SAFETY <i>R.H. Dennis 4/27/78</i>		<i>JD Galbraith 5/1/78</i>	
QA <i>IMA Garcia 4/27/78</i>		<i>GW. Knopf 5/1/78</i>	
PE <i>AW Akerson 4-27-78</i>		<i>AG Lassila 5/5/78</i>	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY):		(3B) ORIGINATOR OR REPRESENTATIVE <i>JH Parrish</i> 5-10-78 DATE	
NOTE: AFFECTED AREA WAS DETERMINED BY AMERICAN BRIDGE			

App Figure C-8. NCR B-120-106

NONCONFORMANCE REPORT	
(1A) PROJECT, LOCATION OR W.D. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM
(1C) NCR NO. B-120-106 (932-59)	
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REQUIREMENT</u> HPS-220W, Rev.2, page 12, paragraph 3.6.d (Provide protection from inclement weather during welding operations.) <u>REFERENCE</u> NCR B-120-86 (932-39) <u>DESCRIPTION</u> On March 8, 1978, the subcontractor performed welding operations with-out providing protection from falling rain (TK 1055 Round Seam #1 between verts 5 and 6 area markers 14 to 19). The disposition of the subsequent NCR (B-120-86) states, to remove all weld metal which was exposed to falling rain and replace. Approximately 3 feet only, of the affected area has been removed and replaced, leaving approximately 2 feet which has not.	(1E) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA Rockwell *MA Cahill *JD Galbraith JAJ *JW Crites *JJ Flannery LJ Maenpaa Vitro *AW Akerson N.R. KERR IMA Garcia *JH Parrish/PW Armstrong LH Smith *EM Zdravkovich Central File *Official File *Preliminary Copies
(1F) HOLD TAG NO. N/A	(1G) ORIGINATOR, TITLE AND DATE J. H. Parrish, Field Coordinator <i>JHP</i> 7-6-78
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☒ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION PERFORM DYE PENETRANT TESTING ON REMAINING 2 FEET , as per section 15H, paragraph 3.B (3) of Spec. B-120-C4. <u>Justification</u> Absorbed hydrogen (potentially introduced by water) causes delayed underbead cracking.
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. ☐ NO	
(2D) APPROVALS (SIGNATURE AND DATE) Design <i>J. Harris</i> 7/10/78 Safety <i>R.H. Dennis</i> 7/10/78 QA <i>J. Breid</i> 7/10/78 PE <i>R. H.</i> 7/11/78	(2E) CONCURRENCE (SIGNATURE AND DATE) <i>J. H. Parrish</i> 7/14/78 <i>R. H. Dennis</i> 7-14-78 <i>A. G. Lassila</i> 7/17/78 <i>Thomas J. Akerson</i> 7-21-78
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)	ORIGINATOR OR REPRESENTATIVE DATE

App Figure C-9. April 19, 1978 Letter American Bridge to J.A. Jones -Inclement Weather Welding

1. 2. R
#388

85170

American Bridge
DIVISION
UNITED STATES STEEL CORPORATION
P. O. BOX 1099
RICHLAND, WASHINGTON 99352

April 19, 1978

J. A. Jones Construction Company
P. O. Box 560
Richland, Washington 99352

Attention: Mr. J. J. Flannery
Project Manager

Subject: K-9224 - Subcontract No. JAJ-932 (B-120)
241-AW Tank Farm

RECEIVED

APR 20 1978

J. A. JONES
CONSTRUCTION CO.

Gentlemen:

Reference is made to your letters JAJ-932-375, JAJ-932-378 and JAJ-932-384 regarding welding during inclement weather.

Your letters lead one to believe that we have flagrantly abused our contractual responsibilities as outlined by the Specifications. We point out that we have worked over 1,200 welder days in inclement weather and generated six hold tag incidents regarding protection. Obviously, a difference of opinion now exists of what is necessary and adequate.

We first want to go on record as being opposed to the extensive replacement welding outlined in your letters. Weld shrinkage caused by reworks of this magnitude can only have a detrimental affect on the geometry of the final product. The Specification Special Conditions state that work on a nonconformance is not to proceed until its disposition has been determined and received approval. This is your contractual responsibility as outlined in the Specifications. It is a matter of record that the referenced hold tags were removed and work allowed to proceed by the following day of their application. On the dates of your letters, work had proceeded to the point that weld shrinkage can no longer be controlled in the normal matter.

For your information we offer the following:

1. In Tank 105 seam C2V5, the welder began welding at location 0 on the day the hold tag was placed. At the time of placement he was welding between increments 1-2. The maximum length of weld considered, therefore, should be two lineal feet.
2. In Tank 105, of the five lineal feet between increments 14-19, in excess of three feet has already been replaced because of defects found by radiography. Again, two lineal feet should be considered.
3. In Tank 105 between the increments 29-33, our information indicates that arc gouging in preparation for welding was being performed, but actual welding had not yet begun.

J. A. Jones Construction Company
Attention: Mr. J. J. Flannery

-2-

April 19, 1978

4. For Tank 104 knuckle-to-dome weld, the weld backup bar was being tacked to the knuckle side only with 3/16 x 1/2 inch fillet welds when the hold tag was placed. Subsequent weld passes have raised the temperature high enough to allow any entrapped hydrogen in the tacks to escape. There is no standard established in any of our codes, by the way, for the amount of hydrogen acceptable in these materials.

We suggest that alternate inspection methods be employed to determine the adequacy of the weld metal placed.

We request that you re-evaluate the replacement work you have directed and in view of our objections, reaffirm your instructions. As discussed this date, Tank 104 is being readied for stress relief and should be addressed first.

Very truly yours,

C. J. Madewell
C. J. Madewell
Project Manager

CJM/cf

App Figure C-10. April 21, 1978 Letter J.A. Jones to American Bridge – Inclement Weather Welding

✓ 66736
J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-400

April 21, 1978

American Bridge
Division of United States
Steel Corporation
P.O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) K-9224
Reference: Welding in Inclement Weather

With reference to your letter of April 19, 1978, regarding welding during inclement weather, please comply with the following:

- Item No. 1 - Tank 105: Accept your two lineal feet of repair, with sufficient supporting documentation.
- Item No. 2 - Tank 105: Accept your two lineal feet of repair with sufficient supporting documentation.
- Item No. 3 - Tank 105: Accept your statement as is.
- Item No. 4 - Tank 104: Removal of weld metal prior to stress relieving will not be required. However, immediately after stress relieving, dye penetrant testing will be done to the effected area to determine if cracking exists in the weld joint. If cracking does exist, the necessary weld repairs will be made by you to correct this problem.

If you have additional questions, please contact us immediately.

Very truly yours,

J. A. JONES CONSTRUCTION

J. J. Flannery
Project Manager

JJF:kw

cc: B-120 Team Members

App Figure C-11. July 14, 1978 Memorandum from N.R. Kerr – Inclement Weather Welding

62045 File: Vitro Carr 380 (VSK)

VITRO ENGINEERING CORPORATION

TO 241-AW and AN Tank Farm Project
Management Team

FROM N. R. Kerr DATE July 14, 1978

SUBJECT Welds Exposed to Inclement Weather Condition JOB NO. B-120/B-130

This letter is to provide Vitro's position on welds performed and exposed to inclement weather.

All welds which have been made while exposed to wet weather conditions shall have a dye penetrant test performed after a delay period (49 Hours Min.) has transpired. For further information see attachment.

NCR 120-86 and 106 have been dispositioned accordingly. Should other welds be prepared while exposed to wet weather they will also have a similar disposition.

NRK
N. R. Kerr, Project Engineer

NRK:emz
Attachment

cc: J. Harris
JM Johnston 2101M
JH Parrish
Central File
LB

Distr: RD Freeberg/DOE
AG Lassila/DOE
JD Galbraith/RHO
✓JJ Flannery/JAJ
NRK File

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JUL 18 1978

J. A. JONES
CONSTRUCTION CO.

App Figure C-12. NCR B-120-62

(1A) PROJECT, LOCATION OR W.D. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM		(1C) NCR NO. B120-62(JAJ-10)	
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: B-120-C4 Specification, paragraph 3.A.(1).h, pg. 10 Description: Sufficient care was not exercised by the contractor while removing the insulating concrete refractory in area "D" grid of the secondary tank bottom, resulting in numerous scratches and gouges in tank 101 exceeding the maximum depth of 1/32". REC ED JUL 08 1977 J. A. CONSTRUCTO				(1E) DISTRIBUTION ERDA FW Burger AG Lassila GS Rokkan ARHCO JF Albaugh AJ Larson JAJ LJ Maenpaa JE Parsons VITRO AW Akerson IMA Garcia DG King JH Parrish Central File Official File	
(1F) HOLD TAG NO. N/A		(1G) ORIGINATOR, TITLE AND DATE D. G. King/Senior Field Inspector 6-23-77			
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☒ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):		(2B) DISPOSITION JUSTIFICATION and inspect JFA 6/24/77 Repair in accordance with paragraph 3.A.(1)h of Section 15H of construction specification B-120-C4. Gouges with depth of 1/32" or less shall have sharp edges ground smooth.			
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO					
(2D) APPROVALS (SIGNATURE AND DATE)		(2E) CONCURRENCE (SIGNATURE AND DATE)			
Design EEL		Safety 6-23-77			
QA IMA Garcia 6/23/77		JF Albaugh 6/29/77			
Project Management AW Akerson 6-23-77		JH Parrish 6/29/77			
		AG Lassila 7/6/77			
(2A) ☒ DISPOSITION EFFECTED AND DISCLOSED. NCR CLOSED. ☐ OTHER (SPECIFY)		Doughlas B. King 7-6-77 ORIGINATOR (SIGNATURE AND DATE)			

App Figure C-13. June 23, 1977 Memorandum D.R. Olney to J.E. Parsons – Secondary Liner Repairs

INTER-OFFICE CORRESPONDENCE

J. A. JONES CONSTRUCTION COMPANY

To: JE Parsons

From: DR Olney

Date: June 23, 1977

Re: Tank 101 Secondary Bottom

This memo is being written to confirm the agreement made yesterday (June 22, 1977) by the Project B-120 Team members in regards to the chipping gun gouges in segment D of the Tank 101 secondary bottom. These gouges occurred during removal of the insulating refractory from this segment by JA Jones Construction Company. In attendance at the meeting yesterday were AG Lassila and CW Burger of ERDA; LW Roberts and JD Galbraith of ARCHO; AW Akerson and E Smith of VITRO; and JE Parsons and DR Olney of JA Jones. It was decided to treat the gouges in the following manner:

1. Grind out those that are less than 1/32" deep.
2. Repair those that exceed 1/32" depth in accordance with the Specification (B-120-C4, Sect. 15H, PP. 3.A.(1)H).
3. For gouges that are on the weld, grind the reinforcement flush with the base metal and further evaluate the gouge at that point.

It should be noted that Item 1 is not addressed in the Spec., and is, therefore, outside the scope of the Spec.

DR Olney

DRO:jaa

cc: file

App Figure C-14. June 23, 1977 Memorandum A.W. Akerson to J.F. Albaugh – Secondary Liner Repairs

<p>TO J. F. Albaugh, ARHCO. 2704W Building - 200 West Area</p> <p>FROM A. W. Akerson <i>A.W. Akerson</i></p> <p>SUBJECT Project B-120, 241-AW Tank Farm Phase IV, Steel Tanks</p>	<p>VITRO ENGINEERING CORPORATION Architects • Engineers</p> <p>DATE June 23, 1977</p> <p>JOB NO. W.O. C12003 (Title III)</p>
---	---

This letter is to confirm discussions held in the JAJ 241-AW construction trailer on the afternoon of June 22nd with regard to gouges in the 241-AW-101 secondary tank bottom that were made during the course of removing the "D" section of the initial insulating concrete pour. In attendance were the following:

<p><u>ERDA</u> CW Burger AG Lassila</p>	<p><u>ARHCO</u> JD Galbraith LW Roberts</p>	<p><u>Vitro</u> AW Akerson EE Smith</p>	<p><u>JAJ</u> JE Parsons DR Olney</p>
---	---	---	---

It was understood that these gouges were made by a jackhammer that was being used to breakup the cast-in-place insulating concrete. It was decided to repair these gouges as follows:

- Gouges with depth exceeding 1/32": Repair in accordance with paragraph 3.A.(1)h of Section 15H of construction specification B-120-C4.
- Gouges with depth equal to or less than 1/32": Grind sharp edges smooth.

cc: CW Burger, ERDA-RL
AG Lassila, ERDA-RL
JD Galbraith, ARHCO, 2719W
DD Ritter, ARHCO, 2704W
LW Roberts, ARHCO, 2704W
JE Parsons, JAJ, 241-AW Trailer
WH Brayman
P. Felise
DS Mager, 2101M
EV Norris
EE Smith
Central Files
AWA/Files
LB

App Figure C-15. June 23, 1977 Letter J.A. Jones to American Bridge – Secondary Liner Repairs

83196

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-200

June 23, 1977

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224

We request that you make the necessary repairs on the surface of Secondary Tank No. 101 in the area where the insulating concrete was removed. The Vitro inspector has marked the area to be ground, or welded, ground and magnetic particle inspected. Please expedite this work as it is required prior to replacing insulating concrete in Tank 101.

This work is over and above the scope of your original contract and a modification will be written upon agreement of costs.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
Project Manager

JEP:jeg

cc: AW Akerson
JF Albaugh
AG Lassila
BL Moss

App Figure C-16. June 27, 1977 Letter American Bridge to J.A. Jones – Secondary Liner Repairs

#308

106741
American Bridge
DIVISION
UNITED STATES STEEL CORPORATION
P.O. Box 1099
Richland, Washington 99352

REC D
JUN 27 1977
J.A. JONES
CONSTRUCTION

June 27, 1977

J. A. Jones Construction Co.,
P. O. Box 560
Richland, Washington 99352

REC D
JUN 2 1977
J.A. JONES
CONSTRUCTION

Attention: Mr. J. E. Parsons
Construction Manager

Subject: K-9224 - Subcontract No. JAJ-932(B-120)
241-AW Tank Farm

Gentlemen:

This letter is to advise you of the status of work on the project.

The repair work of the steel secondary bottom in Tank 101 you requested American Bridge to make on June 23, 1977 (JAJ-932-200) was accomplished on June 23, 1977. We are awaiting the special replacement material you have ordered for Segment D in order to re-pour this segment per your directive (JAJ-932-198) of June 17, 1977.

Work on Tank 102 (reference your instructions (JAJ-932-184) of May 31, 1977, and our responses of June 1, 1977 and June 20, 1977) was also completed on June 23, 1977. We are awaiting your disposition of the in-place insulating concrete mix specified.

American Bridge has placed our key personnel on a standby status (reference our letter of May 27, 1977). Due to the time that is being taken to find a satisfactory insulating concrete, we are beginning to lose some of these people. It is imperative that we have acceptance of Tanks 101 and 102 insulating concrete, and the promised "marked-up" procedure clarification to your letter (JAJ-932-193) of June 9, 1977 defining the procedure to be followed to pour Tanks 103 and 104 immediately so that we may resume tank fabricating work before all the training and experience built to date is lost.

Very truly yours,

C. J. Madewell
C. J. Madewell
Project Manager

cc: B-120 team 6/28/77

CJM:wl
cc: J.W. Fecko
W.D. McGregor
L. Loper/Vertecs

App Figure C-17. July 14, 1977 Letter J.A. Jones to American Bridge – Secondary Liner Repairs

70414

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-210

RECEIVED

July 14, 1977

JUL 18 1977

VITRO
PRO. MGMT.

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Project B-120 Redistribution
CW Kelley, 2101M
JF Nelson/ DS Mager, 2101M
EE Smith/P. Felise
Central Files
AWA/Files (2)

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224
Reference: Insulating Refractory - Tank 102

Please refer to our letters of June 30, 1977, and July 6, 1977. The administration has removed Sections A and E which were originally intended to be left in place. Please repair bottom plate areas as marked by the Vitro inspector. The repairs are to be accomplished by the same methods used in Tank 101 (Ref: JA Jones letter of June 23, 1977).

As the entire insulating concrete slab in Tank 102 has been removed, please make the conduit changes in the Tank 102 bottom as outlined in our letter of June 27, 1977.

Please submit your claim for this contract change within thirty days.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
Project Manager

JEP:jaa

cc: AW Akerson
JF Albaugh
AG Lassila
BL Moss

App Figure C-18. June 28, 1977 Memorandum from D.R. Olney – Secondary Liner Repairs

INTER-OFFICE CORRESPONDENCE

J. A. JONES CONSTRUCTION COMPANY

To: File

From: DR Olney *DROlney*

Date: June 28, 1977

Re: Insulating Refractory

During our Weekly Construction Meeting on May 4, 1977, Mr. D. D. Ritter, (ARCHO), observed Mr. J. Murphy (VERTECS), using a chain saw to remove slabs of insulating refractory from Tank 106. Mr. Ritter stated that he was very concerned about the damage that could occur if the saw blade came in contact with the steel secondary bottom. He demanded that the operation be stopped. In accordance with this direction, I wrote FTM JAJ-932-167 to American Bridge.

App Figure C-19. NCR B-120-71

(1A) PROJECT, LOCATION OR W.O. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-71 (JAJ-12)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: 1) Construction Specification B-120-C4, Section 15H, page 10, paragraph 3.A.(1).h. 2) NCR #B-120-62-(JAJ-10). Description: Sufficient care was not exercised by the contractor while removing insulating refractory in secondary tank bottom #106, resulting in numerous gouges on the tank bottom. *NOTE: None of the gouges are deeper than 1/32".		(1G) DISTRIBUTION ERDA *RD Freeburg *AG Lassila QA Rockwell *JD Galbraith AJ Larson JAJ *JJ Flannery LJ Maenpaa Vitro *AW Akerson IMA Garcia *CW Kelley *JH Parrish RR Wyer Central File *Official File	
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish/Senior Field Inspector 10-3-77 *Preliminary Copies		
(12A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☒ OTHER (SPECIFY):	(12B) DISPOSITION JUSTIFICATION Gouges shall have sharp edges ground smooth. (Reference: NCR #B-120-62)		
(12C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO	<div style="text-align: center;"> REC D OCT 13 1977 J. A. CONSTRUCT </div>		
(12D) APPROVALS (SIGNATURE AND DATE)		(12E) CONCURRENCE (SIGNATURE AND DATE)	
Design <i>Paul Felix</i> 10/5/77	Safety <i>RE. Clancy</i> 10-5-77	<i>J. H. Parrish</i> 10/10/77	
QA <i>IMA Garcia</i> 10/5/77		<i>J. W. Kelley</i> 10/10/77	
Project Management <i>A. W. Akerson</i>		<i>R. J. Sutter</i> 10/11/77	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>J. H. Parrish</i> 10-12-77 ORIGINATOR OR REPRESENTATIVE DATE	

App Figure C-20. NCR B-120-89

RL-624 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.D. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-89 (932-42)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION		(1G) DISTRIBUTION	
<p><u>Reference</u> 1) Construction Specification B-120-C4 Section 15H, paragraph 3.C. (2) d.</p> <p>2) ASME Section VIII, Division 2, Article F-4 Tables AF-402.1 and/or AF-402.2.</p> <p><u>Description</u> 1) After the recorded temperature of (any thermocouple on) Primary Tank 102 reached 600°F the 200° maximum temperature differential between high and low thermocouple was not maintained.</p> <p style="padding-left: 40px;">Note: The 200° was exceeded by approximately 25° for a period of 5 minutes.</p> <p>2) Thermocouples #1, 22, 43 and 64 (Bottom center thermocouples) did not achieve the required stress relieving temperature as specified.</p>		<p>DOE *RD Freeberg *AG Lassila QA RHO *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery Vitro *AW Akerson IMA Garcia *KA Lucas LH Smith *JH Parrish Central File *Official File/2101M</p>	
(1E) HOLD TAG NO. N/A		(1F) ORIGINATOR, TITLE AND DATE J.H. Parrish, Senior Field Inspector 3-29-78	
(2A) RECOMMENDED DISPOSITION:		(2B) DISPOSITION JUSTIFICATION	
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):		<p style="text-align: right;">*Preliminary Copies</p> <p>A review of all of the temperature data indicates the steel primary tank had an acceptable stress relief.. Item (2) reflects a malfunction of the thermocouples probably from excessive moisture.</p>	
(2C) DESIGN CHANGE REQUIRED?			
☐ YES NO. _____ ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)	
DESIGN <i>Karl Tolio</i> 4/25/78 Q.A. <i>IMA Garcia</i> 4/26/78		SAFETY <i>IA Shepherd</i> 4/26/78 PE <i>AW Akerson</i> 4-26-78	
		<i>JD Galbraith</i> 4/27/78 <i>A.W. Kraft</i> 4-27-78 <i>AG Lassila</i> 4/31/78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>James H. Parrish</i> 5-2-78 ORIGINATOR OR REPRESENTATIVE DATE	

App Figure C-21. NCR B-120-97

RL-604 (3-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-97 (932-50)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REFERENCE</u> 1. Construction Specification B-120-C4, Section 15H, Paragraph 3.C. (2) d. 2. ASME Section VIII, Division 2, Article F-4, Tables AF-402.1 and/or AF-402.2. <u>DESCRIPTION</u> 1. After the recorded temperature (of any thermocouple) reached 600°F, the 200°F maximum temperature differential between high and low thermocouple was not maintained. This condition existed on thermocouples #1, 22, 43, and 64; of Primary Tank 103. 2. Thermocouples #1, 22, 43, and 64 did not achieve the required stress relieving temperature as specified.		(1E) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA Rockwell *JD Galbraith *PB Fisk JAJ *JJ Flannery LJ Maenpaa Vitro *AW Akerson IMA Garcia *KA Lucas *JH Parrish LH Smith Central File *Official File/2101M *Preliminary Copies	
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish, Senior Field Inspector, 5-5-78		
(2A) RECOMMENDED DISPOSITION: ☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION A REVIEW OF ALL THE TEMPERATURE DATA INDICATES THE STEEL PRIMARY TANK HAD AN ACCEPTABLE STRESS RELIEF. ITEM (2) REFLECTS A MALFUNCTION OF THE THERMOCOUPLES, PROBABLY FROM EXCESSIVE MOISTURE.		
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)	
Design <i>AW Akerson</i> 5/12/78		<i>JD Galbraith</i> 5/17/78	
PE <i>AW Akerson</i> 5-16-78		<i>AW Akerson</i> 5-19-78	
QA <i>IMA Garcia</i> 5/12/78 Safety <i>JD Galbraith</i> 5/15/78		<i>AG Lassila</i> 5/24/78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		James H. Parrish 5-24-78 ORIGINATOR OR REPRESENTATIVE DATE	

App Figure C-22. NCR B-120-98

RL-604 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.D. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-98 (932-51)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION			(1G) DISTRIBUTION
<p><u>REFERENCE</u></p> <ol style="list-style-type: none"> Construction Specification B-120-C4, Section 15H, Paragraph 3.C. (2) d. ASME Section VIII, Division 2, Article F-4, Tables AF-402.1 and/or AF-402.2. <p><u>DESCRIPTION</u></p> <ol style="list-style-type: none"> After the recorded temperature (of any thermocouple) reached 600°F, the 200°F maximum temperature differential between high and low thermocouple was not maintained. This condition existed on thermocouples #1, 22, 43, and 64; of Primary Tank 104. Thermocouples #1, 22, 43, and 64 did not achieve the required stress relieving temperature as specified. 			DOE *RD Freeberg *AG Lassila QA Rockwell *JD Galbraith *PB Fisk JAJ *JJ Flannery LJ Maenpaa Vitro *AW Akerson IMA Garcia *KA Lucas *JH Parrish LH Smith Central File *Official File/2101M *Preliminary Copies
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish, Senior Field Inspector, 5-5-78		
(2A) RECOMMENDED DISPOSITION:		(2B) DISPOSITION JUSTIFICATION	
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):		A REVIEW OF ALL THE TEMPERATURE DATA INDICATES THE STEEL PRIMARY TANK HAD AN ACCEPTABLE STRESS RELIEF. ITEM (2) REFLECTS A MALFUNCTION OF THE THERMOCOUPLES, PROBABLY FROM EXCESSIVE MOISTURE.	
(2C) DESIGN CHANGE REQUIRED?			
☐ YES NO. _____ ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)	
Design <i>[Signature]</i> 5/12/78		<i>[Signature]</i> 5/17/78	
Safety <i>[Signature]</i> 5/15/78		<i>[Signature]</i> 5-19-78	
QA <i>[Signature]</i> 5/12/78	PE <i>[Signature]</i> 5-16-78	<i>[Signature]</i> 5-22-78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>[Signature]</i> 5-24-78 ORIGINATOR OR REPRESENTATIVE DATE	

App Figure C-23. NCR B-120-102

NONCONFORMANCE REPORT		
(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-102 (932-55)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION		(1G) DISTRIBUTION
<p><u>REQUIREMENTS</u></p> <ol style="list-style-type: none"> Construction Specification B-120-C4, Section 15H, paragraph 3.C (2) d. ASME Section VIII, Division 2, Article F-4, Tables AF-402.1 and/or AF-402.2. <p><u>REFERENCES</u></p> <ol style="list-style-type: none"> R. A. Nederhood's memo, attached. NCR'S # B-120-89, 97, and 98. <p><u>DESCRIPTION</u></p> <ol style="list-style-type: none"> After the recorded temperature (of any thermocouple) Continued on page 2. 		<p>DOE</p> <p>*RD Freeberg</p> <p>*AG Lassila</p> <p>QA</p> <p>Rockwell</p> <p>*MA Cahill</p> <p>*JD Galbraith</p> <p>JAJ</p> <p>*JJ Flannery</p> <p>LJ Maenpaa</p> <p>Vitro</p> <p>*AW Akerson <i>NR KERR</i></p> <p>IMA Garcia</p> <p>*JH Parrish and/or</p> <p>PW Armstrong</p> <p>LH Smith</p> <p>*EM Zdravkovich</p> <p>Central File</p> <p>*Official File</p>
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE <i>JHP</i> J. H. Parrish, Field Coordinator 6-21-78	
(2A) RECOMMENDED DISPOSITION:	(2B) DISPOSITION JUSTIFICATION	
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	<p>A REVIEW OF ALL THE TEMPERATURE DATA INDICATES THE STEEL PRIMARY TANK HAD AN ACCEPTABLE STRESS RELIEF. ITEM (2) REFLECTS A MALFUNCTION OF THE THERMOCOUPLES, [REDACTED] FROM EXCESSIVE MOISTURE.</p>	
(2C) DESIGN CHANGE REQUIRED?		
☐ YES NO. _____ ☒ NO		
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)
Design <i>W. J. G. 6/29/78</i>		<i>J. H. Parrish</i> 7/7/78
Safety <i>J. H. Parrish 7/9/78</i>		<i>P. W. Armstrong</i> 7-12-78
QA <i>IMA Garcia 6/29/78</i> PE <i>W. J. G. 4/30/78</i>		<i>W. J. G. 7/14/78</i>
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>James H. Parrish</i> 7-19-78 ORIGINATOR OR REPRESENTATIVE DATE

App Figure C-24. NCR B-120-103

NONCONFORMANCE REPORT	
(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM
(1C) NCR NO. B-120-103 (932-56)	
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION	
<p><u>REQUIREMENTS</u></p> <ol style="list-style-type: none"> Construction Specification B-120-C4, Section 15H, paragraph 3.C (2) d. ASME Section VIII, Division 2, Article F-4, Tables AF-402.1 and/or AF-402.2. <p><u>REFERENCES</u></p> <ol style="list-style-type: none"> R. A. Nederhood's memo, attached. NCR'S # B-120-89, 97, and 98. <p><u>DESCRIPTION</u></p> <ol style="list-style-type: none"> After the recorded temperature (of any thermocouple) (Continued on page 2.) 	
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish, Field Coordinator 6-21-78
(2A) RECOMMENDED DISPOSITION:	(2B) DISPOSITION JUSTIFICATION
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	<p>A REVIEW OF ALL THE TEMPERATURE DATA INDICATES THE STEEL PRIMARY TANK HAD AN ACCEPTABLE STRESS RELIEF. ITEM (2) REFLECTS A MALFUNCTION OF THE THERMOCOUPLES, FROM EXCESSIVE MOISTURE.</p>
(2C) DESIGN CHANGE REQUIRED?	
☐ YES ☒ NO	
(2D) APPROVALS - (SIGNATURE AND DATE)	(2E) CONCURRENCE - (SIGNATURE AND DATE)
Design H. B. Bickel 6/27/78	J. H. Parrish 7/2/78
Safety Shepherd 6/29/78	W. J. Galt 7-10-78
QA M. G. Aron 6/29/78 PE	W. J. Galt 7/14/78
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)	<p>James H. Parrish 7-19-78</p> <p>ORIGINATOR OR REPRESENTATIVE DATE</p>

App Figure C-25. NCR B-120-57

NONCONFORMANCE REPORT

63196

(1A) PROJECT, LOCATION OR W.D. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-57 (932-18)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: Construction Specification B-120-C4, Section 15H, Appendix B, paragraph 3, page 27. Description: Initial survey of secondary tank bottom #102 indicates four areas that are not within the required tolerance of 3/8" per foot.		(1E) DISTRIBUTION ERDA *CW Burger *AG Lassila GS Rokkan ARHCO *JF Albaugh *AJ Larson JAJ LJ Maenpaa *JE Parsons VITRO *AW Akerson IMA Garcia *JH Parrish RR Wyer Central File *Official File * Preliminary Copies
(1F) HOLD TAG NO. N/A	(1G) ORIGINATOR, TITLE AND DATE J. H. Parrish/Senior Field Inspector 5-2-77	
(2A) RECOMMENDED DISPOSITION: ☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION (See Attached Justification)	
(2C) DESIGN CHANGE REQUIRED? ☐ YES ☐ NO ☒ NO		
(2D) APPROVALS (SIGNATURE AND DATE) DESIGN: <i>Paul Selbie</i> 5/17/77 QA MGR: <i>1 mod area</i> 5/17/77 PROJ ENGR: <i>AW Akerson</i> 5-17-77		(2E) CONCURRENCE (SIGNATURE AND DATE) <i>JF Albaugh</i> 5/27/77 <i>JA Larson</i> 5/27/77 <i>AG Lassila</i> 5/27/77 <i>James H. Parrish</i> 5/31/77
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		

- References: 1. RECOMMENDED BOTTOM FLATNESS TOLERANCES FOR MILLION GALLON WASTE STORAGE TANKS; by WE Anderson, JR Friley, FA Simonen, and M. Vagins; Battelle Pacific Northwest Laboratories, Richland, Washington; June 1976
2. SAM-76-1; ANALYSIS OF STRESSES DUE TO THE FLATTENING OF BUMPS IN THE BOTTOM AND KNUCKLE REGIONS OF MILLION GALLON WASTE STORAGE TANKS; by WE Anderson, JR Friley, FA Simonen, and M. Vagins; Battelle Pacific Northwest Laboratories, Richland, Washington; July 1976

An engineering evaluation of the out-of-specified tolerance conditions in the 241-AW-102, secondary tank bottom, was made; and the conditions are determined to be acceptable as-is. This evaluation included a review of two analytical reports prepared by Battelle Northwest (References 1 and 2) for ARHCO. These reports indicate that bump slopes up to 3/4" per foot are acceptable in bottom plates. This is double the specified slope tolerance of 3/8" per foot. Only one of the four bumps, included in this NCR, has a slope approaching 3/4" per foot; and that is approximately 0.72" per foot.

A review of the BNW analytical reports with their analyst, J. R. Friley, revealed the following considerations that rendered the acceptance of these out-of-tolerance bumps reasonable and yet conservative:

- A. The BNW analytical approach itself was conservative. The assumption was made that tank bottom bumps completely flattened out under operational loading conditions--actually, it is inconceivable that bottom bumps will ever completely flatten out under actual operational loading.
- B. Compressive stresses indicated in the reports will not vary significantly as a function of plate thickness. This is important because the 3/4" per foot tolerance stated above was determined for 1/2" plate rather than for 3/8" plate as used in the 241-AW-102 Tank secondary bottom.
- C. The BNW analysis was based on yield strength of plate material at +350°F (39,000 psi); whereas, the secondary tank bottom operating temperature will probably be closer to +200°F maximum (44,000 psi). This will reduce the potential of building-in residual stresses through full loading cycles (See Page A-7 of Ref. 2).

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-191

June 8, 1977

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224

Reference is made to our letter No. JAJ-932-172-B dated May 17, 1977 regarding the out of tolerance condition of the Tank 102 secondary bottom. As you are aware, the Administration has decided to disposition this Nonconformance to accept "as is". The requirement for American Bridge to provide an analysis or a repair procedure is waived. Please do not construe this disposition to the out of tolerance condition on the Tank 102 secondary bottom to apply to out of tolerance conditions that may be detected in the future on other bottoms, as they will be reviewed and evaluated on a case by case basis.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
Project Manager

JEP:DRO:jeg

cc: AW Akerson
JF Albaugh
AG Lassila
BL Moss

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-172-6

May 17, 1977

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224
SLOPE TOLERANCE - TANK 102-S BOTTOM

You have been notified, verbally, on several occasions, that the secondary bottom for Tank 102 has several areas that do not meet the slope requirement of 3/8" per foot as specified in Specification B-120-C4, Section 15H, Appendix B, paragraph 3, page 27; and from our recent conversations, it appears that American Bridge chooses to interpret the specifications different from the Administration. I feel obligated to inform you that Vitro has written an NCR (B-120-57, 932-18, attached), recording this condition. Vitro's Engineering Department has been unable to come up with justification for accepting the "out of tolerance" condition "as is" and will require corrective action on the part of the subcontractor, which can be comprised of any of the following items:

1. Demonstrate, through analytical means, that the above areas cannot be stressed more than specification allowances.
2. Implement a repair procedure which will correct the "out of tolerance" conditions.

Please note that a repair procedure will be subject to approval by the Administration. From a Project standpoint, this item does materially affect your overall schedule.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
J. E. Parsons
Project Manager

JEP:jeg

cc: AW Akerson AG Lassila
JF Albaugh BL Moss

AB CONST. DEPT.
HANFORD-RICHLAND, WASH.

App Figure C-26. May 2, 1977 Memorandum D.R. Olney to J.E. Parsons – Bottom Flatness

INTER-OFFICE CORRESPONDENCE

J. A. JONES CONSTRUCTION COMPANY

To: J. E. Parsons

From: D. R. Olney

Date: May 2, 1977

Re: HOLD TAGS NO. 0328, 0330, 0331

On the afternoon of Friday, April 29, 1977, two red tags (#0328 and #0330) were placed on the "bumps" in the Tank 102 secondary bottom. These tags read "No corrective measures to correct dimensional tolerances are to be used unless approved by the Administration." American Bridge removed tag #0328 in order to make a copy of it. This prompted the placement of tag #0331 which read "Subcontractor removed red stop tag #0328 upon application of Vitro Inspector".

American Bridge had checked the Tank 102 secondary bottom for flatness tolerance, and had found two areas where the slope of the bottom exceeded that which was allowed by the Specifications (3/8" per foot). Preliminary information from Vitro Survey had confirmed these findings. Prior to the tags being placed, I had personally witnessed American Bridge personnel measuring these out of tolerance areas. I also witnessed them gently place two pieces of a 36" WF beam on one of the bumps in an attempt to flatten it out (one piece of beam was placed on top of the other). I also observed Vitro Inspectors J. H. Parrish and J. E. Van Arsdale watching the operation from another location in Tank 102.

After I had returned to the office (approximately 20 minutes later), J. H. Parrish presented us with copies of the red tags. Parrish also informed us that the beams were being "dropped" on the bumps. While I only observed the placement of the beams one one of the bumps, at no time did I see the beams being "dropped" on that bump.

Apparently, the hold tags were placed to force American Bridge to prepare and submit a procedure for flattening the bumps. To my knowledge, there is no Specification requirement for submittal of this procedure. I can only assure that these tags constitute direction from the Administration, and I will request American Bridge to prepare and submit a procedure for flattening the bumps.

DRO:jeg

cc: File

App Figure C-27. NCR B-120-55

PL-604 (3-76)		NONCONFORMANCE REPORT	
(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE ADDITIONAL HIGL LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-55 (932-16)	
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: Construction Specification B-120-C4, Section 15H, paragraph 3.A.(1).i. (page 10) Description: The sub-contractor dropped a wide flange beam (approximately 6 times) directly on a portion of Secondary Tank Bottom #102 which is not within the required dimensional tolerances of 3/8" per foot. (See attached sketch of beam dimensions)		(1G) DISTRIBUTION ERDA *CW Burger *AG Lassila GS Rokkan ARHCO *JF Albaugh *AJ Larson JAJ LJ Maenpaa *JE Parsons VITRO *AW Akerson IMA Garcia *JH Parrish RR Wyer Central File *Official File * Preliminary Copies	
(1E) HOLD TAG NO. Red Tags 0328 & 0330	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish/Senior Field Inspector 4-29-77		
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☒ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION Method used to attempt to reduce out-of-tolerance condition is unacceptable; however, what has been done will be accepted on condition that visual and magnetic particle inspection reveals no apparent damage to plate in vicinity of impact.		
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)	(2E) CONCURRENCE - (SIGNATURE AND DATE)		
DESIGN <i>[Signature]</i> SAFETY <i>[Signature]</i> 5/17/77	<i>[Signature]</i> 6/1/77		
QA MGR <i>[Signature]</i> 5/17/77	<i>[Signature]</i> 6/1/77		
PROJ ENGR <i>[Signature]</i> 6-1-77	<i>[Signature]</i> 6/1/77		
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)	<i>[Signature]</i> 6-1-77 ORIGINATOR OR REPRESENTATIVE DATE

N/A						U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION					
						RICHLAND OPERATIONS OFFICE					
						SCALE	NONE	APPD.	N/A	SAF	N/A
						DRAWN	N/A	CLASSIFICATION	N/A	QA	N/A
REVISIONS						CHKD.	N/A	CLASS. BY	N/A	SKETCH	
										NO.	

VE-147 (2-75)

App Figure C-28. May 17, 1977 Letter J.A. Jones to American Bridge – Bottom Flatness

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-172 -B

May 17, 1977

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

PROJECT B-120 REDISTRIBUTION

P. FELISE
IMA GARCIA/WH BRAYMAN
JH KLEINPETER/MD CHANG
RR WYER
CENTRAL FILES
AWA/FILES
EV NORRIS
DS MAGER, 2101M

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224
SLOPE TOLERANCE - TANK 102-S BOTTOM

You have been notified, verbally, on several occasions, that the secondary bottom for Tank 102 has several areas that do not meet the slope requirement of 3/8" per foot as specified in Specification B-120-C4, Section 15H, Appendix B, paragraph 3, page 27; and from our recent conversations, it appears that American Bridge chooses to interpret the specifications different from the Administration. I feel obligated to inform you that Vitro has written an NCR (B-120-57, 932-18, attached), recording this condition. Vitro's Engineering Department has been unable to come up with justification for accepting the "out of tolerance" condition "as is" and will require corrective action on the part of the subcontractor, which can be comprised of any of the following items:

1. Demonstrate, through analytical means, that the above areas cannot be stressed more than specification allowances.
2. Implement a repair procedure which will correct the "out of tolerance" conditions.

Please note that a repair procedure will be subject to approval by the Administration. From a Project standpoint, this item does materially affect your overall schedule.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
J. E. Parsons
Project Manager

RECEIVED

MAY 20 1977

VITRO
PRO. MGMT.

JEP:jeg OS:1 WJ SZ AMW 121
1377 MAY 25 PM 1:50

cc: AW Akerson AG Lassila
JF Albaugh BL Moss

c. J. Parsons 5/25 Ram

App Figure C-29. June 8, 1977 Letter J.A. Jones to American Bridge – Bottom Flatness

66736

J. A. JONES CONSTRUCTION COMPANY
801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707
JAJ-932-191

June 8, 1977

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224

Reference is made to our letter No. JAJ-932-172-B dated May 17, 1977 regarding the out of tolerance condition of the Tank 102 secondary bottom. As you are aware, the Administration has decided to disposition this Nonconformance to accept "as is". The requirement for American Bridge to provide an analysis or a repair procedure is waived. Please do not construe this disposition to the out of tolerance condition on the Tank 102 secondary bottom to apply to out of tolerance conditions that may be detected in the future on other bottoms, as they will be reviewed and evaluated on a case by case basis.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
Project Manager

JEP:DRO:jeg

cc: AW Akerson
JF Albaugh
AG Lassila
BL Moss

App Figure C-30. NCR B-120-72

NONCONFORMANCE REPORT		
(1A) PROJECT, LOCATION OR W.D. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-72 (932-26)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION		(1E) DISTRIBUTION
<p><u>Reference</u></p> <p>Construction Specification B-120-C4, Section 15H, page 27, paragraph 3; NCR B-120-67 (932-18).</p> <p><u>Description</u></p> <p>The subcontractor has not met the 3/8" per foot slope requirement on secondary tank bottom #106.</p> <p>See attached sketch.</p>		<p><u>ERDA</u></p> <p>*RD Freeburg</p> <p>*AG Lassila</p> <p>QA</p> <p>Rockwell</p> <p>*JD Galbraith</p> <p>AJ Larson</p> <p>JAJ</p> <p>*JJ Flannery</p> <p>LJ Maenpaa</p> <p>Vitro</p> <p>*AW Akerson</p> <p>TMA Garcia</p> <p>*CW Kelley</p> <p>*JH Parrish</p> <p>RR Wyer</p> <p>Central File</p> <p>*Official File</p>
(1F) HOLD TAG NO. N/A	(1G) ORIGINATOR, TITLE AND DATE J. H. Parrish, Senior Field Inspector 10-3-77	
(1H) PRELIMINARY COPIES		
*Preliminary Copies		
(2A) RECOMMENDED DISPOSITION:	(2B) DISPOSITION JUSTIFICATION	
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(SEE ATTACHED JUSTIFICATION)	
(2C) DESIGN CHANGE REQUIRED?		
☐ YES ☒ NO		
(2D) APPROVALS (SIGNATURE AND DATE)		(2E) CONCURRENCE (SIGNATURE AND DATE)
Design <i>Paul F. Lisc</i> 10/4/77 QA <i>TMA Garcia</i> 10/5/77 PE <i>A. W. Akerson</i>		Safety <i>RE. O'Donoghue</i> 10-5-77 <i>J. D. Galbraith</i> 10/10/77 <i>P. V. Kraft</i> 10/11/77 <i>Art Hoseney</i> 10/11/77 <i>R. D. Juley</i> 10/11/77
(2F) DISPOSITION EFFECTED AS DIRECTED, WHEN CLOSED		(2G) ORIGINATOR OR REPRESENTATIVE
☒ DISPOSITION EFFECTED AS DIRECTED, WHEN CLOSED ☐ OTHER (SPECIFY):		<i>James H. Parrish</i> 10/12/77

- References:
1. RECOMMENDED BOTTOM FLATNESS TOLERANCES FOR MILLION GALLON WASTE STORAGE TANKS; by WE Anderson, JR Friley, FA Simonen, and M. Vagins; Battelle Pacific Northwest Laboratories, Richland, Washington; June 1976
 2. SAM-76-1; ANALYSIS OF STRESSES DUE TO THE FLATTENING OF BUMPS IN THE BOTTOM AND KNUCKLE REGIONS OF MILLION GALLON WASTE STORAGE TANKS; by WE Anderson, JR Friley, FA Simonen, and M. Vagins; Battelle Pacific Northwest Laboratories, Richland, Washington; July 1976

An engineering evaluation of the out-of-specified tolerance conditions in the 241-AW-106 secondary tank bottom was made; and the conditions are determined to be acceptable as-is. This evaluation included a review of two analytical reports prepared by Battelle Northwest (references 1 and 2) for ARHCO. These reports indicate that bump slopes up to 3/4" per foot are acceptable in bottom plates. This is double the specified slope tolerance of 3/8" per foot. Only one of the bumps, included in this NCR, has a slope of 3/4" per foot.

A review of the BNW analytical reports with their analyst, JR Friley, revealed the following considerations that rendered the acceptance of these out-of-tolerance bumps reasonable and yet conservative:

- A. The BNW analytical approach itself was conservative. The assumption was made that tank bottom bumps completely flattened out under operational loading conditions--actually, it is inconceivable that bottom bumps will ever completely flatten out under actual operational loading.
- B. Compressive stresses indicated in the reports will not vary significantly as a function of plate thickness. This is important because the 3/4" per foot tolerance stated above was determined for 1/2" plate rather than for 3/8" plate as used in the 241-AW-106 secondary tank bottom.
- C. The BNW analysis was based on yield strength of plate material at +350°F (39,000 psi); whereas, the secondary tank bottom operating temperature will probably be closer to +200°F maximum (44,000 psi). This will reduce the potential of building-in residual stresses through full loading cycles (see page A-7 of Ref. 2).

App Figure C-31. July 5, 1978 Construction Progress Meeting Minutes – Bottom Flatness

J. A. JONES CONSTRUCTION COMPANY		MINUTES OF WORK MEETING	
PROJECT B-120 241-AW TANK FARM		DATE July 5, 1978	
PURPOSE OF MEETING Construction Progress		PREPARED BY D. R. Olney DRO	
ATTENDEES	AEC RD Freeberg	VITRO NR Kerr JH Parrish	ARHCO JD Galbraith
	JAJ JJ Flannery DR Olney		
DISTRIBUTION: MJ Barainca, AG Lassila, JM Nelson, GS Rokkan, DOE; WH Braymen, JM Johnston, ATTENDEES PLUS - Vitro; JF Albaugh, GW Kraft, RHO; SJ Bridges, BL Moss, JAJ			
MINUTES:			
<p>I. The minutes of the previous meeting were reviewed with no comments.</p> <p>A. Action Items</p> <ol style="list-style-type: none"> 1. Bottom flatness survey of Tank 106 was performed Thursday afternoon-- results showed the bottom to be acceptable. 2. NCR 83A has yet to be resolved (#86 is in the same category). 3. BNW sister splice test procedure is acceptable to Vitro. 4. Raising of the construction jt. for the first lift for Tanks 103-106 appears to be acceptable--Halvorson will make a formal submittal. <p>II. Tanks (JAJ-932)</p> <p>A. American Bridge is 98.5% complete vs. 96.5% scheduled (overall) and 97% complete with field erection.</p> <p>III. Concrete and Backfill (JAJ-1083)</p> <p>A. Halvorson is 19% complete vs. 20% scheduled.</p> <p>B. NCR 104 - repairs were made prior to disposition of the NCR; repairs were made in accordance with ACI; most areas were 1" to 2" deep--only one went in about 9".</p> <p>IV. Tank Farm Completion (JAJ-1087)</p> <p>A. Spec. P3 and HVAC instrumentation submittals have been received.</p> <p>B. McMillin has been requested to provide a quote to delete furnishing the 3-way 1½" seal loop ball valves.</p> <p>C. Vitro is being requested to approve a longitudinal split of a small segment of the encasement for access to the welds on the interior line during hydrotest.</p> <p>D. McMillin will request approval to use MIG & FCAW procedures for their shop work.</p>			
ACTION		PROMISE DATE	RESPONSIBILITY
1. Resolve NCR's 83A and 86.		7/12/78	Vitro
2. The next meeting will be at 9:30 a.m. on Wednesday, July 12, 1978 at the JAJ 241-AW Tank Farm jobsite trailer.			
			RL OFFICE RECEIVED JUL 7 1978 CONST. DIV.

BD-9800-195 (12-73)

App Figure C-32. NCR B-120-46

RL-604 (3-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE Additional High Level Waste Storage Facility - 241 AW Tank Farm	(1C) NCR NO. B-120-46(932-10)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference - Construction Specification C-120-C4, Section 3B, para. 2B Description: Compressive strength tests of refractory test cylinders indicate that the in-place material of Tank 105 and Tank 106 has not achieved the required 130 psi. (See attached listing for specific test results) Due to the low strengths indicated by the test cylinders, 23 core samples of the in-place refractory were obtained and tested. The results of the core samples (attached) also demonstrates that the in-place refractory is unacceptable. Note: This NCR supersedes - NCR-B-120-44(932-8) NCR-B-120-45(932-9)		(1E) DISTRIBUTION ERDA *CW Burger *AJ Lassila GS Rokkan ARHCO *JD Galbraith *AJ Larson Vitro *AW Akerson *PW Armstrong IMA Garcia RR Wyer Central File *Official File *Preliminary
(1F) HOLD TAG NO. -----	(1G) ORIGINATOR, TITLE AND DATE D. S. Mager, 4-13-77	
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☒ REJECT ☒ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION <u>DISPOSITION</u> 1. Remove in-place refractory from Tanks 105 and 106. 2. Require demonstration of successful refractory installation procedure before any further refractory work is allowed to proceed on the secondary tank bottoms. As a minimum, the demonstration must include the following: A. A documented, step-by-step procedure that can be monitored during the demonstration by the ERDA inspection representative. B. Vendor (refractory material supplier) approval of the documented procedure. C. Strict adherence to the documented procedure. D. Satisfactory test results (see Exhibit A for details). <u>JUSTIFICATION</u> The test results (Exhibit B), indicate that the present procedure used by the refractory subcontractor (VERTECS) is not	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO	(2D) APPROVALS (SIGNATURE AND DATE) DESIGN: <i>W. H. Danner</i> 4/14/77 SAFETY: <i>R. H. Danner</i> 4/14/77 QA: <i>IMA Garcia</i> 4/14/77 PROJECT MANAGEMENT: <i>A. W. Akerson</i> 4-14-77 (2E) CONCURRENCE (SIGNATURE AND DATE) <i>DRO</i> 6/2/77 <i>J. F. Albright</i> 4/29/77 <i>J. D. Galbraith</i> 4/27/77 <i>C. W. Burger</i> 4/27/77 <i>A. J. Lassila</i> 4/27/77 <i>G. S. Rokkan</i> 4/27/77	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY): NOTE: FULL ACCOUNTING OF FINAL CONDITIONS, ORIGINATOR OR REPRESENTATIVE, DATE, APPROPRIATE FORMS AND/OR CORRESPONDENCE.		

2B (continued)

producing satisfactory results in that the specification requirement of 130 psi has not been met prior to stress relieving.

EXHIBIT A

Satisfactory test results for refractory installation procedure consists of a minimum compressive strength of 130 psi obtained from test samples under each of the following conditions:

1. Test samples allowed to cure for minimum of 48 hours at ambient conditions, and broken dry.
2. Test samples cured as in 1 above, emersed in lime water for an additional 24 hours (minimum) and broken wet.
3. Test samples cured as in 1 above, subjected to heating cycle simulating the tank stress relieving conditions, and broken dry.
4. Test samples cured as in 1 above, subjected to heating as in 3 above, emersed in lime water for an additional 24 hours (minimum), and broken wet.

Test samples for Tests 1 through 4 above shall be 3-inch diameter by 6-inch long cylinders in conformance with ASTM C495. Five test samples (cylinders) shall be subjected to each test.

Exhibit B to NCR B-120-46(932-1)

4-11-77

B-120
Tanks 105 and 106

Core Sample Test Results (Wet)

	<u>SAMPLE</u>	<u>COMPRESSIVE STRENGTH(psi)</u>
Tank 105	A-1	106
	A-2	95
	B-1	167.24
	B-2	123
	B-3	125
	C-1	115
	C-2	82
	D-1	195.12
	D-2	135
	E-1	117
Tank 106	E-5	96
	F-1	150
	F-2	113.34
	G-1	150
	G-2	128.9
	G-3	151
	H-1	121.9
	H-2	216.7
	J-1	91.4
	J-2	115.5
	K-1	108.6
	K-2	117

E. L. Davis
4-13-77

Exhibit B to NCR B-120-46(932-10)

Page 1 of 2

Insulating Concrete Specimens (Tested Wet)

Tank 105		3 lab	3 fld	7 lab	7 fld	14 lab	14 fld	28 lab	28 fld
3-21-77	07195-1	53.0							
	-2	58.3							
	-3					61.9			
	-4					67.2			
	-5								
	-6								
	-7		63.6						
	-8		60.1						
	-9						67.9		
	-10						84.8		
	-11								
	-12								
3-22-77	07916-1	92.6							
	-2	93.4							
	-3					84.8			
	-4					69.3			
	-5								
	-6								
	-7		75.3						
	-8		63.7						
	-9						104.7		
	-10						70.7		
	-11								80.84*
	-12								80.48*
	-13 through -20		on hold						
	-21			137.9					
	-22			123.8					
	-23					127.3			
	-24					130.8			
	-25								
	-26								
	-27			141.5					
	-28			166.2					
	-29						170.4		
	-30						162.7		
	-31								
	-32								
Tank 106									
3-29-77	07921-1	113.1							
	-2	104.6							
	-3					141.4			
	-4					125.5			
	-5								
	-6								
	-7		76.3						
	-8		70.7						
	-9						70.37		
	-10						73.5		
	-11								
	-12								

* 21 day break

Exhibit B to NCR B-120-46(932-1f

Page 2 of 2

Insulating Concrete Specimens
(Tested Wet)

		3 lab	3 fld	7 lab	7 fld	14 lab	14 fld	28 lab	28 fld
Tank 106									
3-30-77	07922-1			147.2					
	-2			258.4					
	-3								
	-4								
	-5								
	-6								
	-7				84.8				
	-8				84.8				
	-9								
	-10								
	-11								
	-12								
	-13 through -20	on hold							
	-21			32.9					
	-22			35.7					
	-23								
	-24								
	-25								
	-26								
	-27				121.6				
	-28				104.6				
	-29								
	-30								
	-31								
	-32								

Ronald Meyer
4/13/77

App Figure C-33. May 25, 1977 Letter Pryor-Giggey to J.A Jones – Refractory Replacement

THE PRYOR • GIGGEY CO.
Post Office Box 739
Whittier, California 90608
Telephone
944-7981, Area Code 213

May 25, 1977

J. A. Jones Construction Company
801 First Street
Richland, Washington 99352

Attention: Mr. J. E. Parsons

Subject: PROCEDURES FOR PLACING LW-50 - 241-AW TANK FARM

Gentlemen:

In an effort to clarify confusion which seems to exist in regard to acceptable procedures by which to place the subject refractory concrete, we would like to, once again - only through your company - put forth what we believe to be procedures which, if followed, should allow LW-50 to be placed to specification. These procedures, whereas perhaps appearing non-restrictive and even more artful than scientific, represent the method by which we, and probably all other refractory manufacturers place most of their refractory concretes for service far more severe than that to be encountered on waste tank bases. These procedures are attached.

It is our intent, by transmission of these procedures in this manner, that they be considered by J. A. Jones Construction Company and Vitro Engineering Company, intact, and be approved as written so that acceptable refractory concrete may be placed on this contract. Our written and oral submittals to Vertecs Company, et al, have been continually modified to one form or another to the end that, whereas the result may sometimes be operable, these changes usually incorporated philosophical or judgmental modifications which made them too restrictive, or too easily misconstrued as to our intent.

Our understanding, in regard to procedures, is that we are to provide such input to Vertecs Company, who in turn submits them ultimately to Vitro Engineers for approval. We have had the opportunity to submit, in one form or another, procedural data which have never survived intact the critical scrutiny and modification penchant apparently incurably afflicting those who are in a position to evaluate them. We take strong exception to this, believing that we, as manufacturers of the refractory material on this job, have, first, the knowledge by which to place the material properly, and, second, the responsibility to provide suitable procedures to the installation. We have made our recommendations, and they have been consistently second-guessed, modified, or ignored.

Mr. J. E. Parsons

-2-

May 25, 1977

We have not had supervisory capacity or authority to enforce our procedures on this job until commencement of the installation of material on base 101, and we now are functioning under authority granted by your company. With this authority we are installing LW-50 per our consistently maintained procedural desires. These procedures incorporate little which may be considered as normally germane to Portland cement work, but only items which we know will allow the material to be correctly placed.

Several procedures have been issued by Vertecs Company for ultimate approval by Vitro Engineering Company. One or two have been approved, some were rejected. We were asked to review and comment on only 1 of these prior to its submission, that being the procedure of December 13, 1976. All other procedures were never formally endorsed by our company, nor were we allowed the privilege of formal review and approval prior to their submission. In fact, we have seen only the submittals of December 13, 1976; January 26, 1977, and a portion of a May 4, 1977 version, subsequently rejected. It is interesting to note that Vertecs' May 4 procedures were submitted without benefit of our procedural restatement letter of the same date. Once again, the Vertecs procedures countermanded our own, both in content and overall philosophy of placement.

The procedures attached correspond closely to those submitted December 13, 1976 when supplemented with our approval letter of January 6, 1977. We have, further to that, added the use of Protex Dispursing Agent, an item not formally incorporated by January 6, 1977. All this is again reiterated in our letter to Vertecs, dated May 4, 1977. The latter submittal again restates our placement philosophy and supplements our letter to Vertecs dated July 29, 1976 on the same subject. It is clear to a prudent man that our intent through all this is to recommend placement of material with heavy consistency and with low water content. This desire is emphasized by the use of Protex Dispursing Agent - a water reducing agent - in the mix.

It may be well to note here that bases 105 and 106 were cast using Protex Air Entraining Concentrate rather than Protex Dispursing Agent (PDA). This action, taken independently by the contractor, Vertecs Company, was directly contrary to our direction. Use of an air-entraining agent usually necessitates the use of large amounts of water during placement with coincident introduction of minute air bubbles throughout the mass to create a highly porous and correspondingly weak end structure. The use of this air-entrainment with LW-50 is not recommended by our company in this application.

Very truly yours,

THE PRYOR-GIGGEY COMPANY

Donald K. Knapp

Donald K. Knapp

Post Office Box 739
Whittier, California 90608
Telephone
944-7981, Area Code 213

THE PRYOR-GIGGEY CO.

May 25, 1977

INSTALLATION PROCEDURES - LITEWATE 50 REFRACTORY CASTABLE

The following reiterates the philosophy that refractory castables should be placed with minimum water content, so as to maximize strength. It thus follows that LW-50 as a refractory castable material, should be so placed.

Mixing - The operator will introduce clean, 45-90° water into mixer by pre-setting the water meter to approximately 58 to 60 gallons - based on approximately 5 gallons per bag. After the introduction of sufficient water (about 20 gallons) into the mixer, along with approximately 16 oz. of Protex Dispursing Agent (PDA) add 12 bags of dry material - approximately 75 lbs. each - into the mixer assuring that all dry material is in mixer prior to final water shutoff. Then continue mixing for approximately one additional minute.

Mix Adjustment

$$\frac{5 \times 8.34}{75} = 55.6\% \text{ H}_2\text{O}$$

Water additions may be made within the general parameters of 53-62% water in order to adjust for variations in mix, batch weight, ambient temperatures, steel temperature, and humidity, with the optimum amount being approximately 55% to achieve pumpable consistency with the lowest water content.

This hose-end consistency is most practically recognized by using the "ball in hand" test where typically a baseball-size ball of material is taken from the batch and thrown a few inches into the air and caught on the palm of the hand. The ball should neither break apart nor excessively flatten during this evaluation.

Finishing (Internal Vibration)

The insulating concrete shall be brought up to the required thickness with a minimum amount of shoveling or sweeping. The material should be vibrated during placement by working an internal vibrator, 2 to 2-3/4" diameter and 12 to 15" long and operating at a minimum 9000 vibrations per minutes, in the mass and moving it through at a rate of 5-10 feet per minute or until bubble formation significantly reduces and the surface takes on a wet look. When excessive water is brought to the surface, the mass has either been over-vibrated or has been placed using too much water and an adjustment should be made.

App Figure C-34. June 7, 1977 Letter J.A. Jones to Vitro – Refractory Replacement

B-120

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

RECEIVED

June 7, 1977

JUN 8 1977

VITRO
PRO. MGMT.

Vitro Engineering Division
Automation Industries, Inc.
P. O. Box 296
Richland, Washington 99352

Attention: Mr. Al Akerson

Gentlemen:

PROJECT B-120 REDISTRIBUTION

JH BRAYMAN
P. FELISE
JH KLEINPETER/MD CHANG
DG LIEN/EA GOAKEY
DS MAGER, 2101M
EV NORRIS
GR PRICE/RR WYER
EE SMITH
CENTRAL FILES
ATA/FILES

INSULATING REFRACTORY #101
PROJECT B-120

Preliminary cylinder compression breaks done by BNW indicate that Section "D" in Tank #101 does not reach the minimum of 130 PSI, wet or dry, before or after stress relief.

The average compression strength of this section after stress relieving is 105 dry and 111 wet.

Since these values are close to 130 PSI, the sampling was from 2 of 40 batches placed and it is our understanding that the 130 PSI is required only for the outside perimeter of the pad, we want to suggest the following as the most economical timely method of resolving this problem:

1. Chip out and remove a pad around the perimeter about 3 feet wide in Section "D".
2. Replace this removed section with an enriched mixture of lite-wate #50 as it is being poured in Tank Foundation #102.

Please expedite an evaluation of our proposal as soon as possible.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
Project Manager

JEP:gb

App Figure C-35. May 31, 1977 Letter Pryor-Giggey to J.A. Jones – Refractory Replacement

May 31, 1977

J.A. Jones Construction Co.
801 First Street
Richland, Wash. 99352

Attention: Mr. J.E. Parsons

Subject: Litewate 50 Insulating Concrete - 241 AW Tank Farm

Gentlemen:

During the time when Vitro Corp. is evaluating the Litewate 50 which has been placed in tank bottom #101 and in an effort to allow American Bridge to continue with its critical construction schedule, we recommend the following: add one (1) 94# sack of Ciment Fondu to each 12 sacks of Lt. Wt. #50 which are placed in tank bottom #102.

Our tests indicate this addition will increase the oven dried compressive strength by approximately 100 p.s.i. and thus provide adequate assurance that the #102 bottom will have a minimum compressive strength of 130 p.s.i. after stress relieving.

The addition of this amount of Ciment Fondu to Lt. Wt. #50 should increase the "K" factor of the material from approximately 1.2 to 1.4 maximum at a mean temperature of 500° F.

Very truly yours,

Wm Ben Gage
Vice President

App Figure C-36. July 6, 1977 Letter J.A. Jones to American Bridge – Refractory Replacement

66736
J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JAJ-932-206

July 6, 1977

American Bridge
Division of United States
Steel Corporation
P. O. Box 1099
Richland, Washington 99352

Attention: Mr. C. J. Madewell
Project Manager

Gentlemen:

SUBCONTRACT NO. JAJ-932 (B-120) - K-9224
Reference: Insulating Refractory

Reference is made to our letter of June 30, 1977, in which we changed Litewate 50 to Litewate 58. Please change the product to Litewate 70. This is on the recommendation of the manufacturer to assure that sufficient margins of safety are allowed to meet all testing requirements. All other items still apply.

Very truly yours,

J. A. JONES CONSTRUCTION COMPANY

J. E. Parsons
Project Manager

JEP:jaa

cc: AW Akerson
AG Lassila
JF Albaugh
BL Moss

App Figure C-37. Design Field Change B-120-53

(1) PROJECT NUMBER AND TITLE Project B-120 Additional High Level Waste Storage Facilities 241-AW Tank Farm		(2) RECORDING DATE 7/29/77	(3) APPROVAL DATE 8-1-77	(4) CHANGE NUMBER B-120-53
(5) DOCUMENTS AFFECTED Construction Specification B-120-C4		(17) DISTRIBUTION: ERDA *RD Freeberg *AG Lassila GS Rokkan Rockwell *JF Albaugh AJ Larson JAJ *JE Parsons Vitro *AW Akerson IMA Garcia *CW Kelley *DS Mager *JH Parrish Central Files *Official File *Preliminary Copies		
(6) DETAILED DESCRIPTION AND JUSTIFICATION <u>Description</u> In Section 3B, part 2. A. (1), of B-120-C4, change Lite Wate#50 to Lite Wate#70. <u>Justification</u> To provide a greater margin of safety for compressive strength (Ref. Pryor-Giggy letter, Ben Gage, to JE Parsons, JAJ, 7/12/77).		(18) ALL DOCUMENTS REVISED ☒ <i>JAJ</i> 6-14-79 (DATE)		
(7) EFFECT ON COST: \$ _____ ☐ ADDITIONAL ☐ SAVINGS		BASIS OR REMARKS:		
(8) EFFECT ON SCHEDULE: NONE ☐ DELAY ☐ IMPROVEMENT				
(9) CONTRACTS, PROJECTS OR WORK ORDER AFFECTED: Project B-120, Phase IV (Steel Tanks) Subcontract JAJ-932 (American Bridge)				
(10) INITIATOR A. W. Akerson		(11) PHONE 942-6817	(12) ORGANIZATION Vitro Project Management	(13) DATE 7/27/77
APPROVALS				
(14) ARCHITECT ENGINEER Design 7/29/77 <i>P. J. Shaffer</i> QA 7/29/77 <i>1 mag arma</i>		(15) OPERATING CONTRACTOR Safety 7-29-77 <i>PE</i> 7-29-77 <i>A. W. Akerson</i>		(16) ERDA 11 <i>JF Albaugh</i> 8/1/77 21 <i>J.D. Belhatch</i> 8/1/77 21 <i>ASR by AWL per telecon</i> 8/1/77

Post Office Box 739
Whittier, California 90608
Telephone
945-3781, Area Code 213

THE PRYOR-GIGGEY CO.

Attachment #1 DFC #B-120-53

July 12, 1977

RECEIVED

JUL 18 1977
REC VITRO
JUL 14 1977
J.A. CONSTRUCT.

J. A. Jones Construction Company
PO Box 560
Richland, Washington 99352

Attention: J. E. Parsons, Construction Manager

Gentlemen:

Re: Material Selection - Insulating Refractory
241-AW Tank Farm

After a thorough review of the requirements placed on the insulating refractory on this project, we recommend that the Administration consider the use of LW-70 insulating castable for tank bottoms 103 and 104 as well as any repairs deemed necessary for 102, 105 and 106.

Although current specifications call for 130 psi cold crushing after stress relieving, it is our understanding that the Administration would prefer that the material placed exceed the minimum called for. LW-70, if properly placed, should provide a greater margin of safety in this regard and reduce the potential of having tank bottoms that don't meet specifications. The stronger material should also help reduce the adverse effects caused by high daytime temperatures and from the heaving of the metal tank bottoms as ambient temperatures fluctuate.

Very truly yours,

THE PRYOR-GIGGEY CO.

Ben Gage
Ben Gage

BG:iw

CC: M. G. Garman
Don Knapp

Project B-120 Redistribution

RM Carroll/AWA/Files
IMA Garcia/WH Brayman
CW Kelley, 2101M
DG Lien/EA Goakey
DR Nelson/EV Norris
JF Nelson/DS Mager, 2101M
GR Price/RR Wyer
EE Smith/P. Felise
JH Kleinpeter
Central Files

MULLITE • CORUNDUM • ZIRCON • FIRECLAY • BASIC • INSULATING REFRACTORIES
ACID BRICK • CEMENT FONDU ALUMINOUS CEMENT

Attachment #2 to DFC #B-120-53Further Discussion of Justification

1. Preliminary results of the laboratory tests of Lite Wate 70 indicate such an increase in compressive strength, with no significant increase in k-factor (thermal conductivity), that it becomes resonable to proceed with the placing of Lite Wate 70 on the remainder of Tank 241-AW-102 in advance of completion of all the tests on the "A" section of Tank 102. Therefore, this DFC is issued with the preliminary test results attached, but the final test results will be added to it later. See attachment #3 for scope of preliminary testing, and attachment #4 for results of preliminary testing.

NOTES: 1) Preliminary testing consisted of compressive strength tests and thermal conductivity tests of laboratory-mixed samples. Final testing will consist of compressive strength tests of field-mixed samples, thermal conductivity tests of field-mixed samples and of core samples from field-cured placement, and compressive strength tests of radiation-exposed, laboratory-mixed samples.

2) Preliminary compressive strength tests were all in excess of 1080 psi (specification requirement is 130 psi minimum).

3) Preliminary k-factor testing indicates that Lite Wate 70 is at least as good as claimed by the manufacturer. This means that the highest temperatures to be expected on the structural concrete foundation during the stress relieving operation will be less than 235°F (specification requirement is 500°F maximum). See attachments #5 and #6 for temperature calculations.

2. A demonstration placement was made for Section "A" of Tank 241-AW-102 with no difficulties. See attachment #7 for procedure. It should be noted that the Lite Wate 70 was placed with buckets rather than being pumped.
3. It is the opinion of Vitro's Process and Nuclear Group that Lite Wate 70 should behave essentially the same as Lite Wate 50 under exposure to nuclear radiation. Laboratory verification of the ability of Lite Wate 70 to withstand nuclear radiation will be covered under the final testing, to be added to this DFC later.

Attachment # 9 to DFC #B-120-53

VITRO ENGINEERING CORPORATION
Architects • EngineersTO R. T. Lansiedel, BNW
Room 413, PSL Building, 3000 Area

FROM A. W. Akerson

DATE July 20, 1977

SUBJECT Project B-120, 241-AW Tank Farm
Mixing/Testing of Insulating ConcreteJOB NO. Vitro: C12003
BNW: C31318

- References:
1. Letter, RE Westerman (BNW) to DE Anderson (Vitro), 10/16/77, transmitting EVALUATION OF "LITE WATE 50" CASTABLE REFRACTORY.
 2. Design/Field Change B-120-47, initiated 5/25/77.
 3. Letter, AW Akerson to RT Lansiedel, 5/23/77.

Confirming conversations between you and Vitro's W. H. Brayman, C. W. Kelley, and myself, please perform the following mixing/testing of the sample of Pryor-Giggy Lite Wate 70 provided to you by JAJ:

- Preparation of Test Cylinders: Preparation of test cylinders shall be in accordance with the methods previously used in the Ref. 1 evaluation; except, the water added to the mix shall be held as close as possible to 27 1/2%, by weight.
- Compressive Testing of Cylinders: Testing shall be in accordance with the Ref. 1 evaluation; except, cylinders shall be cured and tested under the conditions described in Ref. 2 (attached).
- Thermal Conductivity Testing: Thermal conductivity (k-factor) tests shall be conducted to determine the k-factor of the cast material at the following:
 - a. 500° F
 - b. 1000° F
 - c. 1500° F
- Composition of Sample: It is anticipated that another group within BNW will be asked to analyze part of the sample to determine its composition; therefore, please retain a portion of the sample for their use.

Please expedite this effort as much as possible (overtime is authorized) to minimize the delay to ongoing construction efforts in the field.

NOTE: ERDA has decided that the testing I requested in the Ref. 3 letter is no longer required, so please do not initiate that effort -- Consider the Ref. 3 letter cancelled.

cc: RD Freeberg, ERDA-RL
AG Lassila, ERDA-RL
JM Nelson, ERDA-RL
JF Albaugh, Rockwell, 2704W
JE Parsons, JAJ, 241-AW Trailer
WH Brayman
RM Carroll/AWA/Files
CW Kelley, 2101M

A. W. Akerson
A. W. Akerson, Project Engineer

JH Kleinpeter
DG Lien/EA Goakey
DS Mager, 2101M
EV Norris
Central File

An Automation Industries, Inc. Company

VE-8 (12-75)

App Figure C-38. November 18, 1977 Refractory Field Cylinder Testing

TRANSMITTAL NO. B-120-83DATE November 18, 1977TO: DistributionFROM: A. W. Akerson *A.W. Akerson*

PROJ. OR
SUBJECT Project B-120, 241-AW Tank Farm
Phase IV, Steel Tanks
Title III, W.O. C12003

NO. OF EACH	DISTRIBUTION:	LOCATION
1	RD Freeberg, DOE-RL	FB
1	AG Lassila, DOE-RL	FB
0	JF Albaugh, RHO	2704W
1	JD Galbraith, RHO	2704W
1	JJ Flannery, JAJ, 241-AW Trlr. 200I	
1	AW Akerson, Vitro	FB
0	P. Felise	FB
0	IMA Garcia/WH Brayman	FB
1	JM Johnston	2101M
0	CW Kelley	FB
0	DG Lien/EA Goakey	FB
0	EV Norris	FB
0	EE Smith	FB
1	Central Files	FB

ATTACHED ARE	THEY ARE TO BE USED FOR	THESE ARE	PLEASE NOTE	PLEASE
☒ Data	☒ INFORMATION	☐ PRELIMINARY	☐ REVISION	☐ COMMENT
☐ PRINTS	☐ ESTIMATING	☐ UNCHECKED	☐ HOLDS	☐ APPROVE
☐ SPECIFICATIONS	☐ SECURING QUOT.	☐ CHECKED		
☐ ATP	☐ ORDERING MAT'L.	☒ FINAL		
☐ REQUISITIONS	☐ CONSTRUCTION	☐ APPROVED		
☐ REQ. WORK SHEET				
☐ WORK PLAN				
☐ E & M LIST				

DRAWING NUMBERS, TITLES AND COMMENTS:

Attached are the results of all the Lite Wate #70 insulating concrete compressive strength tests performed on field cylinders taken for Tanks 241-AW-102, 103, 104, 105 and 106.

- References:
1. Letter, AW Akerson to JJ Flannery, 11/17/77 (LB:B-130-20a), providing summary of Lite Wate #70 break strength data.
 2. Transmittal #B-120-66, providing results of consistency analysis of Lite Wate #50 insulating concrete.
 3. Transmittal #B-120-65, providing results of compressive strength tests performed on field cylinders taken for placement of Lite Wate #50 placed in Tank 241-AW-101, enriched Lite Wate #50 placed in Tank 241-AW-102, and enriched Lite Wate #50 replaced in Section D of Tank 241-AW-101. Note: Tank 241-AW-102 was replaced with Lite Wate #70.
 4. Transmittal #B-120-59, providing items pertaining to testing of Lite Wate #50 insulating concrete placed in Tanks 241-AW-105 and 106 during March 1977. Note: This refractory was removed and replaced with Lite Wate #70.

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7935-1		7:20	8-1/4"		68°	8-2-77	4	764	Test Dry
	-2						8-2-77	4	846	
	-3						hold			
	-4						hold			
									17. ACCEPT BY <i>J. H. [Signature]</i> DATE 10-27-77	

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

* 8-2-77 RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7935-5		7:20	8-1/4"		68°	8-2-77	4	696	Test after 24 hour
	-6						8-2-77	4	716	submerged in water
	-7						hold			
	-8						hold			
									17. ACCEPT BY <i>J. H. [Signature]</i> DATE 10-27-77	

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

* 8-2-77 RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7935-9		7:20	8-1/4"		68°	8-3-77	5	764	Test dry after
	-10						8-3-77	5	795	heat cycle
	-11						8-3-77	5	741	
									17. ACCEPT BY <i>J. H. [Signature]</i> DATE 10-27-77	

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

* 8-3-77 RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7935-12		7:20	8-1/4		68°	8-4-77	6	962	Test wet after
	-13						8-4-77	6	962	heat cycle
	-14						8-4-77	6	852	
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-31-77	

*8-4-77 RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7935-15		6:10	10"		68°	8-2-77	4	1019	Test Dry
	-16						8-2-77	4	753	
	-17						hold			
	-18						hold			
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-31-77	

* 8-2-77 RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 6-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7935-19		6:10	10"		68°	8-2-77	4	843	Test after 24 hour
	-20						8-2-77	4	1157	submerged in water
	-21						hold			
	-22						hold			
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-31-77	

* 8-2-77 RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7935-23		6:10	10"		68°	8-3-77	5	942	Test dry after
-24						8-3-77	5	905	heat cycle
-25						8-3-77	5	920	
17. ACCEPT BY <i>J. H. H. H.</i> DATE 8-3-77									

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 7-29-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7935-26		6:10	10"		68°	8-4-77	6	1256	Test wet after
-27						8-4-77	6	1141	heat cycle
-28						8-4-77	6	965	
17. ACCEPT BY <i>J. H. H. H.</i> DATE 8-4-77									

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-1	15	2:05	8-3/4"		82°	8-4-77	2	1058	Test Dry
-2						8-4-77	2	1140	
-3					hold				
-4					hold				
17. ACCEPT BY <i>J. H. H. H.</i> DATE 8-4-77									

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-5	15	2:05	8-3/4"		82°	8-5-77	3	1236	Test after 24 hour
-6						8-5-77	3	951	submerged in water
-7						hold			
-8						hold			
17. ACCEPT BY <i>[Signature]</i> DATE 8-5-77									

* 8-5-77 RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-9	15	2:05	8-3/4"		82°	8-9-77	7	1038	Test dry after
-10						8-9-77	7	1019	heat cycle
-11						8-9-77	7	1027	
17. ACCEPT BY <i>[Signature]</i> DATE 8-9-77									

8-9-77 RTL *

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-12	15	2:05	8-3/4"		82°	8-10-77	8	1180	Test wet after
-13						8-10-77	8	1217	heat cycle
-14						8-10-77	8	1132	
17. ACCEPT BY <i>[Signature]</i> DATE 8-10-77									

8-10-77 RTL *

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7930-15	49	6:05	7"		80°	8-4-77	2	945	Test dry
	-16						8-4-77	2	1010	
	-17						hold			
	-18						hold			
									17. ACCEPT BY <i>[Signature]</i> DATE 8-21-77	

8-4-77 RTL ★RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7930-19	49	6:05	7"		80°	8-5-77	3	710	Test after 24 hour
	-20						8-5-77	3	1058	submerged in water
	-21						hold			
	-22						hold			
									17. ACCEPT BY <i>[Signature]</i> DATE 8-21-77	

8-5-77 RTL ★ RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7930-23	49	6:05	7"		80°	8-9-77	7	942	Test dry after
	-24						8-9-77	7	897	heat cycle
	-25						8-9-77	7	973	
									17. ACCEPT BY <i>[Signature]</i> DATE 8-21-77	

8-9-77 RTL ★ RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY DATE PWA 8-2-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-26	49	6:05	7"		80°	8-10-77	8	1452	Test wet after
-27						8-10-77	8	1520	heat cycle
-28						8-10-77	8	1355	
17. ACCEPT BY <i>[Signature]</i> DATE 8-10-77									

8-10-77 RTL *

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-29	5	a.m. 1:30	6-3/4"		81°	8-10-77	7	1218	Test Dry
-30						8-10-77	7	1703	
-31						hold		<i>[Signature]</i>	
-32						hold		<i>[Signature]</i>	
17. ACCEPT BY <i>[Signature]</i> DATE 8-10-77									

8-10-77 RTL *

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-33	5	a.m. 1:30	6-3/4"		81°	8-11-77	8	1293	Test after 24 hour
-34						8-11-77	8	1321	submerged in water
-35						hold		<i>[Signature]</i>	
-36						hold		<i>[Signature]</i>	
17. ACCEPT BY <i>[Signature]</i> DATE 8-11-77									

8-11-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7930-37	5	a.m. 1:30	6-3/4"		81°	8-12-77	9	973	Test dry after
	-38						8-12-77	9	1024	heat cycle
	-39						8-12-77	9	894	
17. ACCEPT BY: <i>[Signature]</i> DATE: 8-11-77										

8-12-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7930-40	5	a.m. 1:30	6-3/4"		81°	8-16-77	13	1146	Test wet after
	-41						8-16-77	13	1109	heat cycle
	-42						8-16-77	13	1180	
17. ACCEPT BY: <i>[Signature]</i> DATE: 8-11-77										

8-16-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7930-43	17	a.m. 2:30	4-1/2"		80°	8-10-77	7	1302	Test dry
	-44						8-10-77	7	1256	
	-45						hold			
	-46						hold			
17. ACCEPT BY: <i>[Signature]</i> DATE: 8-11-77										

8-10-77 RTL *

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY, DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. °AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-47	17	a.m. 2:30	4-1/2"		80°	8-11-77	8	1355	Test after 24 hour
-48						8-11-77	8	996	submerged in water
-49						hold			
-50						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 8-11-77									

8-11-77 * RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY, DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. °AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-51	17	a.m. 2:30	4-1/2"		80°	8-12-77	9	1097	Test dry after
-52						8-12-77	9	1007	heat cycle
-53						8-12-77	9	999	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 8-12-77									

8-12-77 * RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY, DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. °AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7930-54	17	a.m. 2:30	4-1/2"		80°	8-16-77	13	1296	Test wet after
-55						8-16-77	13	1149	heat cycle
-56						8-16-77	13	1135	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 8-16-77									

8-16-77 * RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-57	19	a.m. 5:15	5-1/2"		80°	8-10-77	7	900	Test dry
-58						8-10-77	7	1133	
-59						hold			
-60						hold			
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 10/1/77									

8-10-77 RTL * RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-61	19	a.m. 5:15	5-1/2"		80°	8-11-77	8	772	Test after 24 hour
-62						8-11-77	8	758	submerged in water
-63						hold			
-64						hold			
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 10/1/77									

8-11-77 * RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-65	19	a.m. 5:15	5-1/2"		80°	8-12-77	9	1016	test dry after
-66						8-12-77	9	1002	heat cycle
-67						8-12-77	9	1022	
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 10/1/77									

8-12-77 * RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY, DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME a.m.	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-68	19	5:15	5-1/2"		80°	8-16-77	13	1420	Test wet after
-69						8-16-77	13	1236	heat cycle
-70						8-16-77	13	1440	
17. ACCEPT BY <i>[Signature]</i> DATE <i>8-16-77</i>									

8-16-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY, DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME a.m.	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-71	49	7:30	8-3/4"		80°	8-10-77	7	775	Test Dry
-72						8-10-77	7	857	
-73						hold			
-74						hold			
17. ACCEPT BY <i>[Signature]</i> DATE <i>8-10-77</i>									

8-10-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY, DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME a.m.	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-75	49	7:30	8-3/4"		80°	8-11-77	8	557	Test after 24 hour
-76						8-11-77	8	696	submerged in water
-77						hold			
-78						hold			
17. ACCEPT BY <i>[Signature]</i> DATE <i>8-11-77</i>									

8-11-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-79	49	a.m. 7:30	8-3/4"		80°	8-12-77	9	628	Test dry after
-80						8-12-77	9	580	heat cycle
-81						8-12-77	9	628	
17. ACCEPT BY <i>[Signature]</i> DATE <i>10-2-77</i>									

8-12-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-3-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7931-82	49	a.m. 7:30	8-3/4"		80°	8-16-77	13	722	Test wet after
-83						8-16-77	13	713	heat cycle
-84						8-16-77	13	572	
17. ACCEPT BY <i>[Signature]</i> DATE <i>10-2-77</i>									

8-16-77 RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-85	26	a.m. 2:30	9"		78°	8-17-77	12	1805	Test Dry
-86						8-17-77	12	1435	
-87						hold			
-88						hold			
17. ACCEPT BY <i>[Signature]</i> DATE <i>10-2-77</i>									

8-17-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-89	26	a.m. 2:30	9"		78°	8-18-77	13	781	Test after 24 hours
-90						8-18-77	13	1203	submerged in water
-91						hold			
-92						hold			
									17. ACCEPT BY <i>[Signature]</i> DATE 8-18-77

8-18-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-93	26	a.m. 2:30	9"		78°	8-25-77	20	934	Test dry after
-94						8-25-77	20	860	heat cycle
-95						8-25-77	20	962	
									17. ACCEPT BY <i>[Signature]</i> DATE 8-25-77

8-25-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-96	26	a.m. 2:30	9"		78°	8-26-77	21	1055	Test wet after
-97						8-26-77	21	1352	heat cycle
-98						8-26-77	21	1183	
									17. ACCEPT BY <i>[Signature]</i> DATE 8-26-77

8-26-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-99	48	5:15	7-1/4"		75°	8-17-77	12	1234	Test Dry
-100						8-17-77	12	1302	
-101						hold			
-102						hold			
									17. ACCEPT BY <i>[Signature]</i> DATE 8-17-77

8-17-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31325		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-103	48	a.m. 5:15	7-1/4"		75°	8-18-77	13	1220	Test after 24 hours
-104						8-18-77	13	982	submerged in water
-105						hold			
-106									
									17. ACCEPT BY <i>[Signature]</i> DATE 8-18-77

8-18-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-107	48	a.m. 5:15	7-1/4"		75°	8-25-77	20	611	Test dry after
-108						8-25-77	20	704	heat cycle
-109						8-25-77	20	710	
									17. ACCEPT BY <i>[Signature]</i> DATE 8-25-77

8-25-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE PWA 8-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 102 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7932-110	48	a.m. 5:15	7-1/4"		75°	8-26-77	21	968	Test wet after
-111						8-26-77	21	772	heat cycle
-112						8-26-77	21	823	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 8-26-77									

8-26-77 *RTL

RL-605 (4-76)

ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-1	10	a.m. 2:00	8-1/2"		80°	8-18-77	6 days	1104	Test dry
	-2						8-18-77	6	976	
	-3						hold			
	-4						hold			
								17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77		

8-18-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-5	10	a.m. 2:00	8-1/2"		80°	8-19-77	7	631	Test after 24 hours
	-6						8-19-77	7	693	submerged in water
	-7						this cylinder was damaged during construction			
	-8						hold			
								17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77		

8-19-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-9	10	a.m. 2:00	8-1/2"		80°	8-25-77	13	928	Test dry after
	-10						8-25-77	13	874	heat cycle
	-11						8-25-77	13	804	
									17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77	

8-25-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-12	10	a.m. 2:00	8-1/2"		80°	8-26-77	14	1236	Test wet after
-13						8-26-77	14	1194	heat cycle
-14						8-26-77	14	1254	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

8-26-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C172 - SAMPLING
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-15	22	a.m. 2:30	8-1/2"		80°	8-18-77	6	572	Test Dry
-16						8-18-77	6	917	
-17						hold			
-18						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

8-18-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C172 - SAMPLING
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-19	22	a.m. 2:30	8-1/2"		80°	8-19-77	7	795	Test after 24 hours
-20						8-19-77	7	591	submerged in water
-21						hold			
-22						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

8-19-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C172 - SAMPLING
C94 - READY MIX
C231 - AIR CONTENT

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-23	22	2:30 a.m.	8-1/2"		80°	8-25-77	13	1036	Test dry after
-24						8-25-77	13	538	heat cycle
-25						8-25-77	13	526	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

8-25-77 *RTL RL-605 (4-76)

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-26	22	2:30 a.m.	8-1/2"		80°	8-26-77	14	682	Test wet after
-27						8-26-77	14	560	heat cycle
-28						8-26-77	14	535	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

8-26-77 *RTL RL-605 (4-76)

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-29	22	3:50 a.m.	8-3/4"		80°	8-18-77	6	665	Test dry
-30						8-18-77	6	863	
-31						hold			
-32						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

8-18-77 *RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-33	22	3:50 a.m.	8-3/4"		80°	8-19-77	7	549	Test after 24 hours
	-34						8-19-77	7	570	submerged in water
	-35						hold			
	-36						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									ASTM: C143 - SLUMP C172 - SAMPLING C231 - AIR CONTENT C31 - PREPARATION C39 - STRENGTH C94 - READY MIX	

8-19-77 *RTL

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-37	22	3:50 a.m.	8-3/4"		80°	8-25-77	13	563	Test dry after
	-38						8-25-77	13	588	heat cycle
	-39						8-25-77	13	588	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									ASTM: C143 - SLUMP C172 - SAMPLING C231 - AIR CONTENT C31 - PREPARATION C39 - STRENGTH C94 - READY MIX	

8-25-77 *RTL

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-40	22	3:50 a.m.	8-3/4"		80°	8-26-77	14	756	Test wet after
	-41						8-26-77	14	696	heat cycle
	-42						8-26-77	14	710	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									ASTM: C143 - SLUMP C172 - SAMPLING C231 - AIR CONTENT C31 - PREPARATION C39 - STRENGTH C94 - READY MIX	

8-26-77 *RTL

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-43	60	6:20 a.m.	10"		79°	8-18-77	6	665	Test Dry
	-44						8-18-77	6	770	
	-45						hold			
	-46						hold			
									17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77	

8-18-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C39 - STRENGTH
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-47	60	6:20 a.m.	10"		79°	8-19-77	7	586	Test after 24 hours
	-48						8-19-77	7	747	submerged in water
	-49						hold			
	-50						hold			
									17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77	

8-19-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C39 - STRENGTH
C94 - READY MIX
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-51	60	6:20 a.m.	10"		79°	8-25-77	13	501	Test dry after
	-52						8-25-77	13	510	heat cycle
	-53						8-25-77	13	481	
									17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77	

8-25-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C39 - STRENGTH
C94 - READY MIX
C231 - AIR CONTENT

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-54	60	6:20 a.m.	10"		79°	8-26-77	14	656	Test wet after
-55						8-26-77	14	617	heat cycle
-56						8-26-77	14	594	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

8-26-77 *RTL RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-57	60	7:45 a.m.	9"		78°	8-18-77	6	665	Test Dry
-58						8-18-77	6	673	
-59						hold			
-60						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

8-18-77 *RTL RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-61	60	7:45 a.m.	9"		78°	8-19-77	7	662	Test after 24 hours
-62						8-19-77	7	599	submerged in water
-63						hold			
-64						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE 10-26-77									

8-19-77 *RTL RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-65	28	7:45 a.m.	9"		78°	8-25-77	13	603	Test dry after
	-66						8-25-77	13	657	heat cycle
	-67						8-25-77	13	642	
17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 10-26-77										

8-25-77 *RTL

RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-68	28	7:45 a.m.	9"		78°	8-26-77	14	1020	Test wet after
	-69						8-26-77	14	1053	heat cycle
	-70						8-26-77	14	996	
17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 10-26-77										

8-26-77 *RTL

RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7939-71	20	8:15 a.m.	8"		82°	8-18-77	6	1041	Test Dry
	-72						8-18-77	6	770	
	-73					hold				
	-74					hold				
17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 10-26-77										

8-18-77 *RTL

RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-75	20	8:15 a.m.	8"		82°	8-19-77	7	593	Test after 24 hours
-76						8-19-77	7	679	submerged in water
-77						hold			
-78						hold			
17. ACCEPT BY <i>J.H. [Signature]</i> DATE <i>10-26-77</i>									

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C172 - SAMPLING
C231 - AIR CONTENT

8-19-77 *RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-79	20	8:15 a.m.	8"		82°	8-25-77	13	696	Test dry after
-80						8-25-77	13	603	heat cycle
-81						8-25-77	13	654	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE <i>10-26-77</i>									

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C172 - SAMPLING
C231 - AIR CONTENT

8-25-77 *RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31326		3. PREPARED BY/DATE TLW 8-12-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7939-82	20	8:15 a.m.	8"		82°	8-26-77	14	942	Test wet after
-83						8-26-77	14	852	heat cycle
-84						8-26-77	14	854	
17. ACCEPT BY <i>J.H. [Signature]</i> DATE <i>10-26-77</i>									

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
C172 - SAMPLING
C231 - AIR CONTENT

8-26-77 *RTL RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-85	24	a.m. 2:50	7"		80°	8-30-77	14	2145	Test dry
	-86						8-30-77	14	2250	
	-87		HOLD				8-30-77	14	2160	
	-88		HOLD						2160	
									17. ACCEPT BY <i>J.H. [Signature]</i> DATE <i>10-16-77</i>	

8-30-77 *RTL

RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-89	24	a.m. 2:50	7"		80°	8-31-77	15	979	Test after 24 hours
	-90						8-31-77	15	1672	submerged in water
	-91		HOLD				8-31-77	15	1616	
	-92		HOLD						1616	
									17. ACCEPT BY <i>J.H. [Signature]</i> DATE <i>10-20-77</i>	

8-31-77 *RTL

RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-93	24	a.m. 2:50	7"		80°	9-9-77	24	1231	Test dry after heat
	-94						9-9-77	24	1327	cycle
	-95						9-9-77	24	1314	
										17. ACCEPT BY <i>J.H. [Signature]</i> DATE <i>10-20-77</i>

9-9-77 *RTL

RL-605 (4-76)

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-96	24	a.m. 2:50	7"		80°	9-27-77	45	1415	Test wet after heat
-97						9-27-77	45	1415	cycle
-98						9-27-77	45	1415	
17. ACCEPT BY <i>[Signature]</i> DATE 9-27-77									

9-27-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C31 - PREPARATION
C143 - SLUMP
C172 - SAMPLING
C39 - STRENGTH
C231 - AIR CONTENT
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-99	50	3:00 a.m.	8-3/4"		82°	8-30-77	14	1534	Test dry
-100						8-30-77	14	1505	
-101		HOLD				8-30-77	14	HOLD	
-102		HOLD						HOLD	
17. ACCEPT BY <i>[Signature]</i> DATE 8-30-77									

8-30-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C31 - PREPARATION
C143 - SLUMP
C172 - SAMPLING
C39 - STRENGTH
C231 - AIR CONTENT
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-103	50	3:00 a.m.	8-3/4"		82°	8-31-77	15	852	Test after 24 hours
-104						8-31-77	15	809	submerged in water
-105		HOLD				8-31-77	15	HOLD	
-106		HOLD						HOLD	
17. ACCEPT BY <i>[Signature]</i> DATE 8-31-77									

8-31-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM:
C31 - PREPARATION
C143 - SLUMP
C172 - SAMPLING
C39 - STRENGTH
C231 - AIR CONTENT
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-107	50	3:00 a.m.	8-3/4"		82°	9-9-77	24	962	Test dry after heat
	-108						9-9-77	24	1007	cycle
	-109						9-9-77	24	1026	
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-26-77	

4-9-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section B										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-110	50	3:00 a.m.	8-3/4"		82°	9-27-77	45	1337	Test wet after heat
	-111						9-27-77	45	1174	cycle
	-112						9-27-77	45	1136	
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-26-77	

4-27-77 RTL*

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-113	24	6:00 a.m.	4-3/4"		84°	8-30-77	14	1304	Test dry
	-114						8-30-77	14	1310	
	-115		HOLD				8-30-77	14	1066	
	-116		HOLD						1066	
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-26-77	

8-30-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-117	24	6:00 a.m.	4-3/4"		84°	8-31-77	15	1019	Test after 24 hours
-118						8-31-77	15	1036	submerged in water
-119		HOLD				8-31-77	15		
-120		HOLD							
17. ACCEPT									
BY <i>J. H. [Signature]</i>									
DATE 10-26-77									

8-31-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-121	24	6:00 a.m.	4-3/4"		84°	9-9-77	24	1228	Test dry after
-122						9-9-77	24	1256	heat cycle
-123						9-9-77	24	1263	
17. ACCEPT									
BY <i>J. H. [Signature]</i>									
DATE 10-26-77									

9-9-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-124	24	6:00 a.m.	4-3/4"		84°	9-27-77	45	1415	Test wet after
-125						9-27-77	45	1415	heat cycle
-126						9-27-77	45	1415	
17. ACCEPT									
BY <i>J. H. [Signature]</i>									
DATE 10-26-77									

9-27-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-127	59	7:45 a.m.	9-3/4"		80°	8-30-77	14	965	Test dry
-128						8-30-77	14	1047	
-129		HOLD				8-30-77	14	Noted	
-130		HOLD						Noted	
									17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 10-30-77

8-30-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-131	54	7:45 a.m.	9-3/4"		80°	8-31-77	15	787	Test after 24 hours
132						8-31-77	15	992	submerged in water
133		HOLD						Noted	
-134		HOLD						Noted	
									17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 10-30-77

8-31-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7940-135	54	7:45 a.m.	9-3/4"		80°	9-9-77	24	655	Test dry after
-136						9-9-77	24	608	heat cycle
-137						9-9-77	24	627	
									17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 10-30-77

9-9-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY DATE PWA 8-16-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 103 Section D										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7940-138	54	7:45 a.m.	9-3/4"		80°	9-26-77	44	870	Test wet after
	-139						9-26-77	44	863	heat cycle
	-140						9-26-77	44	920	
17. ACCEPT BY: <i>J.H. [Signature]</i> DATE: 9-26-77									ASTM C31 - PREPARATION C39 - STRENGTH C94 - READY MIX C143 - SLUMP C172 - SAMPLING C231 - AIR CONTENT	

9-26-77 *RTL

1. PROJECT NO. B-120			2. WORK ORDER NO. C31315			3. PREPARED BY/DATE PWA 8-22-77			4. P.S.I. REQUIRED 130			5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A														
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS				
	7944-1	15	6:45 a.m.	8"		80°	9-1-77	10	1251	Test dry				
	-2						9-1-77	10	928					
	-3						hold							
	-4						hold							
	17. ACCEPT BY: <i>[Signature]</i> DATE: 9-1-77													

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

RL-605 (4-76)

1. PROJECT NO. B-120			2. WORK ORDER NO. C31315			3. PREPARED BY/DATE PWA 8-22-77			4. P.S.I. REQUIRED 130			5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A														
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS				
	7944-5	15	6:45 a.m.	8"		80°	9-1-77	10	747	Test after 24 hours				
	-6						9-1-77	10	713	submerged in water.				
	-7						hold							
	-8						hold							
	17. ACCEPT BY: <i>[Signature]</i> DATE: 9-1-77													

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

RL-605 (4-76)

1. PROJECT NO. B-120			2. WORK ORDER NO. C31315			3. PREPARED BY/DATE PWA 8-22-77			4. P.S.I. REQUIRED 130			5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A														
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS				
	7944-9	15	6:45 a.m.	8"		80°	9-9-77	18	934	Test dry after				
	-10						9-9-77	18	1008	heat cycle				
	-11						9-9-77	18	1064					
	17. ACCEPT BY: <i>[Signature]</i> DATE: 9-9-77													

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

RL-605 (4-76)

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-12	15	6:45 a.m.	8"		80°	9-27-77	36	1125	Test wet after
-13						9-27-77	36	1177	heat cycle
-14								1273	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-27-77									

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-27-77 *RTL RL-605 (4-76)

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-15	6	6:20 a.m.	9"		78°	9-1-77	10	1079	Test dry
-16						9-1-77	10	1290	
-17						hold			
-18						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-01-77									

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-01-77 *SMY RL-605 (4-76)

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-19	6	6:20 a.m.	9"		78°	9-1-77	10	1338	Test after 24 hours
-20						9-1-77	10	1245	submerged in water
-21						hold			
-22						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-01-77									

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-01-77 *SMY RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-23	6	6:20 a.m.	9"		78°	9-9-77	18	798	Test dry after
-24						9-9-77	18	826	heat cycle
-25						9-9-77	18	800	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE <i>9-9-77</i>									

9-9-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-26	6	6:20 a.m.	9"		78°	9-26-77	35	1111	Test wet after
-27						9-26-77	35	978	heat cycle
-28						9-26-77	35	887	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE <i>9-26-77</i>									

9-26-77 *RTL

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-29	55	3:15 a.m.	7-1/2"		78°	9-1-77	10	2063	Test dry
-30						9-1-77	10	1384	
-31						hold			
-32						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE <i>9-01-77</i>									

9-01-77 *SMJ

RL-605 (4-76)

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-33	55	3:15 a.m.	7-1/2"		78°	9-1-77	10	1327	Test after 24 hours
-34						9-1-77	10	1163	submerged in water
-35						hold			
-36						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-1-77									

9-01-77 *SAY

RL-605 (4-76)

ASTM: C143 - SLUMP
C39 - STRENGTH
C172 - SAMPLING
C231 - AIR CONTENT

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-37	55	3:15 a.m.	7-1/2"		78°	9-9-77	18	739	Test dry after
-38						9-9-77	18	777	heat cycle
-39						9-9-77	18	850	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-9-77									

9-9-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C39 - STRENGTH
C172 - SAMPLING
C231 - AIR CONTENT

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-40	55	3:15 a.m.	7-1/2"		78°	9-26-77	35	1282	Test wet after
-41						9-26-77	35	1241	heat cycle
-42						9-26-77	35	1270	
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-26-77									

9-26-77 *RTL

RL-605 (4-76)

ASTM: C143 - SLUMP
C39 - STRENGTH
C172 - SAMPLING
C231 - AIR CONTENT

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-43	24	1:40 a.m.	4-1/2"		80°	9-1-77	10	2119	Test dry
-44						9-1-77	10	1955	
-45						hold			
-46						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-01-77									

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-47	24	1:40 a.m.	4-1/2"		80°	9-1-77	10	1235	Test after 24 hours
-48						9-1-77	10	1961	submerged in water
-49						hold			
-50						hold			
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-01-77									

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-51	24	1:40 a.m.	4-1/2"		80°	9-9-77	18	1160	Test dry after
-52						9-9-77	18	1072	heat cycle
-53	NO TEST								
17. ACCEPT									
BY <i>[Signature]</i>									
DATE 9-9-77									

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-54	24	1:40 a.m.	4-1/2"		80°	9-27-77	36	1136	Test wet after
-55						9-27-77	36	1360	heat cycle
-56						9-27-77	36	1333	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-27-77

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C172 - SAMPLING
C231 - AIR CONTENT
C94 - READY MIX

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-57	19	5:40 a.m.	9"		76°	9-1-77	10	1950	Test dry
-58						9-1-77	10	846	
-59						hold			
-60						hold			
									17. ACCEPT BY <i>[Signature]</i> DATE 9-01-77

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C172 - SAMPLING
C231 - AIR CONTENT
C94 - READY MIX

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-61	19	5:40 a.m.	9"		76°	9-1-77	10	538	Test after 24 hours
-62						9-1-77	10	707	submerged in water
-63						hold			
-64						hold			
									17. ACCEPT BY <i>[Signature]</i> DATE 9-01-77

ASTM: C143 - SLUMP
C31 - PREPARATION
C39 - STRENGTH
C172 - SAMPLING
C231 - AIR CONTENT
C94 - READY MIX

RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7944-65	19	5:40 a.m.	9"		78°	9-9-77	18	852	Test dry after
	-66						9-9-77	18	764	heat cycle
	-67						9-9-77	18	877	
17. ACCEPT BY: <i>[Signature]</i> DATE: 9-9-77										

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7944-68	19	5:40 a.m.	9"		76°	9-26-77	35	1129	Test wet after
	-69						9-26-77	35	1201	heat cycle
	-70						9-26-77	35	1096	
17. ACCEPT BY: <i>[Signature]</i> DATE: 9-26-77										

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
RL-605 (4-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7944-71	7	5:10 a.m.	5-1/4"		78°	9-1-77	10	1146	Test dry
	-72						9-1-77	10	1214	
	-73						hold			
	-74						hold			
17. ACCEPT BY: <i>[Signature]</i> DATE: 9-01-77										

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX
RL-605 (4-76)

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-75	7	5:10 a.m.	5-1/4"		78°	9-1-77	10	750	Test after 24 hours
-76						9-1-77	10	789	submerged in water
-77						hold			
-78						hold			
									17. ACCEPT BY: <i>[Signature]</i> DATE: <i>[Signature]</i>

9-01-77 *87%

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-79	7	5:10 a.m.	5-1/4"		78°	9-9-77	18	860	Test dry after
-80						9-9-77	18	852	heat cycle
-81						9-9-77	18	917	
									17. ACCEPT BY: <i>[Signature]</i> DATE: <i>[Signature]</i>

9-9-77 *127L

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

CONCRETE TEST DATA

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-22-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-82	7	5:10 a.m.	5-1/4"		78°	9-27-77	36	1081	Test wet after
-83						9-27-77	36	1112	heat cycle
-84						9-27-77	36	1207	
									17. ACCEPT BY: <i>[Signature]</i> DATE: <i>[Signature]</i>

9-27-77 *127L

RL-605 (4-76)

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-85	54	3:00 a.m.	5-3/4"		79°	9-26-77	34	1415	Test dry
-86						9-26-77	34	1415	
-87		HOLD							
-88		HOLD							
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 9-26-77									

 ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-89	54	3:00 a.m.	5-3/4"		79°	9-27-77	35	1415	Test after 24 hours
-90						9-27-77	35	1415	submerged in water
-91		HOLD							
-92		HOLD							
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 9-27-77									

 ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-93	54	3:00 a.m.	5-3/4"		79°	10-3-77	41	878	Test dry after heat
-94						10-3-77	41	911	cycle
-95						10-3-77	41	1010	
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 10-3-77									

 ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120	2. WORK ORDER NO. C31315	3. PREPARED BY/DATE PWA 8-23-77	4. P.S.I. REQUIRED 130	5. TESTED BY Battelle*					
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-96	54	3:00 a.m.	5-3/4"		79°	10-4-77	42	1372	Test wet after heat
-97						10-4-77	42	1334	cycle
-98						10-4-77	42	1410	
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 10-10-77									

10-4-77 *RTL

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120	2. WORK ORDER NO. C31315	3. PREPARED BY/DATE PWA 8-23-77	4. P.S.I. REQUIRED 130	5. TESTED BY Battelle *					
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-99	21	2:00 a.m.	9-1/4"		80°	9-26-77	34	1415	Test dry
-100						9-26-77	34	1415	
-101		HOLD							
-102		HOLD							
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 9-26-77									

9-26-77 *RTL

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120	2. WORK ORDER NO. C31315	3. PREPARED BY/DATE PWA 8-23-77	4. P.S.I. REQUIRED 130	5. TESTED BY Battelle *					
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-103	21	2:00 a.m.	9-1/4"		80°	9-27-77	35	1415	Test after 24 hours
-104						9-27-77	35	1415	submerged in water
-105		HOLD							
-106		HOLD							
17. ACCEPT									
BY: <i>[Signature]</i>									
DATE: 9-27-77									

9-27-77 *RTL

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-107	21	2:00 a.m.	9-1/4"		80°	10-3-77	41	1142	Test dry after heat
-108						10-3-77	41	1304	cycle
-109						10-3-77	41	1199	
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-3-77

10-3-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-110	21	2:00 a.m.	9-1/4"		80°	10-4-77	42	1415	Test wet after heat
-111						10-4-77	42	1415	cycle
-112						10-4-77	42	1415	
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-4-77

10-4-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-113	24	5:30 a.m.	9-1/2"		78°	9-26-77	34	1415	Test dry
-114						9-26-77	34	1415	
-115		HOLD							
-116		HOLD							
									17. ACCEPT BY: <i>[Signature]</i> DATE: 10-26-77

10-26-77 *RTL

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7944-117	24	5:30 a.m.	9-1/2"		78°	9-27-77	35	1105	Test after 24 hours
	-118						9-27-77	35	833	submerged in water
	-119		HOLD							
	-120		HOLD							
									17. ACCEPT BY <i>[Signature]</i> DATE 9-27-77	

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7944-121	24	5:30 a.m.	9-1/2"		78°	10-3-77	41	919	Test dry after heat
	-122						10-3-77	41	951	cycle
	-123						10-3-77	41	934	
										17. ACCEPT BY <i>[Signature]</i> DATE 10-3-77

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 8-23-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *		
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7944-124	24	5:30 a.m.	9-1/2"		78°	10-4-77	42	1244	Test wet after heat
	-125						10-4-77	42	1361	cycle
	-126						10-4-77	42	1169	
										17. ACCEPT BY <i>[Signature]</i> DATE 10-4-77

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120	2. WORK ORDER NO. C31315	3. PREPARED BY/DATE PWA 8-23-77	4. P.S.I. REQUIRED 130	5. TESTED BY Battelle *					
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-127	51	6:15 a.m.	7-3/4"		75°	9-26-77	34	1415	Test dry
-128						9-26-77	34	1415	
-129		HOLD							
-130		HOLD							
17. ACCEPT									
BY									
DATE									

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT

C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-26-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120	2. WORK ORDER NO. C31315	3. PREPARED BY/DATE PWA 8-23-77	4. P.S.I. REQUIRED 130	5. TESTED BY Battelle *					
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-131	51	6:15 a.m.	7-3/4"		75°	9-27-77	35	1134	Test after 24 hours
-132						9-27-77	35	1096	submerged in water
-133		HOLD							
-134		HOLD							
17. ACCEPT									
BY									
DATE									

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT

C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-27-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120	2. WORK ORDER NO. C31315	3. PREPARED BY/DATE PWA 8-23-77	4. P.S.I. REQUIRED 130	5. TESTED BY Battelle *					
6. POUR DESCRIPTION Insulating Concrete Tank 104 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7944-135	51	6:15 a.m.	7-3/4"		75°	10-3-77	41	993	Test dry after heat
-136						10-3-77	41	961	cycle
-137						10-3-77	41	1002	
17. ACCEPT									
BY									
DATE									

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT

C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

10-3-77 *RTL

54-2099-605 RL-605 (REV. 11-76)

[illegible]

CONCRETE TEST DATA

C31 - PREPARATION	ASTM:	C143 - SLUMP
C39 - STRENGTH		C172 - SAMPLING
C94- READY MIX		C231 - AIR CONTENT

C-99

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-20-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section c									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-1	23		3"		70°	9-28-77	8	1169	Test dry
-2	"		"		"	9-28-77	8	1415	
-15	58		9"		74°	9-28-77	8	1415	
-16	"		"		"	9-28-77	8	1415	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-28-77

CONCRETE TEST DATA

 ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

4-28-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-20-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section c									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-3	23		3"		70°			NO TEST	Test after 24 hours
-4	"		"		"	9-28-77	8	1415	submerged in water
-17	58		9"		74°	9-28-77	8	1415	
-18	"		"		"	9-28-77	8	1415	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-28-77

CONCRETE TEST DATA

 ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

4-28-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-20-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-29	4		8-1/4"		76°	9-28-77	8	1415	Test dry
-30	"		"		"	9-28-77	8	1415	
-43	18		9"		76°	9-28-77	8	1415	
-44	"		"		"	9-28-77	8	1415	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-28-77

CONCRETE TEST DATA

 ASTM:
 C143 - SLUMP
 C172 - SAMPLING
 C231 - AIR CONTENT
 C31 - PREPARATION
 C39 - STRENGTH
 C94 - READY MIX

4-28-77 *RTL

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-20-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-31	4		8-1/4"		76°	9-28-77	8	> 1415	Test after 24 hours
-32	"		"		"	9-28-77	8	> 1415	submerged in water
-45	18		9"		76°	9-28-77	8	> 1415	
-46	"		"		"	9-28-77	8	> 1415	
17. ACCEPT									
BY									
DATE									

9-28-77 *RTL.

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-20-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-57	6		8"		72°	9-28-77	8	> 1415	Test dry
-58	"		"		"	9-28-77	8	> 1415	
-71	20		9-1/4"		70°	9-28-77	8	> 1415	
-72	"		"		"	9-28-77	8	> 1415	
17. ACCEPT									
BY									
DATE									

9-28-77 *RTL.

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-20-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-59	6		8"		72°	9-28-77	7	> 1415	Test after 24 hours
-60	"		"		"	9-28-77	7	> 1415	submerged in water
-73	20		9-1/4"		70°	9-28-77	7	> 1415	
-74	"		"		"	9-28-77	7	> 1415	
17. ACCEPT									
BY									
DATE									

9-28-77 *RTL.

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-21-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-85	23		5"		68°	9-28-77	7	1370	Test dry
-86	"		"		"	9-28-77	7	1359	
-99	55		7"		72°	9-28-77	7	1415	
-100	"		"		"	9-28-77	7	1415	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-28-77

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-28-77 *RTL

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-21-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-87	23		5"		68°	9-28-77	7	1023	Test after 24 hours
-88	"		"		"	9-28-77	7	1073	submerged in water
-101	55		7"		72°	9-28-77	7	1415	
-102	"		"		"	9-28-77	7	1415	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-28-77

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-28-77 *RTL

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-21-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-113	21		8-1/4"		70°	9-28-77	7	1415	Test dry
-114	"		"		"	9-28-77	7	1415	
-127	47		5"		72°	9-28-77	7	1415	
-128	"		"		"	9-28-77	7	1415	
									17. ACCEPT BY <i>[Signature]</i> DATE 9-28-77

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

9-28-77 *RTL

54-2099-608 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 9-21-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 105 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7941-115	21		8-1/4"		70°	9-28-77	7	1415	Test after 24 hours
-116	"		"		"	9-28-77	7	1299	submerged in water
-129	47		5"		72°	9-28-77		1391	
-130	"		"		"	9-28-77		1415	
								17. ACCEPT BY <i>[Signature]</i> DATE <i>[Signature]</i>	

CONCRETE TEST DATA

9-28-77 *RTL

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-1	18		7-1/2"		60°	10-10-77	3	1415	Test dry
-2	"		"		"	10-10-77	3	1415	
-15	58		4-1/2"		62°	10-10-77	3	1415	
-16	"		"		"	10-10-77	5	933	
									17. ACCEPT DATE 11-4-77

10-10-77 RTL*

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section C									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-3	18		7-1/2"		60°	10-11-77	6	1415	Test after 24 hours
-4	"		"		"	10-11-77	6	1415	submerged in water
-17	58		4-1/2"		62°	10-11-77	6	1386	
-18	"		"		"	10-11-77	6	1174	
									17. ACCEPT DATE 11-4-77

10-11-77 RTL*

54-2099-605 RL-605 (REV. 11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Section E Tank 106									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-29	5		5"		68°	10-10-77	5	1316	Test dry
-30	"		"		"	10-10-77	3	1415	
-43	20		8"		68°	10-10-77	3	1415	
-44	"		"		"			NO TEST	
									17. ACCEPT DATE 11-4-77

10-10-77 RTL*

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section E									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-31	5		5"		68°	10-11-77	8	1415	Test after 24 hours
-32	"		"		"	10-11-77	8	1415	submerged in water
-45	20		8"		68°	10-11-77	8	1415	
-46	"		"		"	10-11-77	8	1415	
17. ACCEPT BY <i>J. H. Harris</i> DATE 11-4-77									

10-11-77 *R.L.

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-57	7		6"		70°	10-10-77	8	1415	Test Dry
-58	"		"		"	10-10-77	8	1415	
-71	17		6-1/2"		70°	10-10-77	8	1415	
-72	"		"		"	10-10-77	8	1415	
17. ACCEPT BY <i>J. H. Harris</i> DATE 11-4-77									

10-10-77 *R.L.

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-5-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section A									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-59	7		6"		70°	10-11-77	8	1415	Test after 24 hours
-60	"		"		"	10-11-77	8	1415	submerged in water
-73	17		6-1/2"		70°	10-11-77	8	1415	
-74						10-11-77	8	1415	
17. ACCEPT BY <i>J. H. Harris</i> DATE 11-4-77									

10-11-77 *R.L.

CONCRETE TEST DATA

ASTM: C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-6-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-85	18		7-1/2"		62°	10-20-77	14	1879	Test dry
-86	"		"		"	10-20-77	14	2079	
-99	50		7"		64°	10-20-77	14	1899	
-100	"		"		"	10-20-77	14	2140	
									17. ACCEPT BY <i>J. H. Harnish</i> DATE 11-4-77

10-20-77 *RIL

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-6-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section B									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-87	18		7-1/2"		64°	10-21-77	15	1486	Test after 24 hours
-88	"		"		"	10-21-77	15	1341	submerged in water
-101	50		7"		64°	10-21-77	15	1454	
-102						10-21-77	15	1797	
									17. ACCEPT BY <i>J. H. Harnish</i> DATE 11-4-77

10-21-77 *RIL

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-6-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle *	
6. POUR DESCRIPTION Insulating Concrete Tank 106 Section D									
7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
7945-113	16		8"		64°	10-20-77	14	2153	Test dry
-114	"		"		"	10-20-77	14	2192	
-127	50		8"		64°	10-20-77	14	2148	
-128	"		"		"	10-20-77	14	2201	
									17. ACCEPT BY <i>J. H. Harnish</i> DATE 11-4-77

10-20-77 *RIL

CONCRETE TEST DATA

ASTM:
C143 - SLUMP
C172 - SAMPLING
C231 - AIR CONTENT
C31 - PREPARATION
C39 - STRENGTH
C94 - READY MIX

54-2099-605 RL-605 (REV.11-76)

1. PROJECT NO. B-120		2. WORK ORDER NO. C31315		3. PREPARED BY/DATE PWA 10-6-77		4. P.S.I. REQUIRED 130		5. TESTED BY Battelle*		
6. POUR DESCRIPTION Insulating Concrete Tank 106 SectionD										
CONCRETE TEST DATA	7. CYL. NO.	8. MIX NO.	9. TIME	10. SLUMP	11. %AIR	12. TEMP.	13. TEST DATE	14. AGE	15. P.S.I.	16. REMARKS
	7945-115	16		8"		64°	10-21-77	15	2111	Test after 24 hours
	-116	"		"		"	10-21-77	15	1319	submerged in water
	-129	50		8"		64°	10-21-77	15	2102	
	-130	"		"		"	10-21-77	15	2162	
17. ACCEPT BY <i>[Signature]</i> DATE 11-4-77									ASTM: C143 - SLUMP C172 - SAMPLING C231 - AIR CONTENT C31 - PREPARATION C39 - STRENGTH C94 - READY MIX	

10-21-77 *RTL

App Figure C-39. November 18, 1977 Lite Wate #70 Thermal Test Results

TRANSMITTAL NO. B-120-85

DATE November 18, 1977

TO: Distribution
 FROM: A. W. Akerson
 PROJ. OR SUBJECT: Project B-120, 241-AW Tank Farm
Phase IV, Steel Tanks
Title III, W.O. C12003

70412

NO. OF EACH	DISTRIBUTION	LOCATION
1	RD Freeberg, DOE-RL	FB
1	AG Lassila, DOE-RL	FB
0	JF Albaugh, RHO	2704W
1	JD Galbraith, RHO	2704W
1	JJ Flannery, JAJ, 241-AW trlr. 200E	FB
1	AW Akerson, Vitro	FB
0	P. Felise	FB
0	IMA Garcia/WH Brayman	2101M
1	JM Johnston	FB
0	CW Kelley	FB
1	JH Kleinpeter	FB
0	DG Lien/EA Goakey	FB
0	EV Norris	FB
0	EE Smith	FB
1	Central Files	FB

ATTACHED ARE	THEY ARE TO BE USED FOR	THESE ARE	PLEASE NOTE	PLEASE COMMENT
☒ Data PRINTS	☒ INFORMATION	☐ PRELIMINARY	☐ REVISION	☐ APPROVE
☐ SPECIFICATIONS	☐ ESTIMATING	☐ UNCHECKED	☐ HOLDS	☐
☐ ATP	☐ SECURING QUOT.	☒ CHECKED		☐
☐ REQ. WORK SHEET	☐ ORDERING MAT'L.	☐ FINAL		☐
☐ WORK PLAN	☐ CONSTRUCTION	☐ APPROVED		☐
☐ E & M LIST				☐

Attached are the results of the following thermal gradient tests (for relative thermal conductivity--k factor--determination) performed by Battelle Pacific Northwest Laboratories for Lite Wate #70 castable refractory:

- Tank 241-AW-102
Field Cast Cylinder; 500F, 1000F and 1500F, covered and uncovered
Field Core; 500F, 1000F and 1500F, covered and uncovered
- Tanks 241-AW-103, 104, 105 and 106
Field Cast Cylinder; 1000F, uncovered

References: 1. Transmittal #B-120-84, transmitting analysis of Lite Wate #70 and compressive strength tests and thermal gradient tests of laboratory-mixed and cast Lite Wate #70.
 2. Transmittal #B-120-83, which summarizes other insulating concrete test data distributed to date.

K&E
10 X 10 TO 14 INCH 2 X 10 INCHES
KLEINFELDER & ESSER CO. MADE IN U.S.A.

46 1320

TANK 241-10-10-10
Field Cast Ground
500°F Uncovered
Line Wate #70

FIELD WITH GRADIENT TEST
LITE WATE-70 (FIELD CAST)

83-77

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 500 °F
	<u>T/C 2</u>	<u>3</u>	<u>4</u>	
IMB. 1230	78	78	78	SPECIMEN UN COVERED
1/2 1300	78	78	78	
1 1330	78	78	78	
1 1/2 1400	81	78	78	
2 1430	83	78	78	
2 1/2 1500	84	79	79	
3 1530	85	79	79	
3 1/2 1600	87	79	79	
4 1630	88	80	80	
4 1/2 1700	89	81	81	
5				
5 1/2				
6				
6 1/2				
7				

RTL

K&E
10 X 10 TO 1/2 INCH 7 X 1/2 INCHES
KIEFFER, & ESSEN CO. MADE IN U.S.A.

46 1320

TAKE 24-10-10 C
FROD CAST GUINER
500°F COVERED
LINE WARE #70

TEMPERATURE GRADIENT TEST
LITE WATE-70 (FIELD CAST)

8-3-77

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 500 °F
	<u>1/2</u>	<u>3</u>	<u>4</u>	
AMB. 1700	78	78	78	SPECIMEN COVERED
1/2 1730	110	78	78	
1 1800	137	82	78	
1 1/2 1830	141	86	80	
2 1700	146	88	82	
2 1/2 1930	149	90	84	
3 2000	152	92	84	
3 1/2 2030	153	93	86	
4 2100	155	94	87	
4 1/2 2130	157	95	87	
5 2200	157	96	87	
5 1/2				
6				
6 1/2				
7				

RTL

K&E
10 X 10 TO 1/2 INCH 7 X 10 INCHES
KROFFEL & EISEN CO. MADE IN U.S.A.

46 1320

Form 241-AW-102
Field Cast Cylinder
1000°F Covered
Note Water #70

TEMPERATURE GRADIENT TEST
LITE WATE-70 (FIELD CAST)

8-4-77

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F
	<u>1/2</u>	<u>3</u>	<u>4</u>	
AMB. 0930	79	79	79	SPECIMEN COVERED
1/2 1000	150	92	88	
1 1030	189	103	97	
1 1/2 1100	208	117	104	
2 1130	212	120	105	
2 1/2 1200	221	125	108	
3 1230	233	127	110	
3 1/2 1300	242	129	110	
4 1330	252	130	112	
4 1/2 1400	257	130	112	
5 1430	262	130	112	
5 1/2 1500	264	130	112	
6 1530	265	130	112	
6 1/2				
7				

RTL

K&E
10 X 10 TO 1/2 INCH 2 X 10 INCHES
KUPFEL & ESSER CO. MADE IN USA

46 1320

Form 241-AW-107
Field Cast Specimen
1000°F Uncovered
Late Water #70

8-5-77 TEMPERATURE GRADIENT TEST
LITE WATE-70 (FIELD CAST)

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F
	<u>1/2</u>	<u>3</u>	<u>4</u>	
AMB. 0700	78	78	78	SPECIMEN CAN COVERED
1/2 0730	152	96	92	
1 0800	190	109	101	
1 1/2 0830	200	117	106	
2 0900	205	120	109	
2 1/2 0930	207	123	111	
3 1000	219	125	112	
3 1/2 1030	230	127	113	
4 1100	238	127	114	
4 1/2 1130	243	127	114	
5 1200	244	127	114	
5 1/2				
6				
6 1/2				
7				

W
 RTL

KE 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KAYE & CO. INC. MADE IN U.S.A.

46 1320

Test 241-AW-102
Fire Cast Cymoch
1500°F Covered
Line Wires #70

LITERATURE GRADIENT 1951
LITE WATE-70 (FIELD CAST)

8-5-77

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1600 °F
	1/2	3	4	
1 MB. 1500	79	79	79	SPECIMEN COVERED
1/2 1530	192	102	95	
1 1600	273	118	106	
1 1/2 1630	315	132	114	
2 1700	336	140	116	
2 1/2 1730	350	144	121	
3 1800	358	147	122	
3 1/2 1830	361	148	123	
4 1900	365	150	124	
4 1/2 1930	367	150	124	
5 2000	367	150	124	
5 1/2				
6				
6 1/2				
7				

RTL

K-E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KUPFER & ESSER CO. MADE IN U.S.A.

46 1320

TANK 241-AW-102
Field Cast Cylinder
1500°F Uncooled
Lite White #70

~~TEMPERATURE GRADIENT TEST~~
LITE WATE-70 (FIELD CAST)

8-8 77

<u>TIME</u> <u>HRS.</u>	<u>TEMPERATURE (°F)</u>			<u>TEST TEMP.</u> 1500 °F
	<u>1/C 2</u>	<u>3</u>	<u>4</u>	
AMB. 0830	80	80	80	
1/2 0900	151	96	91	SPECIMEN IN COVERED
1 0930	258	117	108	
1 1/2 1000	287	108	116	
2 1030	311	136	121	
2 1/2 1100	327	140	123	
3 1130	337	142	125	
3 1/2 1200	342	143	126	
4 1230	346	143	126	
4 1/2 1300	348	143	126	
5				
5 1/2				
6				
6 1/2				
7				

RTL

12

10 X 10 TO 1/4 INCH 7 X 10 INCHES
REO/AL. & EARTH CO. MAINT. 112

46 1320

TAKE 241-AW-10 c
FIELD CORE
500°F UNCOVERED
LITE WARE #70

TEMPERATURE GRADIENT TEST CORE
LITE WATE-70 (FIELD CASE) 2.7" DIA

ME RS.	TEMPERATURE (°F)			TEST TEMP. 500 °F
	<u>T/C 2</u>	<u>3</u>	<u>X</u>	
B. 1030	77	77		SPECIMEN UNCOVERED
1100	102	86		
1130	126	92		
1200	135	94		
1230	143	96		
1300	147	97		
1330	148	97		
1400	150	98		
1430	152	98		
1500	153	98		
1530	154	98		
1/2				

1/2

RTL
8-15-77

14

KE 10 X 10 TO 1/4 INCH 7 X 10 INCHES
KUPFEL & ESSER CO. MADE IN U.S.A.

46 1320

TRAM 241-AW-102
FIELD Core
500°F COVERED
LITE WHITE #70

THERMAL GRADIENT TEST CORE
LIVE WATE-70 (FIELD CAST) 2.7"

<u>TIME</u> <u>HRS.</u>	<u>TEMPERATURE (°F)</u>			<u>TEST TEMP.</u> 500°F
	<u>T/C 2</u>	<u>3</u>	<u>4</u>	
AMB. 1300	76	76		SPECIMEN COVERED
1/2 1330	99	82		
1 1400	125	87		
1 1/2 1430	146	94		
2 1500	153	96		
2 1/2 1530	155	97		
3 1600	158	99		
3 1/2 1630	161	99		
4 1700	163	100		
4 1/2 1730	164	100		
5				
5 1/2				
6				
6 1/2				
7				

RTL
8-16-71

LITER/MIL GRADIENT / C 3 / CORE
LITE WATE-70 (FIELD ~~SET~~) 2.7"

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F
	<u>T/C 2</u>	<u>3</u>	<u>4</u>	
9MB. 0930	77	77		
1/2 1000	134	94		SPECIMEN UNCOVERED
1 1030	184	108		
1 1/2 1100	209	114		
2 1130	221	116		
2 1/2 1200	230	117		
3 1230	236	118		
3 1/2 1300	239	119		
4 1330	241	119		
4 1/2 1400	242	120		
5 1430	243	120		
5 1/2				
6				
6 1/2				
7				

RTL
8-17-78

K&E
10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

Task 241-AW-102
From Core
1000°F Covered
Line Wire #70

TEMPERATURE GRADIENT TEST
LITE WATE-70 (FIELD CAST)

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F
	<u>T/C 2</u>	<u>3</u>	<u>4</u>	
AMB. 1430	84	84		SPECIMEN COVERED
1/2 1500	137	92		
1 1530	184	104		
1 1/2 1600	216	114		
2 1630	229	117		
2 1/2 1700	239	120		
3 1730	245	121		
3 1/2 1800	249	122		
4 1830	252	123		
4 1/2 1900	253	123		
5				
5 1/2				
6				
6 1/2				
7				

RTL

8-18-72b

K&E
10 X 10 TO 1/4 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

Trunk 241-AW-102
Field Core
1500°F Covered
Line Water #70

2

~~LITE WATER - 70 (FIELD CAST)~~
LITE WATER - 70 (FIELD CAST)

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1500 °F
	<u>1/2</u>	<u>3</u>	<u>4</u>	
AMB. 1030	80	80		SPECIMEN COVERED
1/2 1100	191	105		
1 1130	266	122		
1 1/2 1200	298	133		
2 1230	313	138		
2 1/2 1300	323	141		
3 1330	329	143		
3 1/2 1400	332	144		
4 1430	335	145		
4 1/2 1500	336	146		
5 1530	337	146		
5 1/2				
6				
6 1/2				
7				

RTL
8-19-72

KE 10 X 10 TO 14 INCH 2 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

TRUCK 241-AW-102
FRESH COKE
1500°F. UNCOVERED
LITE WASTE #70

23

TEMPERATURE GRADIENT TEST
LITE WATE-70 (FIELD CAST)

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1500 °F
	<u>1/2</u>	<u>3</u>	<u>4</u>	
MB. 1030	79	79		SPECIMEN UNCOVERED
1/2 1100	170	113		
1130	233	127		
1/2 1200	254	131		
1230	277	136		
1/2 1300	287	138		
1330	292	140		
1/2 1400	295	140		
1430	297	141		
1/2 1500	298	141		
1530	299	141		
1/2				
1/2				

RTL

8-22-77₂₄

HOE 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

TAKE 241-AW-103
FIELD CAST CYLINDER
1000°F UNCOVERED
LINE WIRE #70

TEMPERATURE GRADIENT TEST
LITE WATE - 70 (FIELD CAST)

9-29-77

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F TANK 103 #7940 B4 SPECIMEN UN COVERED
	<u>1/2 2</u>	<u>3</u>	<u>4</u>	
4B. 1100	74	74	74	
1/2 1130	125	87	83	
1 1200	170	94	88	
1/2 1230	187	100	90	
2 1300	191	103	90	
1/2 1330	197	105	91	
3 1400	207	107	92	
1 1/2 1430	213	107	92	
4 1500	217	108	92	
1 1/2 1530	220	108	92	
5 1600	221	108	92	
5 1/2 1630	222	108	93	

1/2

7

RTL
9-29-77 26

K&E 10 X 10 TO 1 1/2 INCH 7 X 10 INCHES
KROHNE & HESSER CO. MADE IN U.S.A.

46 1320

Town 241-AW-104
Field Cast Gravel
1000°F Uncovered
Air-Water #70

30-77

TEMPERATURE GRADIENT TEST
LITE WATER - 70 (FIELD CAST)

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F TANK 104 7944-C4
	<u>1/2 2</u>	<u>3</u>	<u>4</u>	
1B. 0930	72	72	72	SPECIMEN UN COVERED
1/2 1000	116	83	80	
1030	164	91	85	
1/2 1100	187	101	92	
1130	191	105	94	
1/2 1200	197	107	94	
1230	206	108	94	
1/2 1300	211	108	94	
1330	216	108	94	
1/2 1400	220	109	95	
1430	223	109	94	
1/2 1500	223	109	94	

1/2

RTL

9-30-77 28

10 X 10 TO THE 1/2 INCH
MATHIL N. REICH CO.
MADE IN U.S.A.

8

TRUCK 241-AW-105
FIELD CAST CYLINDER
1000°F UNCOVERED
LITE WHITE #70

<u>TEMPERATURE GRADIENT TEST</u>				
<u>LITE WATE - 70 (FIELD CAST)</u>				
0-11-77				
TIME	TEMPERATURE (°F)			TEST TEMP.
HRS.	<u>1/2</u>	<u>3</u>	<u>4</u>	1000 °F
MB. 0900	65	65	65	
1/2 0930	131	75	72	SPECIMEN UNCOVERED
1 1000	156	83	76	TANK 105
1 1/2 1030	173	91	80	SECTION D
2 1100	182	97	84	
2 1/2 1130	187	100	86	
3 1200	189	101	87	
3 1/2 1230	191	103	88	
4 1300	192	104	88	
4 1/2 1330	193	104	89	
5 1400	193	105	89	
5 1/2				
6				
6 1/2				
7				

RTL

16-2
10 X 10 TO THE 1/2 INCH
358-11
MATERIAL & DESIGN CO.
MADE IN U.S.A.

Trunk 241-AW-100
Field Cast Glycol
1000°F Uncovered
Line like #70

31

THERMAL GRADIENT TEST
LITE WATE-70 (FIELD CAST)

0-12-77

TIME HRS.	TEMPERATURE (°F)			TEST TEMP. 1000 °F
	<u>T/C 2</u>	<u>3</u>	<u>4</u>	
4B. 0830	65	65	65	SPECIMEN UNCOVERED TANK 106 SECTION A
1/2 0900	115	73	70	
1 0930	147	81	75	
1/2 1000	165	90	80	
2 1030	174	94	82	
2 1/2 1100	180	97	84	
3 1130	184	100	85	
3 1/2 1200	185	101	86	
4 1230	186	101	86	
4 1/2 1300	187	102	86	
5 1330	187	102	87	
5 1/2				
6				
6 1/2				
7				

RTL

32

App Figure C-40. November 18, 1977 Lite Wate #70 Laboratory Analysis and Testing

TRANSMITTAL NO. B-120-84DATE November 18, 1977

TO: Distribution

FROM: A. W. Akerson *A. W. Akerson*

PROJ. OR SUBJECT Project B-120, 241-AW Tank Farm
 Phase IV, Steel Tanks
 Title III, W.O. C12003

7-11-77

NO. OF EACH	DISTRIBUTION :	LOCATION
1	RD Freeberg, DOE-RL	FB
1	AG Lassila, DOE-RL	FB
0	JF Albaugh, RHO	2704W
1	JD Galbraith, RHO	2704W
1	JJ Flannery, JAJ, 241-AW Trlr. 200I	
1	AW Akerson, Vitro	FB
0	P. Felise	FB
0	IMA Garcia/WH Brayman	FB
1	JM Johnston	2101M
0	CW Kelley	FB
1	JH Kleinpeter	FB
0	DG Lien/EA Goakey	FB
0	EV Norris	FB
0	EE Smith	FB
1	Central Files	FB

ATTACHED ARE	THEY ARE TO BE USED FOR	THESE ARE	PLEASE NOTE	PLEASE
☒ Data PRINTS	☒ INFORMATION	☐ PRELIMINARY	☐ REVISION	☐ COMMENT
☐ SPECIFICATIONS	☐ ESTIMATING	☐ UNCHECKED	☐ HOLDS	☐ APPROVE
☐ ATP	☐ SECURING QUOT.	☐ CHECKED		
☐ REQUISITIONS	☐ ORDERING MAT'L.	☒ FINAL		
☐ REQ. WORK SHEET	☐ CONSTRUCTION	☐ APPROVED		
☐ WORK PLAN				
☐ E & M LIST				

DRAWING NUMBERS, TITLES AND COMMENTS:

Attached are the results of the following work performed on Lite Wate #70 by Battelle Pacific Northwest Laboratories:

- Analysis of Lite Wate #70
- Compressive strength tests of laboratory-mixed and cast Lite Wate #70
- Thermal gradient tests of laboratory-mixed and cast Lite Wate #70

Note: Preparation of laboratory-mixed and cast cylinders was accomplished in accordance with the methods previously used in the Ref. 1 evaluation; except, the water added to the mix was held as close as possible to 27 1/2%, by weight.

- References: 1. Letter, RE Westerman (BNW) to DE Anderson (Vitro), 10/16/74, transmitting EVALUATION OF "LITE WATE 50" CASTABLE REFRACTORY
2. Transmittal #B-120-83, which summarizes other insulating concrete test data distributed to date.

Project Number _____

Internal Distribution

Date August 12, 1977
To A. W. Akerson/C. W. Kelley
From R. W. Sanders
Subject ANALYSIS OF LITE WATE 70

Two bags of Lite Wate 70 were received by this laboratory for constituent analysis. One bag was delivered by JAJ from A. W. Akerson, the other from C. W. Kelley. The bags were given I.D. numbers of LW-70(A) (Akerson) and LW-70(CK) (Kelley) and grab-sampled top and bottom (500 cc). The remaining material was coned and quartered to 1/64 of the original volume to produce a homogeneous sample. The three samples from each bag were hammer-milled, coned and quartered to proper sample size. The homogenized samples were analyzed by AA using a LiBO_2 fusion procedure. The analytical data generated by Atomic Absorption Analysis were used to standardize the Energy Dispersive X-Ray Analysis.

The results of the analysis demonstrated within error agreement on the homogenized samples as well as quite good agreement on the grab (top and bottom) samples from the undisturbed bags.

RWS/sek
Attachment

RECEIVED

OCT 13 1977

VITRO
ERO, MGMT.

LITE WATE 70

Analysts: R. W. Sanders and C. L. Nelson
Battelle-Northwest

Sample	Analytical Method	Al ₂ O ₃ (%)	SiO ₂ (%)	CaO(%)
Lite Wate 70 (A) Coned & quartered	AA ^(a)	27.6±0.6	40.9±1.3	14.8±0.7
	XRF(1) ^(b)	27.6±1.6 ^(c)	40.9±0.6	14.9±0.2
	XRF(2)	27.3±1.8	41.8±0.6	15.0±0.2
	Density =	1.18 g/cc		
Lite Wate 70 (CK) Coned and quartered	AA	27.8±0.6	40.3±1.3	15.0±0.7
	XRF(1)	29.7±1.8	39.4±0.6	15.3±0.2
	XRF(2)	26.4±1.6	39.5±0.6	15.4±0.2
	Density =	1.15 g/cc		
Lite Wate 70 (A) Top grab	XRF(1)	28.2±1.7	42.9±0.6	14.7±0.2
	XRF(2)	25.9	42.9	14.9
Bottom grab	XRF(1)	26.8	43.2	15.0
	XRF(2)	27.6	43.6	14.9
Lite Wate 70 (CK) Top grab	XRF(1)	28.3	38.3	15.9
	XRF(2)	29.9	39.0	15.9
Bottom grab	XRF(1)	27.0	42.4	14.5
	XRF(2)	27.1	44.0	14.4

^(a) Atomic Absorption Analysis (AA)^(b) Energy-Dispersive X-Ray Fluorescence (XRF)^(c) XRF data is based on destructive analysis by AA. Errors for XRF data are 2σ statistical errors only.

BNW LAB. MIXED AND CASTED LITE WATER-
70 SPECIMENS FOR COMPRESSIVE STRENGTH
TESTING. MIX - 27 1/2% BY WT. H₂O

SPECIMEN NO.	AREA (SQ IN)	ULT. LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)	
PRE STRESSED (THERMAL)		TESTED DRY		
70-1	7.258	> 10 K	> 1378	7-23-77
70-2	"	> 10 K	> 1378	
70-3	"	> 10 K	> 1378	
70-4	"	> 10 K	> 1378	
70-5	"	> 10 K	> 1378	
		*		
PRE STRESSED (THERMAL)		TESTED WET (24 HR. H ₂ O SOAK)		
70-6	"	> 10 K	> 1378	7-23-77
70-7	"	> 10 K	> 1378	
70-8	"	> 10 K	> 1378	
70-9	"	> 10 K	> 1378	
70-10	"	> 10 K	> 1378	
		*		
POST STRESSED (THERMAL 1100°F)		TESTED DRY		
70-11	"	8360	1152	7-23-77
70-12	"	7900	1088	
70-13	"	8640	1190	
70-14	"	8560	1179	
70-15	"	8420	1160	
POST STRESSED (THERMAL 1100°F)		TESTED WET (24 HR. H ₂ O SOAK)		
70-16	"	> 10 K	> 1378	7-24-77
70-17	"	> 10 K	> 1378	
70-18	"	> 10 K	> 1378	
70-19	"	> 10 K	> 1378	
70-20	"	> 10 K	> 1378	
		*		

* THE INSTRON TEST MACHINE HAS A MAXIMUM LOAD RANGE OF 10,000 LBS.

RT. LANDSIEDEL BNW
 7-24-77

Le-Mixed 3rd Cast Pyrocl.
500' Uncovered
Line Wares #70

<u>THERMAL GRADIENT TEST</u>				
<u>LITE LATE - 7C</u>				
7-21-77				
<u>TIME</u>	<u>TEMPERATURE</u>			<u>TEST TEMP 500°F</u>
<u>(HRS)</u>	<u>(°F)</u>			<u>SPECIMEN UNCOVERED</u>
1 MB. 0900	#2 75	#3 75	#4 75	
1/2 0930	79	75	75	
1 1000	112	75	75	
1 1/2 1030	137	78	75	
2 1100	148	84	77	
2 1/2 1130	150	85	78	
3 1200	152	87	78	
3 1/2 1230	152	87	78	
4 1300	152	87	78	
4 1/2				
5				
5 1/2				
6				
6 1/2				
7				
7 1/2				
8				

RTS

K&E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

Low-Mixed 5 Cast Concrete
500°F Covered
LTS No. #70

<u>THERMAL GRADIENT TEST</u>				
<u>LITE WATER - 70</u>				
7-21-77				
<u>TIME</u> <u>(HRS)</u>	<u>TEMPERATURE</u> <u>(°F)</u>			<u>TEST TEMP 500°F</u>
	<u># 2</u>	<u># 3</u>	<u># 4</u>	<u>SPECIMEN COVERED</u>
IMB. 1300	75	75	75	
1/2 1330	113	75	75	
1 1400	138	79	76	
1 1/2 1430	147	83	76	
2 1500	150	84	77	
2 1/2 1530	154	89	79	
3 1600	155	89	80	
3 1/2 1630	159	92	81	
4 1700	161	93	81	
4 1/2 1730	162	93	81	
5				
5 1/2				
6				
6 1/2				
7				
7 1/2				
8				

RTS 7

KE 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KENT-HILL & ESSERY CO. MADE IN U.S.A.

46 1320

*LAG-Mixed 3 Cast Gypsum
1000°F Uncoated
Line Wite #70*

<u>TEMPERATURE CONTROL TEST</u>				
<u>LITE LATE - 7C</u>				
<u>7-21-77</u>	<u>TEMPERATURE</u>			<u>TEST TEMP / COEF</u>
<u>TIME</u>	<u>(°F)</u>			<u>SPECIMEN UN COVERED</u>
<u>(HRS)</u>				
IMB. 1830	#2 76	#3 76	#4 76	
1/2 1900	141	85	83	
1 1930	167	92	85	
1 1/2 2000	182	102	91	
2 2030	188	106	91	
2 1/2 2100	196	109	92	
3 2130	197	109	94	
3 1/2 2200	200	111	94	
4 2230	200	111	94	
4 1/2 2300	200	111	94	
5				
5 1/2				
6				
6 1/2				
7				
7 1/2				
8				

RTS.

9

K-E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KUPPEL & ESSER CO. MADE IN U.S.A.

46 1320

LAS - Mixed & Cast Cyanoac
1000°F Covered
Long time 170

<u>TEMPERATURE CONTROL TEST</u>				
<u>LITE DATE - 76</u>				
7-22-77				
<u>TIME</u>	<u>TEMPERATURE</u>			<u>TEST TEMP 1000°F</u>
<u>(HRS)</u>	<u>(°F)</u>			<u>SPECIMEN COVERED</u>
IMB. 0900	#2 74	#3 74	#4 74	
1/2 0930	115	75	74	
1 1000	176	82	77	
1 1/2 1030	200	93	82	
2 1100	207	102	87	
2 1/2 1130	209	105	87	
3 1200	222	111	89	
3 1/2 1230	236	113	92	
4 1300	245	113	92	
4 1/2 1330	256	115	93	
5 1400	257	115	93	
5 1/2 1430	257	115	93	
6				
6 1/2				
7				
7 1/2				

RTS

11

10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFEL & ESSER CO. MADE IN U.S.A.

46 1320

46-Mixed Cast Cylin
1500°F Uncovered
Line Note #70
12

INTERMITTENT GRAPHICAL TEST
LITE WATER - 7C

7-22-77

<u>TIME</u> <u>(HRS)</u>	<u>TEMPERATURE</u> <u>(°F)</u>			<u>TEST TEMP 1500°F</u>
	#2	#3	#4	<u>SPECIMEN UNCOVERED</u>
IMB. 1500	78	78	78	
1/2 1530	155	94	87	
1 1600	219	116	102	
1 1/2 1630	251	127	112	
2 1700	274	134	116	
2 1/2 1730	287	137	117	
3 1800	294	140	118	
3 1/2 1830	300	140	118	
4 1900	300	140	118	
4 1/2				
5				
5 1/2				
6				
6 1/2				
7				
7 1/2				
8				

RT

46 1320

Lab-Mixed 3rd East Cyrenoid St
1500°F Covered
Line Wave #7D

WHITE WATER - 7C

TIME (HRS)	TEMPERATURE (°F)			TEST TEMP °F	
	#2	#3	#4	SPECIMEN	COVERED
IMB. 1900	80	80	80		
1/2 1930	160	82	81		
1 2000	263	103	94		
1 1/2 2030	309	120	101		
2 2100	327	128	106		
2 1/2 2130	345	135	111		
3 2200	358	138	113		
3 1/2 2230	364	140	113		
4 2300	366	142	114		
4 1/2 2330	371	142	114		
5 2400	371	142	114		
5 1/2					
6					
6 1/2					
7					
7 1/2					
8					

RTS

15

App Figure C-41. May 10, 1977 Initial Lite Wate #50 Refractory Testing Data for Tanks AW-105 and AW-106.

VITRO ENGINEERING CORPORATION
Architects • Engineers

Box #83 197

TRANSMITTAL NO. B-120-59

DATE MAY 10, 1977

TO: DISTRIBUTION

FROM: A. W. AKERSON *AWA*

PROJ. OR SUBJECT: PROJECT B-120, 241-AW TANK FARM
PHASE IV, STEEL TANKS
TITLE III, W.O. C12003

NO. OF EACH	DISTRIBUTION:	LOCATION
1	CW BURGER, ERDA-RL	FB
1	AG LASSILA, ERDA-RL	FB
3	JF ALBAUGH, ARHCO	2704M
0	DD RITTER, ARHCO	2704M
0	BL MOSS, JAJ	1262
1	JE PARSONS, JAJ, 241-AW TRAILER	
1	AW AKERSON, VITRO	FB
1	ES DAVIS	1154
1	P. FELISE	FB
1	IMA GARCIA/VH BRAYMAN	FB
1	DG LIEN/EA GOAKEY	FB
1	DS MAGER	2101M
1	JF NELSON	FB
0	EV NORRIS	FB
1	EE SMITH	FB
1	RR WYER	FB
1	CENTRAL FILES	FB

ATTACHED ARE	THEY ARE TO BE USED FOR	THESE ARE	PLEASE NOTE	PLEASE
☒ DATA PRINTS	☒ INFORMATION	☐ PRELIMINARY	☐ REVISION	☐ COMMENT
☐ SPECIFICATIONS	☐ ESTIMATING	☐ UNCHECKED	☐ HOLDS	☐ APPROVE
☐ ATP	☐ SECURING QUOT.	☐ CHECKED		
☐ REQUISITIONS	☐ ORDERING MAT'L	☒ FINAL		
☐ REQ. WORK SHEET	☐ CONSTRUCTION	☐ APPROVED		
☐ WORK PLAN				
☐ E & M LIST				

DRAWING NUMBERS, TITLES AND COMMENTS:

ATTACHED ARE THE FOLLOWING ITEMS PERTAINING TO TESTING OF THE INSULATING CONCRETE POURED ON TANKS 241-AW-105 AND 106 DURING MARCH 1977:

1. LETTER, RT LANDSIEDEL (BNW) TO AW AKERSON, 5/2/77, TRANSMITTING RESULTS OF TESTING OF CORES TAKEN FROM INSULATING CONCRETE PLACED ON TANKS 105 AND 106.
2. VITRO CONSTRUCTION AND INSPECTION CHECK LIST, 3/16/77, INDICATING LOCATION OF CORES TAKEN FROM INSULATING CONCRETE PLACED ON TANKS 105 AND 106 (2 SHEETS).
3. BAR CHART GRAPHS (4) INDICATING RESULTS OF SAMPLING REPORTED IN ITEM 1 ABOVE.
4. SIMPLE STATISTICAL ANALYSIS OF RESULTS OF SAMPLING REPORTED IN ITEM 1 ABOVE.

RECEIVED

MAY - 4 1977

VITRO
PRO. MGMT.

May 2, 1977

Mr. A. W. Akerson
Vitro Engineering Corporation
Room 391
Federal Building
Richland, WA 99352

Pacific Northwest Laboratories
Battelle Boulevard
Richland, Washington 99352
Telephone (509) 946-2518
Telex 32-6345

Subject: Project B-120,241-AW Tank Farm, Phase IV, Steel Tanks, Testing of Insulating Concrete from Tanks 105 and 106

Reference: Letter from A.W. Akerson to R.T. Landsiedel on April 14, 1977

Dear Mr. Akerson:

The four phases (Ref.) of testing insulating concrete have been completed. These phases were:

- Phase 1. Dry Test
- Phase 2. Wet Test
- Phase 3. Heat/Dry Test
- Phase 4. Heat/Wet Test

The procedure for determining the compressive strength of light weight insulating concrete (ASTM C495-69) was followed throughout with one exception. The samples tested were not cast in molds but were removed by core drilling. All of the test specimens supplied by Vitro were retrieved from the tank floor by core drilling. A 3-inch (nominal) core drill was used. The drill gave a cylinder nominally 2.7 inches in diameter. This diameter was used to establish the area of 5.726 square inches for all test specimens.

All the compression tests were done on an Instron compression/tension test machine (Instron Corporation, Canton, MA) at a cross-head travel rate of 0.100 inches/min. The calibration certification for the machine is traceable to a Morehouse force gauge, serial number 50795, rated at 10 K.I.P.

The as-received test results for phases 1 and 2 are listed in tables 1 and 2 respectively. Test results for phases 3 and 4, which included a heat treatment on the as-received material are shown in tables 3 and 4.

The heat treatment for phases 3 and 4 employed the following thermal cycle: 150°F/hr. to 600°F; a 2 hr. hold at 600°F; a 100°/hr. increase to 1100°F; a 1/2 hr. hold at 1100°F; and finally a 150°F/hr. cooling rate to ambient room temperature.

Table 1. Phase 1: Drytest (As Received, Room Temperature)

Tank 241-AW-105			Tank 241-AW-106		
Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)	Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)
L1	672	117	S1	1175	205
L5	1075	188	S5	730	128
M1	1104	193	T1	1120	196
M5	740	129	T5	1000	175
*N1			U1	937	164
*N5			U5	1050	183
N9	639	112	U9	642	112
N13	715	125	U13	1150	201
*P1			V1	984	172
P5	1160	203	V5	1018	178
R1	1065	186	V9	805	141
R5	615	107	W1	944	165

*Not Received

Table 2. Phase: Wet Test (12 Hour Water Immersion, Room Temperature)

Tank 241-AW-105			Tank 241-AW-106		
Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)	Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)
**L2	425	74	S2	588	103
L6	593	104	S6	535	93
M2	771	135	T2	817	143
M6	563	98	T6	659	115
*N2			U2	760	133
*N6			**U6	733	128
N10	575	100	**U10	470	82
N14	501	88	U14	726	127
*P2			V2	932	163
P6	892	156	V6	779	136
R2	599	105	V10	591	103
**R6	412	72	**W2	631	110

*Not Received

**Floated in Water Bath Approximately 10 minutes

Table 3. Phase 3: Heated/Dry Test (Room Temperature)

Tank 241-AW-105			Tank 241-AW-106		
Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)	Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)
L3	431	75	S3	829	145
L7	666	116	S7	512	89
M3	771	135	T3	953	166
M7	779	136	T7	740	129
*N3			U3	554	97
*N7			U7	535	93
N11	697	122	U11	504	88
N15	655	114	U15	793	138
*P3			V3	1364	238
P7	648	113	V7	702	123
R3	585	102	V11	601	105
R7	607	106	W3	579	101

*Not Received

Table 4. Phase 4: Heated/Wet Test (12 Hour Water Immersion, Room Temperature)

Tank 241-AW-105			Tank 241-AW-106		
Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)	Specimen Number	Ultimate Compressive Load (lbs)	Compressive Strength (psi)
L4	262	46	S4	568	99
L8	699	122	S8	402	70
M4	519	91	T4	610	106
M8	548	96	T8	587	102
*N4			U4	455	79
*N8			U8	472	82
N12	563	98	U12	317	55
N16	473	83	U16	775	135
*P4			V4	620	108
P8	582	102	V8	531	93
R4	466	81	V12	375	65
R8	345	60	W4	420	73

*Not Received

All the original Instron and furnace control charts are included with this letter.

Sincerely yours,

A handwritten signature in cursive script that reads "R. T. Landsiedel".

R. T. Landsiedel
Metallurgy Research Section
Materials Department

VITRO ENGINEERING DIVISION
CONSTRUCTION AND INSPECTION CHECK LIST

SHEET NO. 1 OF 1

PROJECT	B-120, Phase IV - 241-AW Tank Farm (Tank Fabrication)	PREPARED BY	P. W. Armstrong
FEATURE	LOCATION DIAGRAM FOR SAMPLING OF INSULATING REFRACTORY	Approved by	<i>Paul H. Hays</i>
REFERENCE	Construction Specification B-120-C4	DATE	3-16-77
OTHER DATA	TANK NO. <u>TK 105</u> POUR SLIP NO. _____ DATE <u>4/1/77</u> <u>MARKED OUT AREAS FOR CORE DRILLING</u>		
		DISTRIBUTION

John
5/21/77

VITRO ENGINEERING DIVISION	
CONSTRUCTION AND INSPECTION CHECK LIST	
Phase IV - 241-AW Tank Farm (Tank Fabrication)	PREPARED BY P. W.
SECTION DIAGRAM FOR SAMPLING OF INSULATING REFRACTORY	Approved by <i>[Signature]</i>
REFERENCE	DATE 3-16-77
Construction Specification B-120-C4	DISTRIBUTION
OTHER DATA	
TANK NO. 106 POUR SLIP NO. DATE 4/19/77 LAB BUT AREAS FOR CORE DRILLING	

STARTED CORE DRILLING 4/14/77 P.W.A.
 TEST CORES FOR VITRO

W
POURED 3/27/77
12' 3" 4"
8' 6" 5"
12' 11" 0" 1" 8"
12' 5" 1" 6"

U
POURED 3/21/77
12' 3" 4"
8' 6" 5"
12' 11" 0" 1" 8"
12' 5" 1" 6"

T
POURED 3/30/77
12' 3" 4"
8' 6" 5"
12' 11" 0" 1" 8"
12' 5" 1" 6"

S
POURED 3/29/77
12' 3" 4"
8' 6" 5"
12' 11" 0" 1" 8"
12' 5" 1" 6"

RECEIVED
 APR 20 1977
 VITRO
 P.W. MGMT

[Signature]
 4/21/77

THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD DEVIATION OF UNGROUPED DATA.

	DATA	MEAN	
1	117.400000000	117.400000000	Tank 105, Dry 107-203
2	187.700000000	152.550000000	
3	192.800000000	165.966666666	
4	129.200000000	156.775000000	
5	111.600000000	147.740000000	
6	124.900000000	143.933333333	
7	202.600000000	152.314285714	
8	186.000000000	156.525000000	
9	107.400000000	151.066666666	

VARIANCE = 1590.047500370

STANDARD DEVIATION = 39.875399689

THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD DEVIATION OF UNGROUPED DATA.

	DATA	MEAN	
1	74.200000000	74.200000000	Tank 105, Wet 72-156
2	103.600000000	88.900000000	
3	134.600000000	104.133333333	
4	98.300000000	102.675000000	
5	100.400000000	102.220000000	
6	87.500000000	99.766666666	
7	155.800000000	107.771428571	
8	104.600000000	107.375000000	
9	72.000000000	103.444444444	

VARIANCE = 730.885278000

STANDARD DEVIATION = 27.034890012

THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD DEVIATION OF UNGROUPED DATA.

	DATA	MEAN	
1	205.200000000	205.200000000	Tank 106, Dry 112-205
2	127.500000000	166.350000000	
3	195.600000000	176.100000000	
4	174.600000000	175.725000000	
5	163.600000000	173.300000000	
6	183.400000000	174.983333333	
7	112.100000000	166.000000000	
8	200.800000000	170.350000000	
9	171.800000000		
10			

Apple Summary 27.05.1989
THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD DEVIATION OF UNGROUPED DATA.

	DATA	MEAN
1	75.300000000	75.300000000
2	116.300000000	95.800000000
3	134.600000000	108.733333333
4	136.000000000	115.550000000
5	121.700000000	116.780000000
6	114.400000000	116.383333333
7	113.200000000	115.928571429
8	102.200000000	114.212500000
9	106.000000000	113.300000000

Tank 105, DAY

75-136

VARIANCE = 333.782500000

STANDARD DEVIATION = 18.269715378

THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD DEVIATION OF UNGROUPED DATA.

	DATA	MEAN
1	46.000000000	46.000000000
2	122.000000000	84.000000000
3	91.000000000	86.333333333
4	96.000000000	88.750000000
5	98.000000000	90.600000000
6	83.000000000	89.333333333
7	102.000000000	91.142857142
8	81.000000000	89.875000000
9	60.000000000	86.555555555

Tank 105, Wet

46-122

VARIANCE = 516.027777800

STANDARD DEVIATION = 22.716244799

THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD DEVIATION OF UNGROUPED DATA.

	DATA	MEAN
1	144.800000000	144.800000000
2	89.400000000	117.100000000
3	166.400000000	133.533333333
4	129.200000000	132.450000000
5	96.800000000	125.320000000
6	93.400000000	120.000000000
7	88.000000000	115.428571428

Tank 106, DAY

88-233

App Figure C-42. American Bridge NCR 77-1

K-9224

NON-CONFORMANCE REPORT

77-1

Piece Mark 102B011Ref. Drawing E102 and 102Description: See attached sketchHeat No. 105823Slab No. 1400BProposed Disposition: Relocate to bottom fabrication area.

- 1) Make repair per Welding Procedure Specification WTD-1-A
- 2) Insure complete removal of defect using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual
- 3) Grind as-deposited weld metal flush with parent material
- 4) Perform Magnetic Particle Inspection as defined in the Construction Department Quality Assurance Manual - Section 8

This repair procedure has been technically reviewed and evaluated to be non-detrimental to the plate.

Approved:

2-25-77Project Mgr. C. J. Madgwick2-25-77Q.A. Supervisor J. H. Hooker3-8-77Customer J. E. Parsons

REC CD

FEB 25 1977

J. A.
CONSTRUCT

App Figure C-43. American Bridge NCR 77-2

K-9224

77 - 2

NON-CONFORMANCE REPORT

Piece Mark 102BC1

Ref. Drawing E107AB

Description: SURFACE DEFECT LOCATED BY VISUAL INSPECTION

HEAT NO. 201138

SLAB NO. 06000

Proposed Disposition: 1) Make repair per Welding Procedure Spec. WLD-1-A.
2) Insure complete removal of defect using magnetic
particle inspection as defined in Section 8 of the
Construction Dept. Quality Assurance Manual.
3) Grind as-deposited weld metal flush with parent material
4) Perform Magnetic Particle Inspection as defined in
the Const. Dept. Quality Assurance Manual - Section 8.

Approved:

Project Mgr. J. J. Halden

Q.A. Supervisor H. H. Halden

Customer

2-15-77

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CORPORATION
1977 FEB 17 PM 1:42

App Figure C-44. American Bridge NCR 77-3

K-9224

NON-CONFORMANCE REPORT

77-3

Piece Mark 102B08Ref. Drawing E102 and 102Description: Surface defect located by visual inspectionHeat No. 201142Slab No. 2300CProposed Disposition: 1) Relocate to the bottom fabrication area2) Make repairs per Welding Procedure Specification WLD-1-A3) Insure complete removal of defect using magnetic particle inspection as defined in Section 8 of the Const. Dept. Q.A. Manual4) Grind as-deposited metal flush with the parent material5) Perform Magnetic Particle Inspection as defined in the Const. Dept. Q. A. Manual - Section 8This repair procedure has been technically reviewed and evaluated to be non-detrimental to the plate

Approved:

2-25-77Project Mgr. *C. J. [Signature]*2-25-77Q.A. Supervisor *D. H. [Signature]*

Customer _____

1977 MAR -1 PM 12:35

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CORPORATION

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FEB 25 1977

J. A.
CONSTRUCT

App Figure C-45. American Bridge NCR 77-4

K-9224

NON-CONFORMANCE REPORT

77-4

Piece Mark 102B05Ref. Drawing E102 and 102

Description: Two gouges in the surface located by visual inspection
Heat No. 2G1138
Slab No. 09000

Proposed Disposition:

- 1) Relocated to the bottom fabrication area
- 2) Make repair per Welding Procedure Specification WLD-1-A
- 3) Insure complete removal of defects using magnetic particle
inspection as defined in Section 8 of the Construction Department
Quality Assurance Manual
- 4) Grind as-deposited weld metal flush with the parent material
- 5) Perform magnetic particle inspection per Section 8 of the
Construction Department Quality Assurance Manual

Approved:

2-16-77Project Mgr. C. J. McNeill2-16-77Q.A. Supervisor A. B. Brooks2-16-77Customer St. Louis

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 FEB 17 PM 1:42
 MICRO ENGINEERING
 CORPORATION

App Figure C-46. American Bridge NCR 77-5

K-9224

NON-CONFORMANCE REPORT

NCR 77-5

Piece Mark 102B09Ref. Drawing E108ABDescription: Surface defect located by visual inspectionPiece is part of Tank 106-S bottom and is located
next to seam BRS #2 and film identification #54Heat No. 2G1142Slab No. 1700C

Proposed Disposition:

- 1) Make repair per Welding Procedure Spec. WLD-1-A.
- 2) Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual
- 3) Grind as-deposited weld metal flush with parent material
- 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual

This repair procedure is approved by Engineering, and provides
a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. E. J. McNeillQ.A. Supervisor E. J. Brooks

Customer _____

3-10-773-10-77

g. h. h. -
3-10-77
1:24

App Figure C-47. American Bridge NCR 77-9

K-9224

NON-CONFORMANCE REPORT

77-9

Piece Mark 102B010

Ref. Drawing E1.06AB

Description: Heat No. 1G5823 Slab No. 1600A

Surface defect located by visual inspection. Piece is part of Tank 104-S (bottom plate) and is located 7 1/2" (abt) west of Weld Seam BNS #5, between film markers 2 and 3.

Proposed Disposition:

- 1) Make repair per Welding Procedure Spec. WLD-1-A.
- 2) Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.
- 3) Grind as-deposited weld metal flush with parent material.
- 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.

This repair procedure is approved by Engineering, and provides a repaired plate equivalent to a plate not requiring repair.

Approved:

5-9-77 Project Mgr. C. G. Marshall

May 9, 1977 Q.A. Supervisor R. Brooks

5-9-77 Customer J. E. Farnsworth

10:00
5-9-77

App Figure C-48. American Bridge NCR 77-10

R-9224

NON-CONFORMANCE REPORT

77-10

Piece Mark 102B08Ref. Drawing E106ABDescription: Heat No. 203142 Slab No. 2100A

Surface defect located by magnetic particle. Piece is part of Tank 104-S
(Bottom Plate) and is located 2" (abt) west of Seam BNS #1, between
film markers 1 and 2

Proposed Disposition:

- 1) Make repair per welding Procedure Spec. WLD-1-A
- 2) Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.
- 3) Grind as-deposited weld metal flush with parent material
- 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.

This repair procedure is approve by Engineering, and provides
a repaired plate equivalent of a plate not requiring repair.

Approved:

Project Mgr. E. J. MahanQ.A. Supervisor Ph. GrovesCustomer J. E. Vansoren

5/8/77

May 9, 1977

5/9/77

203142-2100A

App Figure C-49. American Bridge NCR 77-11

K-9224

NON-CONFORMANCE REPORT

NCR 77-11

Piece Mark 201B05Ref. Drawing E2034B and 201Description: Heat No. D05379 Slab No. 06027

Surface defect located by visual inspection. Piece is part of Tank 102-P (Bottom Plate) and is located 1" (Ab't) west of Seam BHS #2 and between film markers 5 and 6.

Proposed Disposition:

1. Make repair per welding Procedure Spec. WLD-1-A
2. Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.
3. Grind as-deposited weld metal flush with parent material
4. Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.

This repair procedure is approved by Engineering, and provides a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. *[Signature]*Q.A. Supervisor *[Signature]*Customer *[Signature]*5-17-77MAY 17, 19775-17-77*by [Signature] 5/17/77*

App Figure C-50. American Bridge NCR 77-13

34.0

REC D
JUL 13 1977
K-9224
NON-CONFORMANCE REPORT
J.A. INSUR
77-13

Piece Mark 102B-11

Ref. Drawing 13.05AB

Description: Surface defect located by dye penetrant inspection
Heat No. 105823
Slab No. 11008

Proposed Disposition: 1) Make repair per Welding Procedure Spec. W.D.1-A.
 2) Require complete removal of defect using magnetic particle inspection as defined in Section 8 of the Construction Dept. Quality Assurance Manual.
 3) Grind as-deposited weld metal flush with parent material.
 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Dept. Manual.

Note: This repair procedure is approved by Engineering, and provides a repaired plate equivalent to a plate not requiring repair.

Approved:

7-13-77 Project Mgr. C. J. McNeill

7-13-77 Q.A. Supervisor P. H. Doyle

7-13-77 Customer J. E. Varson

App Figure C-51. American Bridge NCR 77-18

Alkerson

NON-CORROSION REPORT

RECEIVED K-9224
NOV 18 1977 77-18
VITRO
PRO. MGMT.

Piece Mark 501M1

Ref. Drawing E502AB

Description: Surface defect located by visual inspection
Tank 101 - Secondary Tank - 1st course shell plate
Heat No. 1G4720
Slab No. 1600C

Proposed Disposition:

- 1) Make repair per Welding Procedure Spec. WLD-1-A.
- 2) Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.
- 3) Grind as-deposited weld metal flush with parent material.
- 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual.

This repair procedure is approved by Engineering, and provides a repaired plate equivalent to a plate not requiring repair.

Approved:

11-15-77 Project Mgr. *C. J. Johnson*
11-15-77 Q.A. Supervisor *P. H. Brooks*
11-15-77 Customer *James F. ...*

Redistribution by AWA
P. Felise
IMA Garcia/WH Brayman
✓ JM Johnston, 2101M
Central Files/B-120
AWA Files/B-120, 0.0c

RECEIVED
NOV 16 1977
J. A. JONES
CONSTRUCTION CO.

C JHP

App Figure C-52. American Bridge NCR 78-2

K9224

NON-CONFORMANCE REPORT

78-2 R1

Piece Mark 501M1Reference Drawing E501Description Heat No. 1G5826Slab No. 0800ASurface defect located by visual inspectionTANK 103-S COURSE #1

Proposed Disposition 1) Make repair per Welding Procedure Spec. WLD-1-A
2) Insure complete removal of defect using magnetic
particle inspection as defined in Section 8 of the
Construction Department Quality Assurance Manual.
3) Grind as-deposited weld metal flush with parent
material
4) Perform magnetic particle inspection as defined
in Section 8 of the Construction Dept. Q. A. Manual

Note: This repair procedure is approved by Engineering
and provides a repaired plate equivalent to a
plate not requiring repair.

Approved:

Project Mgr. E. J. McNeill Date 1-15-78Q.A. Super. J. H. Haddock Date 1-15-78Customer J. Blum Date 1-15-78

NOTE: REVISION ISSUED TO SHOW CORRECTION FROM COURSE #2 P. #1

App Figure C-53. American Bridge NCR 78-3

K9224

NON-CONFORMANCE REPORT

78-3

Piece Mark 501M1Reference Drawing E501Description Heat No. 1G5826Slab No. 2200ASurface defect located by visual inspectionTank 103-S Course No. 2

Proposed Disposition 1) Make repair per welding procedure spec. W.D-1-A
2) Insure complete removal of defect using magnetic
particle inspection as defined in Section 8 of the
Construction Department Quality Assurance Manual
3) Grind as-deposited weld metal flush with parent
material
4) Perform magnetic particle inspection as defined
in Section 8 of the Const. Department Q. A. Manual.

Note: This repair procedure is approved by Engineering and provides
a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. C. J. Haskins Date 1-16-78Q.A. Super. J. B. Cook Date 1-16-78Customer J. B. Blum Date 1-16-78

App Figure C-54. American Bridge NCR 78-4

K9224

NON-CONFORMANCE REPORT

78-4

Piece Mark E501M RECEIVED

Reference Drawing E501 FEB 2 1978

Description Heat No. 1G5826 J. A. JONES
CONSTRUCTION CO.

Slab No. 1700A

Surface defect located by visual inspection

Tank 101-S Course No. 2 Near top of slab between
radiograph marks 40 & 41 (Near Vert 5)
(28-29, 29-30) (AT #29) PNB

NOTE
CORRECTION

Proposed Disposition

- 1) Make repair per Welding Procedure Spec. WLD-1-A
- 2) Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual
- 3) Grind as-deposited weld metal flush with parent material.
- 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual

Note: This repair procedure is approved by Engineering and provides a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. E. J. McArthur Date 1-31-78

Q.A. Super. Ph. Frank Date 1-31-78

Customer J. J. Flannery Date 2/1/78
DROBney

App Figure C-55. American Bridge NCR 78-4

K9224

NON-CONFORMANCE REPORT

78-4

Piece Mark E501M RECEIVED

Reference Drawing E501 FEB 2 1978

Description Heat No. 1G5826 J. A. JONES
CONSTRUCTION CO.

Slab No. 1700A

Surface defect located by visual inspection

Tank 101-S Course No. 2 Near top of slab between
radiograph marks 40 & 41 (Near Vert 5)
(28-29, 29-30) (AT #29) PNB

NOTE
CORRECTION

Proposed Disposition

- 1) Make repair per Welding Procedure Spec. WLD-1-A
- 2) Insure complete removal of defect by using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual
- 3) Grind as-deposited weld metal flush with parent material.
- 4) Perform magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual

Note: This repair procedure is approved by Engineering and provides a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. E. J. McArthur Date 1-31-78Q.A. Super. Ph. Frank Date 1-31-78Customer J. J. Flannery Date 2/1/78

DROPPY

App Figure C-56. American Bridge NCR 78-8

63197

K9224

NON-CONFORMANCE REPORT

78-8

Piece Mark F501ML

Reference Drawing E501

Description Heat No. 105826

Slab No. 0400A

Surface defect located by visual inspection

Tank 106-S 2nd Course Shell Plate

Proposed Disposition 1) Make repair per Welding Procedure Spec WLD-1-A

2) Insure complete removal of defect by using Magnetic Particle Inspection

as defined in Section 8 of the Construction Department Quality Assurance

Manual. 3) Grind as-deposited weld metal flush with parent material.

4) Perform inspection as in 2, above.

Note: This repair procedure is approved by Engineering and provides

a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. P. C. H. [Signature] Date 3-20-78Q.A. Super. P. H. [Signature] Date 3-20-78Customer [Signature] Date 3-20-78

App Figure C-57. American Bridge NCR 78-9

K9224

NON-CONFORMANCE REPORT

78-9

Piece Mark F501MReference Drawing E501Description Heat No. 1G5824Slab No. 2800ASurface defect located visual inspectionTank 103-S 4th Course Shell Plate

Proposed Disposition 1. Make repair per Welding Procedure Specification WLD-1-A
2. Insure complete removal of defect by using Magnetic Particle Inspection
as defined in Section 8 of the Construction Department Quality Assurance
Manual. 3. Grind as-deposited weld metal flush with parent material.
4. Perform inspection as in 2 above.

Note: This repair procedure is approved by Engineering and provides
a repaired plate equivalent to a plate not requiring repair.

Approved:

Project Mgr. [Signature] Date 3-30-78Q.A. Super. [Signature] Date 3-30-78Customer [Signature] Date 3-30-78

RECEIVED

MAR 30 1978

J. A. JONES
CONSTRUCTION CO.

App Figure C-58. January 26, 1977 Surface Defect Log Note

- 1/26/77
2. Vito Surve shot inverts of existing 8" RW & 3" Emergency Water lines where they had been exposed. (Project B-130). Invert^{8" RW} at NW corner is El. 651.29 (649.50 is shown on dwg H-2-71902) & invert of the 8" RW @ the SE corner is El. 648.25 (648.07 shown on dwg.). Bottom of 3" pipe is El. 648.97 (650.87 shown on dwg.).
3. Jim Parrish placed a red tag^{#0312} on the piece of plate that had a lamination problem (A red tag had been applied by A.B. when it arrived at the jobsite). Parrish stated that an NCR will be written in order to formally receive the NCR that A.B. had written. Parrish was informed that this was beyond the scope of the contract & that A.B. would probably refuse to give them a copy of their NCR.
4. Jim Parrish removed the red tag dealing with the radiography #0310
5. Power City was not on site today
6. A.B. continued production welding on the secondary bottom on the Tank 103 staging (putting in cover pass on bot weld on flat plate); several knuckle sections have been welded together but not to the bottom yet; continued tack welding & production welding on the secondary bottom on the Tank 104 staging
7. Labor A.B. 11 Boilermakers, 1 Persian Boilermaker, 1 Boilermaker Apprentice, 3 Operators, 6 Supervision
 X-Ray 1 Supervisor, 1 Boilermaker, 1 Oriental BM, 1 Trainee
 JAJ - 12 hrs Synv., 10 hrs Lab, 12 hrs Team, 16 hrs OE, 24 hrs PF
8. JAJ continued excavation for relocation of the raw water line (Project B-130)
9. Red tag #0312 reads as follows: "Lamination Condition existing in plate. / Amer. Bridge's NCR is not being routed to Project Team for concurrence of disposition"
- Hold Tag

App Figure C-59. NCR B-120-36

NONCONFORMANCE REPORT		
(1A) PROJECT, LOCATION OR NO. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-36-(932-2)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <p>Reference: AS reference drawing E101 and 102; ASTM A20 with supplementary requirement S12.</p> <p>Description: See attached American Bridge NCR.</p>		(1E) DISTRIBUTION <p>ERDA AG Lassila - CW Burger GS Rokkan ARHCO JF Albaugh AJ Larson JAJ JE Parsons LJ Maenpaa VITRO AW Akerson IMA Garcia JH Parrish RR Wyer Central File Official File</p>
(1F) HOLD TAG NO. Red Tag #0312	(1G) ORIGINATOR, TITLE AND DATE J. H. Parrish, Senior Field Inspector 1-26-77	
(2A) RECOMMENDED DISPOSITION ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☒ OTHER SPECIFY:	(2B) DISPOSITION JUSTIFICATION <p>DISPOSITION ALLOW AMERICAN BRIDGE TO PROCEED WITH REPAIRS IN ACCORDANCE WITH THEIR OWN PROPOSED DISPOSITION, PER ATTACHED AMERICAN BRIDGE NCR; HOWEVER, AMERICAN BRIDGE MUST PROVIDE ASSURANCE THAT THE PLATE, AS REPAIRED, CONFORMS TO ASTM A537, CLASS 1, AND ASTM A20 WITH supplementary requirement S12, as specified by the Construction Specification B-120-C4. <i>AWA 2-9-77</i></p> <p>JUSTIFICATION IF ADEQUATE ASSURANCE IS PROVIDED, THE REPAIRED PLATE CAN BE CONSIDERED EQUIVALENT TO A SIMILAR PLATE NOT REQUIRING REPAIRS.</p>	
(2C) DOES CHANGE REQUIRE? ☐ YES ☐ NO ☒ NO		
(3A) APPROVALS - SIGNATURE AND DATE DESIGN <i>Paul Felino 2/1/77</i> QA <i>1/1/77</i> PE <i>A.W. Akerson 2-1-77</i>	(3B) CONCURRENCE - SIGNATURE AND DATE <i>DRO 2/14/77</i> <i>JF Albaugh 2/9/77</i> <i>JH Parrish 2/9/77</i> <i>AG Lassila 2/9/77</i>	
(3C) DISPOSITION EXPECTED AS DIRECTED - NCR CLOSED ☒ DISPOSITION EXPECTED AS DIRECTED - NCR CLOSED ☐ OTHER (SPECIFY): <p><i>ALL LAMINATED PLATES IN TR*103 SECONDARY</i></p>		

NON D-120-50-1336-2, ALL. 1

K-9224

NON-CONFORMANCE REPORTPiece Mark 102B011Ref. Drawing E102 and 102Description: See attached sketchHeat No. 105823Slab No. 1400BProposed Disposition: Relocate to bottom fabrication area.

- 1) Make repair per Welding Procedure Specification WID-1-A
- 2) Insure complete removal of defect using magnetic particle inspection as defined in Section 8 of the Construction Department Quality Assurance Manual
- 3) Grind as-deposited weld metal flush with parent material
- 4) Perform Magnetic Particle Inspection as defined in the Construction Department Quality Assurance Manual - Section 8

Approved:

Project Mgr. C. J. MedwellQ.A. Supervisor J. H. Trappe

Customer _____

Rec'd 1-27-77
1:57 gbf-

NCR B-120-36-(932-2), Att. 2

GM255
01 000 0175

Reference No.

App Figure C-60. NCR B-120-37

NONCONFORMANCE REPORT		
(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE 241-AW Tank Farm	(1C) NCR NO. B-120-37-932-3
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: ASTM A20 with supplementary requirements S12. Discrepancy: There is a surface defect located in the 3/8" bottom plate of Tank #105 as shown on the attached sketch. <div style="text-align: center;">REC'D FEB 24 1977 J. A. CONSTRUCTO.</div>		(1E) DISTRIBUTION ERDA AG LASSILA GS ROKKAN ARHCO JF ALBAUGH AJ LARSON JAJ JE PARSONS LJ MAENPAA VITRO AW AKERSON IMA GARCIA JH PARRISH RR WYER CENTRAL FILES OFFICIAL FILE
(1F) HOLD TAG NO. Red Tag 0315	(1G) ORIGINATOR, TITLE AND DATE J. H. Parrish - Sr. Field Inspector - 2/14/77	
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☒ REPAIR ☐ REJECT ☒ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION Disposition: Repair by first removing the defect by grinding. Magnetic particle or liquid penetrant testing shall then be utilized to assure complete removal of defect. Reweld and grind smooth the repaired area and then test the completed repair weld with magnetic particle testing. All welding and non destructive testing shall be performed in accordance with the applicable approved procedures Justification: ASTM A20 allows weld repairs of material with customer approval. Also, Specification B-120-C4 Section 15H, paragraph 3A. (1) h. defines repairs of surface defects.	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO		
(2D) APPROVALS (SIGNATURE AND DATE)		(2E) CONCURRENCE (SIGNATURE AND DATE)
DESIGN: <i>Ref. Telia 2-15-77</i> SAFETY: <i>TC Chidsey 4/16/77</i> QUALITY ASSURANCE: <i>IMA Garcia 2-16-77</i> PROJECT MANAGEMENT: <i>A.W. Akerson 2-17-77</i>		<i>DEO 2/17/77</i> <i>JF Albaugh 2/18/77</i> <i>JH Parrish 2/18/77</i> <i>GS Rookan 2/18/77</i>
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>Robert R. Thome 2-14-77</i> ORIGINATOR OR REPRESENTATIVE DATE

ONE		NONE		NONE		U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION					
						RICHLAND OPERATIONS OFFICE					
DATE		DESCRIPTION		BY	CH	AP	SCALE	APPD.	SAF	H/A	
							JHP 2-14-72			H/A	
REVISIONS							CHKD.	CLASS. BY	NO.	B-120-37-932-3	

App Figure C-61. Summary of Procedure for Lowering Tank Bottoms

625201

SUMMARY OF PROCEDURE FOR LOWERING TANK BOTTOMS

The following are specification sections that generated requirements for the Tank Lowering Procedures:

Specification B-120-C4, Section 15H

(D) Submittals

(3) Submit the following to the Administration and obtain approval prior to fabrication:

- f. Detailed erection sequence and procedures for assembling primary and secondary tanks, including procedures for assembling and placing tank bottoms and welding sequences.
- h. Procedures for erection of components.

1. On November 18, 1976, we received copies of American Bridges' erection drawing, DE-3 which itemized procedure for lowering tank bottoms. This was reviewed and returned "Approve With Exception" on December 8, 1976. Exceptions are as follows:

- "1. American Bridge should submit strength analysis for bottom plate lifting loads. Analysis should cover bottom plates, lugs, shackles and wire rope strength.
2. Define appropriate procedure for removal of lifting lugs.
(Vitro understands that JAJ will verify that rigging is adequate for lifting capacity required, and will be certified to meet state and federal regulations.).
Please Resubmit."

This information was transmitted to American Bridge.

2. On January 13, 1977, American Bridge resubmitted their erection procedure and design calculations as requested on the first submittal.
3. During the process of review, Vitro determined that additional information was required on the analysis performed by American Bridge. This additional information was hand-delivered February 9, 1977 to Dr. Chang with subsequent formal transmittal on February 11.
4. Upon review of this additional information, Vitro determined that the method of analysis in the area of the lifting lugs was inadequately covered and requested a different method of calculation.
5. JAJ requested this additional information from American Bridge, verbally, and was informed that American Bridge was satisfied with the analysis as it stood, and that they felt they had already supplied more information than was contractually required and that it was up to the Administration to inform them if they wanted American Bridge to do any more work. This information was passed on to Vitro.

Handwritten
Copy to
PARSONS

Page 2

On February 16, 1977, Al Akerson hand-delivered PDT initially disapproving the procedure until additional information was provided. During the Construction Meeting of February 16, team members agreed to an attachment to Vitro's exceptions which all parties were in concurrence with. Late February 16, Vitro rejected this approach.

App Figure C-62. February 14, 1977 Revised Tank Bottom Lifting Calculations

PROCUREMENT DATA TRANSMITTAL PDT 932-31.A

SHEET 1 OF 1

TO: J. V. Lawler - Vitro		DATE: 2-14-77		DISTRIBUTION 1 MD Chang 0 AW Akerson 8 JE Dronen 2/15/77 <div style="text-align: center; border: 1px solid black; padding: 5px; margin: 10px 0;"> RECEIVED FEB 14 1977 </div>
FROM: S. J. Bridges - JAJ				
PROJECT TITLE: 241-AW Tank Farm		BLDG. NO.: 200-East		
P.O. NO.	PROJECT NO. B-120	AEC REG. NO.	AEC W.O. NO.	
CONTR. REG. NO.	SUBCONTRACT NO. JAJ-932	SUBCONTRACTOR OR VENDOR: American Bridge		
FOR: ☐ PRE-PURCHASE EVALUATION ☒ APPROVAL DATA ☐ CMI				
DATA AND QUANTITY FURNISHED: INCLUDE DRAWING NO'S, - SPECIFICATION NO'S, - NUMBER COPIES OF EACH Transmitted herewith, for your approval, are nine (9) copies of revised calculations for tank bottom lifting stresses - Design Analysis of the Lug Connections for Erecting Tank Bottoms & Domes.				
TO: SJ Bridges		DATE: 2/17/77		DISTRIBUTION 1 MD Chang 0 AW Akerson 1 JE Dronen 2 DS Mager 1 JF Albugh 0 WH Braymen 0 AG Lassila 0 Central File
FROM: JE Dronen <i>JED</i>				
☐ APPROVED ☐ NOT APPROVED ☒ APPROVE WITH EXCEPTION				
REMARKS: <i>m</i> American Bridge will be permitted to lower secondary tank bottom 105 based on the confidence they express in their letter of 2/11/77 (CJ Madewell to JE Parsons, JAJ). Vitro will proceed immediately to confirm American Bridge's confidence by performing analysis that Vitro feels is lacking (per PDT 932-19.4A 8B) and expects to complete analysis within one week. If initial Vitro analysis indicates no problems, American Bridge will be allowed to proceed with lowering of next bottom. (Battelle will be asked to check Vitro analysis prior to lowering of remaining bottoms) If analysis reveals a problem, American Bridge will repair or replace lowered bottoms. Vitro will also perform similar analysis to confirm lifting procedure for primary tank bottoms. RESUBMITTAL IS NOT REQUIRED.				
932-120 2/24/77 AIA <i>AMA</i>				

84-5000-104 (6-73)

#109

American Bridge

UNITED STATES STEEL CORPORATION

P.O. Box 1099
Richland, Washington 99352

PDT 932 - *B-A-A*

1977

APPROVED AS INDICATED BY ☒ BELOW

☐ APPROVED

☒ APPROVED WITH EXCEPTIONS NOTED

February 11, 1977

REC FEB 14 1977

Approved in general and does not constitute an approval of dimensions, quantities, etc.

Does not relieve the contractor of his responsibility of performance of the work in accordance with the contract drawings and specifications.

J. A. Jones Construction Co.

VITRO ENGINEERING CORP.
AN AUTOMATION INDUSTRIES CO., INC.
BIRMINGHAM, ALA.

Job No. *B-120*

Checked by *Madewell*

Date *2/17/77*

J. A. Jones Construction Co.
P. O. Box 560
Richland, Washington 99352

Attention: Mr. J. E. Parsons
Construction Manager

Subject: K-9224 Subcontract No. J AJ-932(B-120)
Primary and Secondary Steel
241-AW Tank Farm

Gentlemen:

Please refer to our letter of January 12, 1977, transmitting our Design Analysis of the Lug Connections for erecting the tank bottoms and domes. Enclosed are ten (10) copies each of the following revised calculations for tank bottom lifting stresses during the construction phase:

ABD 6, 6A, 6B, 7, 8, 9, 10, 11 and 12 - all Rev. #1, computer output sheets "K26 to K32" and "R1 to R29" for primary and secondary gravity load stresses.

American Bridge Division has analyzed the stresses to be encountered in the moving of the tank bottoms during construction and find all the stresses are low and well within any construction loading criteria. The circular lug attachments to the center body of the secondary tank (governors) indicate stresses of 10370 p.s.i., and the knuckle 1580 p.s.i. The knuckle was modelled over a 24" portion with fixed boundaries. This gives an indication of the maximum stress to be encountered and any additional modelling will only indicate a slightly lower stress. We are confident, therefore, in our analysis in its present state.

The computer output series "M" and "L" originally sent to you are obsolete. These should be replaced by the "N" and "R" series.

Very truly yours,

C. J. Madewell
C. J. Madewell
Project Manager

CJM:wl

Encls.

cc: S. E. Ault
J. W. Fecko
W. D. McGregor

A-2205.22

D-103 REV. 4-73

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AMERICAN BRIDGE
DIVISION

UNITED STATES STEEL CORPORATION

DATE _____ BY _____

SHEET NO. 6 OF _____

ORDER NO. & INQ. NO. _____

FOR

J A JONES CONST CO

2-1-77 WSH

PRIMARY & SECONDARY TANK BOTTOMS - CONTTANK BOTTOM DEFLECTIONS AND STRESSESSECONDARY TANK BOTTOM (BEING THINNER) SETS
THE MAXIMUM DEFLECTIONS & STRESSES.

KF220
 SHY 6A
 1-2-1-77
 INCR NUMBER
 OF ELEMENTS.

similar to original with
more plates

DOUBLE WALL WASTE TANK BOTTOM LIFTING SCHEME - HANFORD
GRAVITY LOAD ON PLATES PRIMARY BOTTOM
STATIC DEFOR. SUBCASE 1 LOAD 10

D-102 REV. 4-75

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AMERICAN BRIDGE
DIVISION

UNITED STATES STEEL CORPORATION

FOR

J. A. JONES CONST CO

DATE _____ BY _____

SHEET NO. 7 OF 7

ORDER NO. & INQ. NO. K7226

1 2-2-77

PRIMARY & SECONDARY TANK BOTTOMS - CONT

SECONDARY TANK BOTTOM DEFLECTIONS

SEE SHG 6

CHECK DEFLECTION TO VALIDATE
NASTRAN (APPROX ONLY - PER ROARK 4TH ED TABLE XEQUIV. AREA 25' x 20' $a/b = 1.25$ $\alpha = .068$ CASE 3C

$$y = \frac{\alpha w b^4}{E t^3}$$

$$w = \frac{3/8 \text{ E} = 15.3 \text{ #/ft}^2}{144} = .10625 \text{ #/in}^2$$

$$b = 240''$$

$$t = 3/8''$$

$$y = \frac{.068 \times .10625 \times 240^4}{E \times .375^3}$$

$$= 15.67' \approx 15.05'$$

* Raymond J Roark
"Formulas for Stress & Strain"

$\therefore$ Deflections appear
reasonable.

UNITED STATES (USS) STEEL CORPORATION

DATE _____ BY: _____

SHEET NO. 1 OF 1

ORDER NO. & INQ NO 5724

FOR J. A. JONES CONST CO

① 2-4-77
Loren

① 2-4-77
Loren

D-103 REV 4-78

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UNITED STATES STEEL CORPORATIONDATE _____ BY _____
SHEET NO. 1 OF 2
ORDER NO. & INQ. NO. K-22

FOR

J. A. JONES CONST CO.

PRIMARY & SECONDARY TANK BOTTOMS - CONT.

 $\Delta 2.477$
when

TANK BOTTOM BENDING STRESSES - CONT.

ELEMENT 9

$$q = 20.35'' \times 0.2833 = 5.76 \text{ #/IN CIR}$$

Ref Cont. Ring Girder loaded
normal to plane of curvature
DESIGN NEWS 6-18-73

$$M = q R^2 \left(\frac{\alpha}{\tan \alpha} - 1 \right) \quad \alpha = \frac{\phi}{2} = 30^\circ$$

$$= 5.76 \times 480^2 \left(\frac{0.57735}{0.57735} - 1 \right) = 123,550 \text{ #"}$$

$$\sigma = \frac{123,550}{63.9 \text{ m}} = 1933 \text{ #/in}^2$$

ok

$\therefore$ ALL THE BOTTOM BENDING STRESSES DUE
TO DEFLECTION OF BOTTOM ELEMENTS ARE LOW.

ELEMENT #9

#	A	y	Ay	Ay ²	I _{xx}
1	5.0	.25	1.25	.31	-
2	9.63	5.00	48.15	240.75	-
3	5.72	18.28	104.57	1911.54	62.34
	20.35		153.97	2152.60	62.34

$$I = 2162.6 + 62.34 = \frac{153.97^2}{20.35} = 1050 \text{ in}^4$$

$$S = \frac{1050}{24 - 7.566} = 63.9 \text{ m}^3$$

D-103 REV 4-79

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DATE _____ BY _____

SHEET NO. 10 OF _____

ORDER NO. & INQ. NO. K224

FOR

J.A. JONES CONST CO

PRIMARY & SECONDARY TANK BOTTOMS - CONTL2-47;
WENSECONDARY BOTTOM-CLIP ATTACHMENTS

(MAX BENDING AND LOCAL STRESSES WILL OCCUR IN THE THINNER BOTTOM.)

D-103 REV 4-78

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UNITED STATES STEEL CORPORATION

DATE _____ BY _____

SHEET NO. 11 OF 22

ORDER NO. & INQ NO. K-224

FOR

J A JONES CONST CO.

PRIMARY & SECONDARY TANK BOTTOMS-CONT.

SECONDARY BOTTOM-CLIP ATTACHMENTS-CONT

INTERIOR CABLES #162 TO 167 ON 30" DIA

$$\phi_1 = \frac{15}{26.8} = 29.36^\circ$$

$$P_5 = 5.01 \text{ K} \cos \phi_1 = 4.37 \text{ K}$$

$$P_6 = 5.01 \text{ K} \sin \phi_1 = 2.46 \text{ K}$$

* SLIGHT ERROR IN
VECTERING

$$\sqrt{(2.16 \text{ K})^2 + (4.97 \text{ K})^2} = 5.62 \text{ K} \approx 5.01 \text{ K}$$

STRESS IN ELEMENT #34 #35

IS 25.3 KSI (REF MID, 6M11)

** SINGLE LUG VERSION NOT USED (USE 2 PLG)

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FOR

J.A. JONES CONST CO

DATE _____ BY _____

SHEET NO 12 OF 22

ORDER NO. & INQ NO K224

12 #77
W36PRIMARY & SECONDARY TANK BOTTOMS-CONT.SECONDARY BOTTOM CLIP ATTACHMENT-CONT.

* FROM COMPUTER *NIS SHEET MAX STRESS

OCCURS AT ELEMENT #501 = 10.37 KSI dk

(NOT UPDATED AS 5.01 K < 5.4 K USED) Wm

App Figure C-63. February 18, 1977 Surveillance Report SR-B-120-1

Atlantic Richfield Hanford Company Richland, Washington 99352		Report No. <u>SR-B-120-1</u>	
QUALITY ENGINEERING PROJECT SURVEILLANCE REPORT		Date <u>2/18/77</u> Page _____ of _____	
Project Number and Title <u>B-120 (241-AW TANK FARM)</u>		Distribution	
Contractor(s) <u>AMERICAN BRIDGE DIVISION</u>		ARHCO	
Activities Observed (What - When) <u>ABD attempted to lower the 105 secondary tank bottom on 2/18/77. (Extent of lift was approximately 6" off of tank support scaffolding.)</u>		PB Fisk AJ Larson DD Ritter Project Engineer QA Engineer	
Findings <u>After several attempts by ABD it was obvious that there were not enough lifting lugs (or supports) on the tank bottom to lift it without excessive distortion of the bottom. (NOTE: DISTORTION - INELASTIC BUCKLING BETWEEN OUTER LIFTING LUGS.)</u>			
Further Action Required Yes ☐ No ☒			
Action Taken (If Required - Include Control Number, if Applicable) <u>ABD stopped the lifting procedure. ABD contacted their engineering department for further analysis of their lifting (lowering) procedure. Possible resolution to the situation will be to add additional lifting lugs or "strongbacks" to bottoms</u>			
SURVEILLANCE BY:		REVIEWED BY:	
<u>J.D. Dalbrith</u> Quality Assurance Engineer		<u>[Signature]</u> Project Engineer	
<u>2/18/77</u> Date		<u>2/23/77</u> Date	

App Figure C-64. February 25, 1977 A.W. Akerson to J.E. Parsons – Bottom Lift Failure

65045

REC'D
FEB 28 1977

TO J. E. Parsons, JAJ
241-AW Trailer, 200 East Area

FROM A. W. Akerson *AWA*

DATE February 25, 1977

SUBJECT Project B-120, 241-AW Tank Farm
Phase IV, Steel Tanks

J. A. CONSTRUCT. **VITRO ENGINEERING CORPORATION**
Architects • Engineers

JOB NO. W.O. C12003
(Title III)

- References:
1. PDT 932-19.4A, Initiated 1/13/77, Dispositioned 2/14/77
 2. PDT 932-19.4B, Initiated 2/10/77, Dispositioned 2/14/77
 3. PDT 932-19.4C, Initiated 2/14/77, Dispositioned 2/17/77
 4. Letter, CJ Madewell (American Bridge) to JE Parsons, 2/11/77
 5. Letter, CJ Madewell to JE Parsons, 2/17/77

This letter is to respond to the Reference 5 letter which, I believe, requires some clarification.

Vitro's initial review of the analysis submitted with the Ref. 1 material revealed that membrane stresses had been inadequately addressed. Rather than formally disapproving the Ref. 1 PDT and suffering the time delays of a formal resubmittal, you agreed to have Vitro's Dr. Chang communicate directly with American Bridge to resolve analysis shortcomings. Dr. Chang did indeed communicate directly with American Bridge; convinced them of the need for additional analysis to cover membrane stresses; and subsequently received, informally, additional analysis from American Bridge adequately covering the membrane stresses. The additional membrane stress analysis was eventually received, formally, via the Ref. 2 and 3 PDT's.

Upon completing his review of the Ref. 1 material, Dr. Chang found that the analysis model used by American Bridge for the vicinity of the lifting lugs was not realistic. His discussions with American Bridge, however, indicated that they were unwilling to do any further analysis. Accordingly, the Ref. 1 and 2 PDT's were dispositioned by Vitro "APPROVE WITH EXCEPTION" since we could not verify the lifting lug portion of the analysis, and resubmittal was required. Exception was also taken to several other minor items.

The Ref. 3 PDT included a letter in which American Bridge expressed confidence in their analysis in its present state. On 2/17/77, prior to Vitro's disposition of the Ref. 3 PDT, American Bridge indicated their intent to proceed with the lifting operation; and Vitro Title III applied a red hold tag to prevent the lifting of the secondary bottom of tank 105 without an approved lifting procedure. Later in the day, Vitro elected to allow American Bridge to proceed at their own risk, on the basis of the confidence expressed in their letter (Ref. 4) and with the understanding that if Vitro's checking analysis of the lifting lugs proved that a problem did exist, American Bridge would repair or replace the relocated bottom. Vitro thereupon dispositioned the Ref. 3 PDT "APPROVE WITH EXCEPTION" but required no resubmittal-- This action allowed the removal of the hold tag and allowed American Bridge to proceed with the lifting procedure (at their own risk). This action had the full concurrence of the project management team.

cc: CW Burger, ERDA-RL
AG Lassila, ERDA-RL
JF Albaugh, ARHCO, 2704W
MD Chang
P. Felise

ES Davis, 1154
IMA Garcia/WH Brayman
DS Mager, 2101M
EV Norris
EE Smith

RR Wyer
Central Files
AWA/Files
LB

App Figure C-65. NCR B-120-88

RL-604 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.D. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-88 (932-41)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REQUIREMENTS</u> Specification B-120-C4, Appendix B, Section 15H, p. 27, para. 4 <u>DESCRIPTION</u> Tank 101-AW dome exhibits reverse curvature and/or flat spots in the following approximate locations: 1. Riser #5 at 90° 2. Riser #5 at 270° 3. The two 24-inch risers located at 0° and 180° that the subcontractor installed to facilitate stress relieving <u>NOTE</u> 1. These are the tank risers that the burners were stationed on during the stress relieving operation. 2. There are several other areas on the dome exhibiting reverse curvatures and/or flat spots that are not as severe as the locations mentioned above.		(1G) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA Rockwell *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery Vitro *AW Akerson IMA Garcia *KA Lucas *JH Parrish LH Smith Central File *Official File *Preliminary Copies	
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE J. H. Parrish, Senior Field Inspector, 3-28-78		
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☒ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☒ OTHER (SPECIFY):		(2B) DISPOSITION JUSTIFICATION <u>Conditional Accept</u> , if American Bridge, in their capacity of having design responsibility for the steel tanks, can provide adequate analyses to support a position that the after-stress relief configuration of the Tank 101-AW steel dome will not... 1. Be overstressed during the subsequent placing of the concrete dome, and... 2. Create localized overstressing conditions in the dome concrete after the supporting water is removed from the tank	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO ☒ NO		Repair, if above conditions for acceptance cannot be met. The repairs, such as addition of external bracing, must be such that the gross steel tank dome deformations will maintain their configuration with up to a 7-foot head of water internal pressure (pressure reached during placing of concrete dome).	
(2D) APPROVALS - (SIGNATURE AND DATE) Design <i>Paul Telus</i> 4/20/78 QA <i>IMA Garcia</i> 4/26/78 PE <i>A.W. Akerson</i> 4-26-78		(2E) CONCURRENCE - (SIGNATURE AND DATE) <i>J.D. Galbraith</i> 5/1/78 <i>P.B. Fisk</i> 5-1-78 <i>R.D. Freeberg</i> 5/5/78 <i>AG Lassila</i> 5/5/78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>James H. Parrish</i> 6-8-78 ORIGINATOR OR REPRESENTATIVE DATE	

13 005 005F
D-103 REV. 4-75
CAT. NO. 9214.00

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MLK B-120-88 ATT 1

DATE 4/5/78 BY: Prostern

SHEET NO. _____ OF _____

ORDER NO. & INQ. NO. K-9224

FOR _____

Tank 101 42" Nozzles T_{max} 1170F

3.000.06.18
D-103 REV. 4-78
CAT. NO. 9214.00

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UNITED STATES STEEL CORPORATION

NCR B-120-88 Att 2

DATE 4/16/78 BY: Preston

SHEET NO. _____ OF _____

ORDER NO. & INQ. NO. K-9224

FOR _____

Tank 102 42" Nozzles Tmax 1070F

Horiz $\frac{1}{2}" = 1'-0"$ (or use 20 on Engineers Scale)
Vert $5" = 1'-0"$

App Figure C-66. June 2, 1978 Letter American Bridge to J.A. Jones – Dome Deformations

#404

American Bridge

DIVISION
UNITED STATES STEEL CORPORATION

P. O. BOX 1099
RICHLAND, WASHINGTON 99352

June 2, 1978

J. A. Jones Construction Company
P. O. Box 560
Richland, Washington 99352

Attention: Mr. J. J. Flannery
Project Manager

Subject: K-9224 - Subcontract No. JAJ-932 (B-120)
241-AW Tank Farm

Gentlemen:

Please refer to your letter JAJ-932-416 dated May 12, 1978, and Vitro Minutes of Meeting dated May 23, 1978, both regarding deformations in the Tank 101 dome around the 42 inch diameter penetrations.

We enclose a letter from our Engineering Department dated June 2, 1978, which responds to the concerns expressed by the Administration. The welds joining the penetrations to the dome have been examined by the magnetic particle method without any indication of fracture. The suggested 3/4 inch diameter tapped studs have also been installed on the dome in the areas of deformation.

Very truly yours,

C. J. Madewell
C. J. Madewell
Project Manager

CJM/cf

RECEIVED

JUN 2 1978

J. A. JONES
CONSTRUCTION CO.

RECEIVED
American Bridge <small>Division of United States Steel Corporation</small>	JUN 1 1978	Interorganization Correspondence June 2, 1978
AB CONST. DEPT. HANFORD-RICHLAND, WASH.	From: S. Bucksbaum Assistant District Engineer ABD - Los Angeles	To: G. J. Madewell Project Manager ABD - Richland
Subject: K-9224 Six Waste Tanks for J. A. Jones		

Please refer to J. A. Jones letter JAJ932-416, dated May 17, 1978. We are responding to this letter with correspondingly numbered discussions.

1. Thermal Creep Analysis, especially with respect to the third stage of creep regime. The material is, of course, no longer in the creep regime, and its strength has been restored to that represented by room temperature tests as shown on the mill test reports.

To eliminate any question that fracture associated with the third stage actually occurred, and in lieu of analysis we propose to examine the outside surface of the welds attaching the two 42" nozzles to the dome by the magnetic particle method.

2. Magnitude of Residual Stresses. There is no way to determine the magnitude and direction of residual stresses due to forming and welding. It is possible, however, to estimate within acceptable accuracy, the maximum value of such a stress. In my opinion the attached curve provides a basis for an estimate of between 19 ksi and 22 ksi maximum residual stress.
3. The departure from perfection of the dome shape will indeed produce local bending stresses during construction. There will be a period during which the water support pressure will not be resisted by the concrete and the local stresses will develop. As the concrete is poured, however, these stresses will be reduced to essentially zero. The transient local stresses could by no stretch of imagination be a substantial fraction of the yield strength of the material and may be ignored.

We do not believe that residual stresses are a factor to be considered when evaluating the effect of the distortions caused by nozzle weight.

In order to insure that the deformed area of steel plate is positively attached to the concrete, American Bridge Division will install the requested additional 3/4" tapped studs in the area of the deflections.

GSP:rs
 Enclosure
 cc: J. W. Fecko (w/encl.)
 W. D. McGregor - ABD-SSF (w/encl.)

By
 G. S. Preston

RECEIVED

JUN 2 1978

**J. A. JONES
 CONSTRUCTION CO.**

RECEIVED

JUN 2 1978

J. A. JONES
CONSTRUCTION CO.

App Figure C-67. April 21, 1978 Memorandum S. Bucksbaum to C. J. Madewell – Stress Relief Internal Pressure

American Bridge Division of United States Steel Corporation	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> R E C E I V E D APR 24 1978 DD WAI WWH VF </div>	Interorganization Correspondence
To: C. J. MADEWELL Project Manager ABD - Richland	AB CONST. DEPT. HANFORD-RICHLAND, WASH.	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 5px;"> CJM SFH PND </div> <div> From: S. BUCKSBAUM Assistant District Engineer ABD - Los Angeles </div> </div>
		Subject: ABD Job No. K-9224 Stress Relief

During my visit to the site on 4/10/78, we were asked to present the results of any additional analysis done with respect to stress relief of the tanks. One area of particular interest was the matter of internal pressure in Tank 101 during stress relief.

First, it should be noted that the calculations for conditions during stress relief presented in the Design Report are based on zero internal pressure. Inspection of Tables 5.4(a) and 5.4(b) shows low general stresses which are to be compared to the allowable stresses developed in Appendix A-2. The conclusion of the Design Report is that the tank is safe to stress relieve without internal pressurization.

Second, in our letter of September 8, 1977 we discussed the matter of bumps and ridges in the bottoms of previously constructed tanks - particularly with reference to the contribution that the stress relief operation had in their formation. Based on Computer Analysis A/WLXDFA, the conclusion reached in this letter was that if pressurized to 3-1/2" of H₂O during stress relief, the load to the lower tangent point of the bottom knuckle would be lower than when dead load only is applied and that the stresses throughout the tank were quite low.

The lowest internal pressure reported while Tank 101 was over 1000F was 1.6" H₂O. We attach computer output A/WLXD62 which still shows low stresses throughout the tank.

We conclude that the reduced internal pressure was not harmful to the tank. We do, however, continue to believe that the optimum internal pressure in the tank is 3-1/2" of water and have taken steps to assure its maintenance during future operations. Before attempting stress relief of Tank 102, we directed our subcontractor to close up the gaps in the gimbal plate burner mountings with sheet asbestos. This was done and a pressure of over 3" of water was maintained.

Another matter of interest was the distortions observable in the dome of Tank 101 (and Tank 102) which has been considered as follows. On Tank 101 the dome was at or above 1000F from 0200 3/5/78 to 1100 3/5/78, that is, about 9 hours. The maximum temperature was about 1170F. If the distortions were caused by creep, there were two obvious measures which could be taken to reduce those distortions. The temperature, and the time at temperature

C. J. MADEWELL

-2-

April 21, 1978

could be substantially reduced. On Tank 102, the dome was at or above 1000F from 1530 3/23/78 to 2230 3/23/78, that is, about 7 hours. The maximum temperature was about 1090F. There was a very substantial reduction in distortion. Efforts will continue to reduce the time at temperature which will further reduce the distortions.

The remaining component of creep is stress. We adapted the computer model used in Appendix C-4 of the Design Report to include the effect of a 42" nozzle at the center of the dome using 3/8" plate. We did several static, small deflection analyses based on a burner weight of 800 lbs. as follows:

AWLXDPI	Simulate Tank 101	Burner on nozzle, Int Pressure 2"
AWLXDPL	Simulate Tank 102	Burner on nozzle, Int Pressure 3-1/2"
AWLXDPI	Alternate	Burner on nozzle, Int Pressure 4-1/2"
AWLXDPI	Simulate Tank 103	No load to nozzle, Int Pressure 3-1/2"

The models used are shown on sheets SK1 and SK2, dated 4/5/78, enclosed.

Study of the results of these analyses shows that removing the burner weight from the nozzle reduces the stress by about one-half, and, increasing the internal pressure has practically no effect on the local stresses caused by the weight of the nozzle and burner. We do not propose to use the 42" nozzles to heat the remaining tanks.

Results of the stress relief of Tank 103 indicate that the distortions have been reduced to acceptable levels. Those that remain are consistent with the strains to be expected at weld seams after stress relief and with the effect of self-weight of the various nozzles.

The effect of the distortions in the dome of Tanks 101 and 102 on concrete placement has been reviewed. The dome was never capable of resisting the concrete placement loads without support. The scheme presented in the Design Report (Section 5.6.2 and Appendices C-9, C-10 and C-11) for support of the roof utilizes water pressure for support of the dome during concrete placement. The use of this method generates only tensile stresses in the dome before, during, and after placement at the concrete. With the concrete in place, the tensile stresses approach zero.

There was a question regarding the stresses currently existing in the domes. Forming, fitting and welding introduce a very complex system of stresses. When a plate is bent to a shape, it is obvious that the surfaces at least, are at the yield point. Similarly, welding introduces yield level stresses. Upon heating to 1170F (Tank 101) or 1070F (Tank 102) the yield point is very substantially reduced. The material after cooling has stresses in it at about that level. Design Report Appendix A2, page 9,

C. J. MADEWELL

-3-

April 21, 1978

provides test results for Medium Carbon Steel. We enclose a similar page of test results for USS Cor-Ten which gives an idea of the effect on yield strength of a steel with room temperature yield strength above 50,000 psi.

Based on the analysis described above, and the refinement of the stress relief procedure to minimize distortions we should proceed with the stress relief of the remaining tanks and release them for concrete placement upon completion of the hydrotest.

By

G. S. Preston

GSP:rs

Enclosures:

SK1 4/5/78

SK2 4/5/78

AW1XD62

AW1XDPI

AW1XDPL

AW1XDPY

AWSXDFX

p. 30, Steels at Elevated Temperatures

cc: J. W. Fecko (w/o enclosures)

W. D. McGregor - ABD-SSF (w/o enclosures)

App Figure C-68. NCR B-120-91

RL-624 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-91 (932-44)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REQUIREMENT</u> Construction Specification B-120-C4, Section 15H, Appendix B, paragraph 4, page 27. <u>DESCRIPTION</u> Tank #102 Dome exhibits areas of reverse curvature and/or flat spots. Note: P.W.H.T. completed		(1G) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA Rockwell *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery Vitro *AW Akerson IMA Garcia *KA Lucas *JH Parrish LH Smith Central File *Official File/2101M *Preliminary Copies
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE <i>J. H. Parrish</i> J. H. Parrish, Senior Field Inspector 4-5-78	
(2A) RECOMMENDED DISPOSITION: ☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION <i>CURVATURES AND FLAT SPOTS ARE NOT SEVERE.</i>	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO		
(2D) APPROVALS - (SIGNATURE AND DATE) Design <i>Paul Felix</i> 4/12/78 QA <i>IMA Garcia</i> 4/14/78 PE <i>A.W. Akerson</i> 4/14/78		(2E) CONCURRENCE - (SIGNATURE AND DATE) <i>J.D. Galbraith</i> 5/22/78 <i>B.W. Knight</i> 5-22-78 <i>AG Lassila</i> 5-22-78
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>J. H. Parrish</i> 5/22/78 ORIGINATOR OR REPRESENTATIVE DATE

App Figure C-69. NCR B-120-94

WL-604 (3-78)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-94 (932-47)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REQUIREMENT</u> Construction Drawing H-2-70395, Revision 1 Specification B120-C4, Section 15H Appendix B, Paragraph 4, Page 27 <u>DESCRIPTION</u> Tank Dome #104 reveals areas of reverse curvature and a flat spot around riser #5 located at 90° and 270°. Reference # 1 - Add PDT 932-13.J1 Reference # 2 - Add Letter to Proj. Mgt. Team from AW Akerson		(1E) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA Rockwell *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery Vitro *AW Akerson <i>NR Kerr</i> IMA Garcia *KA Lucas <i>EM Zakavkov</i> *JH Parrish LH Smith Central File *Official File/2101M *Preliminary Copies	
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE T.J. Deo, Field Inspector 4-13-78 <i>[Signature]</i>		
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☒ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):		(2B) DISPOSITION JUSTIFICATION <p>The reverse curvatures and flat spots are acceptable if American Bridge takes appropriate action to reduce the possibilities of the curvatures and flat spots getting worse.</p> <p>Per Vitro inspection, deviation of areas of reverse curvature and flat spot is less than 1.5 inches. Tanks 102 and 103 exhibited similar deviations, up to 1.92 inches, which were acceptable. Therefore, these deviations are acceptable for tank 104.</p> <p>As NCRB-120-94 Tank 104 this is an evaluation based on engineering judgement.</p> <p>Ref. # 1 - As per Amer. Bridge ltr, dated 6/2/78, Item - Transient local stresses produced during construction are not a substantial fraction of yield forces, and may be ignored.</p>	
(2C) DESIGN CHANGE REQUIRED ☐ YES ☒ NO			
(2D) APPROVALS (SIGNATURE AND DATE) DESIGN <i>[Signature]</i> 4/20/78 SAFETY <i>[Signature]</i> 4/24/78 N/A See above.		(2E) CONCURRENCE (SIGNATURE AND DATE) <i>[Signature]</i> 6/22/78 <i>[Signature]</i> 6-22-78 <i>[Signature]</i> 7/7/78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>[Signature]</i> 7-13-78 ORIGINATOR OR REPRESENTATIVE DATE	

PROCUREMENT DATA TRANSMITT

SHEET 1 OF 1

PDT 932-13.J.1

TO: J. V. Lawler - Vitro		DATE: 6/12/78		DISTRIBUTION	
FROM: S. J. Bridges - JAJ				1 EES/A. Bjorkedal 1 MD Chang 0 AW Akerson *1 JD Galbraith 0 AG Lassila 0 RD Freeberg 1 DS Beetle 6-12-78	
PROJECT TITLE: 241-AW Tank Farm		BLDG. NO.: 200 East			
P.O. NO.	PROJECT NO.: B-120	AEC REQ. NO.	AEC W.O.NO.		
CONTR. REQ. NO.	SUBCONTRACT NO.: JAJ-932	SUBCONTRACTOR OR VENDOR: American Bridge			
FOR: ☐ PRE-PURCHASE EVALUATION ☒ APPROVAL DATA ☐ CVI					
DATA AND QUANTITY FURNISHED: INCLUDE DRWG. NO.'S. - BULLETIN NO.'S. - NUMBER COPIES OF EACH Transmitted herewith is American Bridge's response to resolve the deficiencies stated in the review remarks of PDT 932-13.J <div style="text-align: center; font-size: 2em; font-weight: bold;">RUSH!</div>					
TO: S. J. Bridges, JAJ		DATE: 6-15-78		DISTRIBUTION	
FROM: D. S. Beetle, Vitro <i>DSB</i>				0 EE Smith 0 MD Chang 0 AW Akerson 2 JM Johnston 0 JD Galbraith 0 WH Braymen 0 AG Lassila 0 RD Freeberg 1 DS Beetle 0 Central Files	
☒ APPROVED ☐ NOT APPROVED ☐ APPROVE WITH EXCEPTION					
REMARKS: The submitted data is approved. <div style="text-align: center;"> <i>NCR B-120-94</i> <i>Back-up information</i> <i>not distributed with</i> <i>NCR</i> <i>JHP</i> <i>7.14.78</i> </div>

J. A. JONES CONSTRUCTION COMPANY

801 FIRST STREET • RICHLAND, WASHINGTON • 99352 • (509) 942-6707

JJF:0098

June 5, 1978

Vitro Engineering Corporation
Automation Industries, Inc.
P.O. Box 296
Richland, Washington 99352

Attention: Mr. A. W. Akerson

Gentlemen:

PROJECT B-120, 241-AW TANK FARM
PHASE IV STEEL TANKS
DEFORMATION IN DOME OF TANK 241-AW-101

With reference to your meeting minutes of May 23, 1978 on the above-referenced subject, the enclosed data supplied by American Bridge will resolve, with your acceptance, items I, II, III and IV and release all outstanding NCR's on Tank No. 101.

Your immediate response is requested.

Very truly yours,

J. A. JONES CONSTRUCTION

J. J. Flannery
Project Manager

JJF:kw

cc: JD Galbraith
AG Lassila
BL Moss

41-104
American Bridge

DIVISION
UNITED STATES STEEL CORPORATION

P. O. BOX 1099
RICHLAND, WASHINGTON 99352

June 2, 1978

J. A. Jones Construction Company
P. O. Box 560
Richland, Washington 99352

Attention: Mr. J. J. Flannery
Project Manager

Subject: K-9224 - Subcontract No. JAJ-932 (B-120)
241-AW Tank Farm

Gentlemen:

Please refer to your letter JAJ-932-416 dated May 12, 1978, and Vitro Minutes of Meeting dated May 23, 1978, both regarding deformations in the Tank 101 dome around the 42 inch diameter penetrations.

We enclose a letter from our Engineering Department dated June 2, 1978, which responds to the concerns expressed by the Administration. The welds joining the penetrations to the dome have been examined by the magnetic particle method without any indication of fracture. The suggested 3/4 inch diameter tapped studs have also been installed on the dome in the areas of deformation.

Very truly yours,

C. J. Madewell
Project Manager

CJM/cf

RECEIVED

JUN 2 1978

J. A. JONES
CONSTRUCTION CO.

D-MS 417 411

UNITED STATES STEEL CORPORATION

SHEET NO. 1 OF 1

ORDER NO. & INQ NO. L-9224

Estimate of Maximum Residual Stresses
after Post weld heat treatment at 1170°F

See USS Steel Design Manual, Figure 1.5 and note
 that all steels have about 38% of room temperature
 Yield Strength at 1170°F

$$0.38 \times 50 = 19 \text{ ksi}$$

RECEIVED

JUN 2 1978

J. A. JONES
CONSTRUCTION CO.

American Bridge
 Division of United States Steel Corporation
 JUN 1 1978
 DD
 WAL
 WMB
 VF
 AB CONST. DEPT.
 HANFORD-RICHLAND, WASH.
 Date: June 2, 1978
 From: S. Bucksbaum
 Assistant District Engineer
 ABD - Los Angeles
 Subject: K-9224
 Six Waste Tanks for J. A. Jones

Please refer to J. A. Jones letter JAJ932-416, dated May 17, 1978. We are responding to this letter with correspondingly numbered discussions.

1. Thermal Creep Analysis, especially with respect to the third stage of creep regime. The material is, of course, no longer in the creep regime, and its strength has been restored to that represented by room temperature tests as shown on the mill test reports.

To eliminate any question that fracture associated with the third stage actually occurred, and in lieu of analysis we propose to examine the outside surface of the welds attaching the two 42" nozzles to the dome by the magnetic particle method.

2. Magnitude of Residual Stresses. There is no way to determine the magnitude and direction of residual stresses due to forming and welding. It is possible, however, to estimate within acceptable accuracy, the maximum value of such a stress. In my opinion the attached curve provides a basis for an estimate of between 19 ksi and 22 ksi maximum residual stress.

3. The departure from perfection of the dome shape will indeed produce local bending stresses during construction. There will be a period during which the water support pressure will not be resisted by the concrete and the local stresses will develop. As the concrete is poured, however, these stresses will be reduced to essentially zero. The transient local stresses could by no stretch of imagination be a substantial fraction of the yield strength of the material and may be ignored.

We do not believe that residual stresses are a factor to be considered when evaluating the effect of the distortions caused by nozzle weight.

In order to insure that the deformed area of steel plate is positively attached to the concrete, American Bridge Division will install the requested additional 3/4" tapped studs in the area of the deflection.

GSP:rs

Enclosure

cc: J. W. Pecke (w/encl.)
 W. D. McGregor - ABD-SSF (w/encl.)

By G. S. Preston

RECEIVED

JUN 2 1978

J. A. JONES
 CONSTRUCTION CO.

App Figure C-70. NCR B-120-95

NL-604 (3-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-95 (932-48)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION <u>REQUIREMENT</u> Construction Specification B-120-C4, Section 15H, Appendix B, paragraph 4, page 27. <u>DESCRIPTION</u> The dome on Tank #103 exhibits areas of reverse curvature and/or flat spots. Note: 1. The areas of reverse curvature are confined mainly to the dome circumferential weld seams. 2. The areas of flat spots are located primarily around the 42" risers and one of the additional 24" risers used for stress relieving.		(1G) DISTRIBUTION DOE *RD Freeberg *AG Lassila QA Rockwell *JD Galbraith *PB Fisk JAJ LJ Maenpaa *JJ Flannery Vitro *AW Akerson IMA Garcia *KA Lucas *JH Parrish LH Smith Central File *Official File
(1E) HOLD TAG NO. N/A	(1F) ORIGINATOR, TITLE AND DATE J.H. Parrish, Sr. Field Inspector, 4-18-78	*Preliminary Copies
(2A) RECOMMENDED DISPOSITION: ☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION Reverse curvatures and flat spots are not critical enough to cause a structural problem during subsequent construction and operational loading conditions.	
(2C) DESIGN CHANGE REQUIRED? ☐ YES ☐ NO ☒ NO		
(2D) APPROVALS - (SIGNATURE AND DATE) Design: 4/24/78 QA: 4/24/78 Safety: 4/24/78 4-26-78		(2E) CONCURRENCE - (SIGNATURE AND DATE) 5/22/78 5-22-78 5/22/78
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED, NCR CLOSED. ☐ OTHER (SPECIFY):
ORIGINATOR OR REPRESENTATIVE		5-28-78 DATE

19,000,0058
D-102 REV. 6/73
CAT. NO. 9214,30

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AMERICAN BRIDGE
DIVISION
UNITED STATES STEEL CORPORATION

DATE 5/10/78 BY 37H
SHEET NO. 1 OF 1
ORDER NO. & INQ. NO. K9224

FOR _____

Tank 103 42" Nozzles

Horiz - $\frac{1}{2}$ " = 1'-0"
Vert 5" = 1'-0"

App Figure C-71. NCR B-120-92

RL-604 (8-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120		(1B) TITLE ADDITIONAL HIGH LEVEL WASTE STORAGE FACILITIES, 241-AW TANK FARM	(1C) NCR NO. B-120-92 (932-45)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION		(1G) DISTRIBUTION	
<p><u>REFERENCE</u></p> <p>American Bridge procedure for Post Weld Heat Treatment of Primary Tanks. PDT 932-32.4</p> <p><u>DISCREPANCY</u></p> <p>Three of the four deflector tubes mounted to the burners during the stress relieving of Primary Tank #102 burned off at approximately 800° and fell to the bottom of the primary floor.</p> <p>Note: 1. The deflector tubes are approximately 8 inches in diameter, made of 3/16" thick plate and vary in length from 8 feet to</p>		<p>DOE</p> <p>*RD Freeberg</p> <p>*AG Lassila</p> <p>QA</p> <p>Rockwell</p> <p>*JD Galbraith</p> <p>*PB Fisk</p> <p>JAJ</p> <p>LJ Maenpaa</p> <p>*JJ Flannery</p> <p>Vitro</p> <p>*AW Akerson</p> <p>IMA Garcia</p> <p>*KA Lucas</p> <p>*JH Parrish</p> <p>LH Smith</p> <p>Central File</p> <p>*Official File/2101M</p>	
(1E) HOLD TAG NO.	(1F) ORIGINATOR, TITLE AND DATE		(1G) DISTRIBUTION
	J. H. Parrish, Senior Field Inspector, 4-6-78		*Preliminary Copies
(2A) RECOMMENDED DISPOSITION:		(2B) DISPOSITION JUSTIFICATION	
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):		<p>NO DAMAGE FOUND AFTER CLOSE EXAMINATION. ANY STRESSES DEVELOPED AS A RESULT OF IMPACT ENERGY WERE SUBSEQUENTLY RELIEVED FROM THE STEEL BY THE HEATING OPERATION. THIS NCR HAS BEEN CREATED TO DOCUMENT AN UNUSUAL OCCURRENCE.</p>	
(2C) DESIGN CHANGE REQUIRED?			
☐ YES ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)	
Design <i>Paul Felix</i> 4/26/78 QA <i>IMA Garcia</i> 4/26/78		Safety <i>I.A. Shephard</i> 4/26/78 PE <i>A.W. Akerson</i> 4-26-78	
		<i>JD Galbraith</i> 4/27/78 <i>J.V. Smith</i> 4-27-78 <i>AG Lassila</i> 4/31/78	
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>James H. Parrish</i> 5-2-78 ORIGINATOR OR REPRESENTATIVE DATE	

NCR 6-20-92 (932-45), Att. 1

(Continued)

DISCREPANCY

13 feet.

NOTE: 2. The surrounding area where the tubes impacted the floor was visually inspected and no gouges, nicks or scratches were recognized.

App Figure C-72. NCR B-120-19

RL-606 (3-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE Additional High Level Waste Storage Facilities, 241-AW Tank Farm	(1C) NCR NO. B-120-19 (947-12)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: Specification B-120-C3, Section 3A (ACI 301-72) 11.7.2 See attached sketch. Description: Concrete finishes and tolerances Tank 102 Foundation 1. The unformed floated finish of the tank foundation does not conform to a Class B tolerance (1/4" in 10' variation). 2. The finish of the top surface of the tank foundation concrete does not conform to the required 1/8" in 2' to a true plane, as determined by a 2' straight edge placed anywhere on the slab in any direction. 3. The measurements made by Vitro Survey for maximum variation in finish surface of plus or minus 1/2 inch from the elevation shown on the drawing indicate that the allowable tolerance has been exceeded. Attachment (1)		(1G) DISTRIBUTION ERDA AG Lassila GS Rokkan ARHCO JF Albaugh AJ Larson JAJ JE Parsons LJ Maenpaa VITRO AW Akerson PW Armstrong IMA Garcia TL Walton RR Wyer Central ✓ Official File
(1E) HOLD TAG NO. None	(1F) ORIGINATOR, TITLE AND DATE P. W. Armstrong, Field Engineer 10-14-76 <i>JP</i>	
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☒ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION Repair in accordance with approved procedure.	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO		
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)
DESIGN <i>10/28/76</i> QA MANAGER <i>IMA Garcia 10/28/76</i> PROJECT ENGINEER <i>AW Akerson 10-28-76</i>		<i>JP</i> <i>J.F. Albaugh 10/28/76</i> <i>J.D. Dalbrath 10/29/76</i> <i>AG Lassila 10/29/76</i>
(3A) ☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>Paul W. Armstrong</i> ORIGINATOR OR REPRESENTATIVE 2/25/77 DATE

AUTOMATION INDUSTRIES, INC.
VITRO ENGINEERING DIVISION

Attachment to NCR B-120-19 (947-1.

CONSTRUCTION AND INSPECTION CHECK LIST

PROJECT B-120 - 241-AW Tank Farm - Phase III Tank Foundations		SHEET NO. 1 OF 1
FEATURE SURVEY CHECK - ELEVATION AND SLOPE FOR FOUNDATION CONCRETE - TANK 102		PREPARED BY J. M. Johnston
REFERENCE Construction Specification B-120-C3 Drawing H-2-70305		Approved by <i>Donald H. Meyer</i>
OTHER DATA		DATE 9-8-76
		DISTRIBUTION

Tanks 101
and 102

North

Tanks 103,
104, 105,
and 106

App Figure C-73. NCR B-120-23

AL-804 (3-76)

NONCONFORMANCE REPORT

(1A) PROJECT, LOCATION OR W.O. B-120	(1B) TITLE Additional High Level Waste Storage Facilities, 241-AW Tank Farm	(1C) NCR NO. B-120-23 (947-16)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION Reference: Disposition for NCR B-120-19 (947-12) Description: The Contractor proceeded to patch/repair concrete surface of Tank Foundation 102 without the approved procedure of the referenced document.		(1E) DISTRIBUTION ERDA AG Lassila ARHCO JF Atbaugh JAJ JE Parsons Vitro AW Akerson Project File ERDA-RL-QA
(1F) HOLD TAG NO. 0013 Red	(1G) ORIGINATOR, TITLE AND DATE P. W. Armstrong, Field Engineer, 11-1-76	
(2A) RECOMMENDED DISPOSITION: ☐ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☒ REPAIR ☐ REJECT ☐ OTHER (SPECIFY):	(2B) DISPOSITION JUSTIFICATION Submit proper procedure for repair and repair in accordance with approved repair procedure.	
(2C) DESIGN CHANGE REQUIRED? ☐ YES NO. _____ ☒ NO	See Attachment <i>Y.P.</i>	
(2D) APPROVALS (SIGNATURE AND DATE) DESIGN: <i>W. G. Baker 11/9/76</i> QA MGR: <i>W. H. Akerson 11-10-76</i> PROJ ENGR: <i>W. H. Akerson 11-10-76</i>		(2E) CONCURRENCE (SIGNATURE AND DATE) SAFETY: <i>W. H. Akerson 11/10/76</i> <i>W. H. Akerson 12/9/76</i> <i>J. F. Atbaugh 12/9/76</i> <i>W. H. Akerson 12/6/76</i>
(3A) ☐ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		
ORIGINATOR OR REPRESENTATIVE		DATE

App Figure C-74. NCR B-120-50

(1A) PROJECT, LOCATION OR W.D.		(1B) TITLE	(1C) NCR NO.
B-120		Additional High Level Waste Storage Facilities, 241-AW Tank Farm	B-120-50 (947-29)
(1D) REQUIREMENTS AND NONCONFORMANCE DESCRIPTION		(1G) DISTRIBUTION	
<p><u>REFERENCES</u></p> <p>Construction Specification B-120-C3 Drawing H-2-70305, Rev. 1</p> <p><u>DESCRIPTION</u></p> <p>Some of the repaired concrete surface of Tank 102 Foundation was found to be spalled. There were six areas. One area was approximately 3' x 12", another 10' x 30". Four other areas were quite small ranging from 6 square inches to 3 square feet. Repairs were accomplished without an approved repair procedure.</p>		<p>ERDA</p> <p>*CW Burger</p> <p>*AG Lassila</p> <p>GS Rokkan</p> <p>ARHCO</p> <p>*JF Albaugh</p> <p>*AJ Larson</p> <p>JAJ</p> <p>LJ Maenpaa</p> <p>*JE Parsons</p> <p>VITRO</p> <p>*AW Akerson</p> <p>*PW Armstrong</p> <p>IMA Garcia</p> <p>RR Wyer</p> <p>Central File</p> <p>*Official File</p> <p>*Preliminary Copies</p>	
(1E) HOLD TAG NO.	(1F) ORIGINATOR, TITLE AND DATE		
None	P. W. Armstrong, Field Engineer 4-22-77		
(2A) RECOMMENDED DISPOSITION:	(2B) DISPOSITION JUSTIFICATION		
☒ ACCEPT AS IS ☐ CONDITIONAL ACCEPT ☐ REWORK ☐ REPAIR ☐ REJECT ☒ OTHER (SPECIFY):	<p>E. A. Goakey, Vitro Civil/Structural Engineer for this project, inspected the in-process repairs, repair procedure utilized (actual procedure used, not a documented procedure), and patching material used; and he, in his technical judgment, has determined that the repair action taken is technically adequate for this specific application. Some of the factors taken into consideration in arriving at his judgement are...</p> <ul style="list-style-type: none"> Size of repaired areas (surface area and/or depth) approach insignificance. Grout patching will continue to cure with the secondary tank resting on them. Grout had not taken any initial set prior to placement of the secondary tank on the foundation which will result in... <ul style="list-style-type: none"> a) Confining of the patches. b) Conforming of the patches to minor deformations of the tank bottom-- c) Protecting the patch while it cures. Grouted surfaces were leveled between existing approach surfaces which should remove requirement for verification of elevation of patched areas. 		
(2C) DESIGN CHANGE REQUIRED?			
☐ YES NO. _____ ☒ NO			
(2D) APPROVALS - (SIGNATURE AND DATE)		(2E) CONCURRENCE - (SIGNATURE AND DATE)	
Design <i>VITRO ENG</i> <i>W. H. H. 4/22/77</i> Safety <i>4/22/77</i> QA <i>R. A. Dennis</i> Project Management <i>4/22/77</i> <i>5-31-77</i>		<i>5/31/77</i> <i>5/31/77</i> <i>5/31/77</i>	
(3A)			
☒ DISPOSITION EFFECTED AS DIRECTED. NCR CLOSED. ☐ OTHER (SPECIFY)		<i>Paul W. Armstrong</i> <i>5/31/77</i> ORIGINATOR OR REPRESENTATIVE DATE	

NCR B-120-50 Att. 1

PJT 6120-23

J. A. JONES CONSTRUCTION COMPANY

May 18, 1977

REPAIR PROCEDURE - PATCHING OF TANK FOUNDATION #102

The procedure J. A. Jones followed to make the repairs on Tank #102 foundation was in accordance with manufacturers recommendations for Prebond Bonding Adhesive which reads as follows:

1. All loose areas were chipped out and thoroughly cleaned.
2. Area was moistened with water and painted with pure, undiluted Pre-Bond.
3. Patching material was applied to area when Pre-Bond became tacky.
4. Patched area was sprayed with Graco Concrete Curing Agent (which also contains a releasing agent).
5. Pre-Bond was mixed with the patching material in accordance with the manufacturers recommendations.

This procedure and material is the standard method used by J. A. Jones on all concrete repairing in the 200-East/200-West Areas and has had a standing approval from Vitro. This procedure has a proven history of success in this area.

NCR B-120-50, Att. 2

Approximate location of repair areas to concrete foundation.

North
↑
Tk. 102

App Figure C-75. November 28, 1980 Letter – AW-104 Pitting

Internal Letter

Date: November 28, 1980

65413-80-331

TO: J. F. Albaugh, Prog Manager
Waste Storage & Disposal
2750-E/200 East

FROM: J. S. Schofield
Waste Processing Technology Unit
2750-E/A113/200 East
3-1048

Subject: Inspection Of Tank 104-AW

Ref: IL 65413-80-280, October 22, 1980, J. S. Schofield to
J. F. Albaugh, "Inspection of Tank 107-AN."

Tank 104-AW has been inspected by Rockwell Hanford Operations' Research and Engineering (R&E) and Quality Assurance (QA) personnel. No significant defects were noted within the tank. This is no evidence of pitting corrosion similar to that found in the new Savannah River Plant (SRP) tanks. The following letter provides a summary of the inspection results. Refer to the referenced letter for details of the inspection criteria.

The Tank 104-AW interior was inspected for pitting corrosion, weld cracks, etc. on November 12 and 13, 1980. Listed below is the pertinent information concerning the inspection and the data obtained.

1. The tank was drained of all liquid, rinsed and dried prior to inspection. A sample was taken of the heel prior to removal.
2. Preliminary inspection of the tank bottom and walls was made by three technical personnel on November 12, 1980. No loose scale was found on the walls as was found in Tank 107-AN, and there were fewer rust buildup spots. The floor had more mill scale than Tank 107-AN, and several small pits were noted. Some areas of the floor were completely covered with mill scale. Areas directly under the east and west access risers were covered by considerable number of small, hard, rust colored nodules. These were evidently caused by rain, or some spray which had entered through the risers. Pits were of negligible depth (0-5 mils est.) under the nodules.
3. The same 20-25 ft² areas (~10 percent of the tank and lower wall bottom) used for Tank 107-AN inspection were marked out on the floor of Tank 104-AW and used for detailed inspection. Inspection criteria were the same as for Tank 107-AN.
4. A total of 73 "pits" were found. No pits were found $\geq 1/16$ inch deep. The largest "pit" was 50 mils deep. All other pits were in the 7-34 mil range. Average depth was .23 mils. The "pits" were found in 13 of the 20 areas inspected. Pitting was fairly evenly distributed about the tank as opposed to those in Tank 107-AN which were predominantly near the edge. Scale and rust samples were taken from the wall and several areas on the bottom.

J. F. Albaugh
Page 2
November 28, 1980

5. All pits were irregular shaped and appeared to be due to a galvanic reaction between the mill scale and bare steel, similar to that encountered in Tank 107-AN. Pitting was greater in those areas without any mill scale. This is logical as the reaction between the mill scale and bare metal is a function of the bare metal (anode) surface area. Much more of the Tank 104-AW bottom was covered with mill scale than in Tank 107-AN, so there was less bare metal surface area. The pitting in those bare areas was, therefore, more numerous than in Tank 107-AN, although still of negligible depth..
6. Pictures were taken of all the "pits" found except those which were very small. Analyses of the heel solution in Tank 104-AN showed no chloride, sulfate or phosphate. Nitrite content was 1400 ppm and the pH was 9.3. It has been recommended by E. L. Moore that we either keep the tanks dry until use, or keep the tank heel solutions at a minimum 500 ppm nitrite and 12.0 pH. Tank 104-AW will be kept dry if possible. Samples have been requested for the other tanks in AW farm which have not yet received waste.

Assuming a normal distribution of pits, and the fact that no pits were found $\geq 1/16$ inch, we can state with a 99 percent confidence level that the average concentration of $1/16$ inch deep or greater defects in Tank 104-AW is < 0.53 per 50 ft². Based upon the results of this inspection, I feel the integrity of Tank 104-AW is sound, and the tank is capable of meeting the criteria to which it was designed and fabricated.

John Schofield

J. S. Schofield
Sr. Engineer
Waste Processing Technology Unit

JSS/rrm

cc: F. E. Boyd	G. A. Huff	R. C. Roal
G. M. Christensen	G. L. Jordan	J. H. Roecker
R. D. Hammond	J. D. Keck	W. D. Schildknecht
J. L. Deichman	A. R. Light	T. B. Veneziano
G. T. Dukelow	E. L. Moore	D. J. Washenfelder
D. G. Harlow	M. J. Oss	D. G. Wilkins <i>Dr</i>
L. P. Hoebe	R. D. Prosser	H. A. Zweifel <i>Dr</i>