241-AP 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-AP tank farm. The construction history of the 241-AP 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-AP tank farm, the sixth double-shell tank farm constructed, tank bottom flatness, refractory material quality, post-weld stress relieving, and primary tank bottom weld rejection were improved.

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EXECUTIVE SUMMARY

The construction of the 241-AP 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 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 sixth double-shell tank farm built (241-AP tank farm) or produced similar reduced margins.

The secondary liner bottom thickness was increased from 1/4-in. in the 241-AY tank farm to 3/8 in. in the 241-AP tank farm and the primary tank bottom thickness was increased from 3/8-in. to 1/2-in. The American Society for Testing and Materials (ASTM) A537-79 carbon steel plate material utilized in the 241-AP tank farm also varied from the ASTM A515-65 carbon steel plate used in the 241-AY tank farm. ASTM A537 provides a higher yield strength.

During construction of the 241-AP tank farm, primary tank bottom weld rejection was significantly improved over that seen during 241-AY-102 tank construction. A weld rejection of 5% to 12% was noted in the 241-AP tank farm, while tank AY-102 primary bottom saw a 34% weld rejection. There were two out-of-specification bulges in primary tank AP-104. Dead weight was placed on the bulges, which brought the primary bottom into specification. No bulges were found in any of the secondary liner bottoms. All 241-AP tank farm stress relief processes were completed successfully using alternate code requirements (1000°F for three hours per inch or 950°F for 5 hours for AP-108 only) and were accepted. There is a higher certainty of proper stress relief in the 241-AP tank farm than was noted for tank AY-102.

Litecrete 60M was the castable refractory material utilized in the 241-AP tank farm tanks (RPP-19097, *Evaluation of Insulating Concrete in Hanford Double-Shell Tanks*, incorrectly indicates that Lite Wate 70 castable refractory material was used). For tanks AP-101 through AP-107, no indication of out-of-specification refractory was found. Plastic shrinkage cracks were found in tank AP-108 refractory, caused by curing too quickly. These cracks were filled with refractory material and the refractory was accepted.

Tank bottom bulging, refractory material quality, post-weld stress relieving, and primary tank bottom weld rejection in the 241-AP tank farm were improved when compared to tank AY-102. These issues, along with others (e.g. concrete foundation and encasement repairs and weld joint preparation), are judged to be minor. Overall condition of the 241-AP tank farm following construction is judged to be better than that of tank AY-102.

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Abbreviations and Acronyms

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BNS	Bottom North-South weld seam
BRS	Bottom Round Seam
DOE	U.S. Department of Energy
DST	Double-Shell Tank
ECN	Engineering Change Notice
LDP	Leak Detection Pit
NCR	Non-Conformance Report
NDE	Non-Destructive Examination
Rockwell	Rockwell Hanford Operations
RRS	Roof Round Seam (tank dome)
SMAW	Shielded Metal Arc Welding
TOC	Tank Operations Contractor
WRPS	Washington River Protections Solutions LLC
WST	Waste Storage Tank

Units

ft	Feet
in	Inch
h	Hour
lb	Pound
Mgal	Million Gallons

TRADEMARK DISCLOSURE

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1.0 INTRODUCTION

This document provides an overview of construction, noting any difficulties encountered for the 241-AP tank farm, the sixth 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*). In tank AY-102, 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 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 (Interoffice MemorandumWRPS-1204931, *Double-Shell Tank 241-AY-102 Primary Tank Leak Extent of Condition Evaluation and Recommended Annulus Visual Inspection Intervals*). The EOC evaluation identified 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 a precursor 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 external letter 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. 241-AW and 241-AN tank farms were evaluated in the following reports:

- RPP-RPT-55981, *241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity*
- RPP-RPT-55982, *241-AN Tank Farm Construction Extent of Condition Review for Tank Integrity*

This report is the last of the six extent-of-condition reports for the Hanford DSTs.

1.1 PURPOSE

The construction of the 241-AP 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-AP tank farm was the sixth farm to be constructed and is the focus of this report. Table 1-1 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 2014

Tank Farm	Number of Tanks	Construction Period	Construction Project	Initial Operation	Service Life	Current Age
241-AY	2	1968 – 1970	IAP-614	1971	40	43
241-AZ	2	1970 – 1974	HAP-647	1976	20	38
241-SY	3	1974 – 1977	B-101	1977	50	37
241-AW	6	1976 – 1979	B-120	1980	50	34
241-AN	7	1977 – 1980	B-130, B-170	1981	50	33
241-AP	8	1982 – 1986	B-340	1986	50	28
Total	28					

In the construction records, letter designations A through P were often used to identify each primary tank or secondary liner. Table 1-2 provides a legend for these letter designations.

Table 1-2. Letter Designations for 241-AP Tank Farm

Tank	Primary	Secondary
AP-101	M	E
AP-102	K	D
AP-103	O	H
AP-104	N	G
AP-105	P	B
AP-106	L	A
AP-107	J	F
AP-108	I	C

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 8-in. insulating concrete 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.

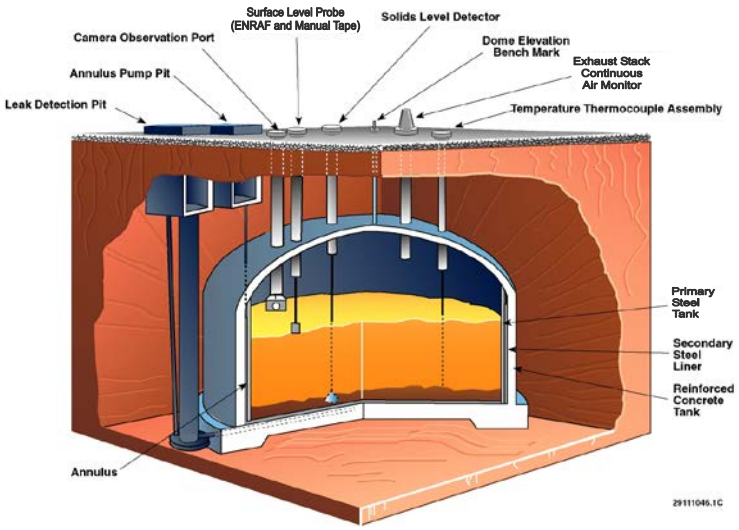

Figure 1-1. Double-Shell Tank Construction

Each tank in the 241-AP tank farm has 71 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-AP TANK FARM CONSTRUCTION INFORMATION

The 241-AP tank farm was constructed between 1982 and 1986. It was designated as Project B-340, *241-AP Tank Farm*. Rockwell Hanford Operations (Rockwell) built the tank farm for the United States Department of Energy (DOE). The 241-AP tank farm contains eight tanks and ancillary equipment. American Bridge Division of US Steel Corporation (American Bridge) was contracted to build the farm. Construction management was provided by J.A. Jones.

The 241-AP tank farm was built according to SD-340-FDC-001, *Function Design Criteria*, and the following construction specifications:

- B-340-D1, *Design Specification for Primary and Secondary Steel Tanks 241-AP Tank Farm*
- B-340-C1, *Construction Specification for the 241-AP Tank Farm Site Preparation*
- B-340-C2, *Construction Specification for the 241-AP Tank Farm Site Excavation*
- B-340-C3, *Construction Specification for the 241-AP Tank Farm Tank Foundations*
- B-340-C4, *Construction Specification for Primary and Secondary Steel Tanks 241-AP Tank Farm*
- B-340-C5, *Construction Specification for the 241-AP Tank Farm Tank Encasement*
- B-340-C6, *Construction Specification for the 241-AP Tank Farm Backfill*
- B-340-C7, *Construction Specification for the 241-AP Tank Farm Completion*

The following three specifications were added to support additional project scope:

- B-340-C8, *Construction Specification for the 241-AP Tank Farm – 242A Evaporator Modifications*
- B-340-C9, *Construction Specification for 241-AP Tank Farm Cathodic Protection Systems*
- B-340-C10, *Construction Specification for 241-AP Tank Farm Additional Pipe Line*

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-340. This information includes:

1. Inspection Reports
2. Radiographic Test Reports
3. Materials Certifications
4. Non-conformance reports
5. Project reports, correspondence, and meeting minutes

There is no evidence of daily logbook entries for construction of the 241-AP tank farm. Daily logbooks generally describe key construction events and issues; without the daily logbooks, some sections may lack extensive detail. 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.

3.0 MATERIALS OF CONSTRUCTION

The materials of construction evolved from the construction of 241-AY tank farm to the construction of the 241-AP tank farm. The primary change in material selection was to use American Society for Testing and Materials (ASTM[1]) A537-79, *Pressure Vessel Plates, Heat Treated, Carbon-Manganese-Silicon* (Specification B-340-C4), for construction of the primary and secondary liners instead of ASTM A515, *Pressure Vessel Plates, Carbon Steel, for Intermediate and Higher Temperature Service*, Grade 60, used in the 241-AY tank farm.

In the 241-AP tank farm, the thickness of the secondary liner bottom plate is increased to 3/8-in. from 1/4-in. seen in the 241-AY tank farm. The primary tank bottom was increased from 3/8-in. to 1/2-in. sections. The refractory material was changed from Kaolite[2] 2200LI castable refractory to Litecrete 60M castable refractory. 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-AP tank farms.

Table 3-1. Materials Comparison

Material	241-AY Tank Farm	241-AP Tank Farm
Concrete	3000 psi Type V for the walls Type III for the haunch and dome	4500 psi Type II for the foundations 5000 psi Type II for the walls, domes, and haunches
Reinforcing Bar	ASTM A432 for the walls, dome and haunch ASTM A15 for the foundation	A615, Grade 60, except #3 ties shall be Grade 40
Steel Plate	ASTM A515-65	ASTM A537-79, Class 1
Refractory	Kaolite 2200LI	Litecrete 60M

3.1 CONCRETE

The structural concrete used in the 241-AP tank farm foundation construction required a 4,500 psi, 28-day compressive strength. The structural concrete used in the 241-AP tank farm concrete shell construction required a 5,000 psi, 28-day compressive strength. The cement for all structural concrete used in 241-AP tank farm tank construction conformed to ASTM C150 Type II (Low Alkali). 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 Type V concrete for the 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

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[2] Kaolite is a registered trademark of Babcock & Wilcox Company.

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

The tank foundation was reinforced with ASTM A615, Grade 60, specifications with minimum yield strength of 60,000 psi. #5, #6, #7, #8, and #10 rebar was utilized to reinforce the tank foundation (see H-2-90439, *Structural Concrete Tank Foundation Plan and Details*, for details) while ASTM A615, Grade 60, #6, #7, #8, #9, and #10 rebar was utilized to reinforce the concrete walls and dome sections (see H-2-90441, *Structural Dome Reinforcement Plan and Detail*, and H-2-90442, *Structural Tank Section and Haunch Reinforcement*, for details).

3.3 STEEL PLATE

All primary tank and secondary liner plates used in the 241-AP tank farm were manufactured to ASTM A537-79, Class 1, standard. The selection of ASTM A537 was a change from ASTM A515 used in the 241-AY tank farm. ASTM A537 is a fine grain size metal produced for moderate and lower temperature service, 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. The 241-AP tank farm tanks were erected using the American Society of Mechanical Engineers (ASME[3]), *Boiler and Pressure Vessel Code*, 1980 through winter 1981 Editions and Addenda of the code.

3.3.1 Secondary Plate

The secondary liner plates consisted of 3/8-in., 1/2-in., and 9/16-in. sections (see H-2-90534, *Tank Cross Section 241-AP Tank Farm*, for details). The 1/2-in. plate was used in the transition plate from the lower knuckle to the bottom and first course of the liner. The 9/16-in. plate was used in the lower knuckle, and the 3/8-in. plate was used for the liner floor, walls and upper knuckle, an increase over the 1/4-in. plate used in the 241-AY tank farm.

3.3.2 Primary Plate

The primary tank bottom utilizes 15/16-in., 3/4-in., 9/16-in., and 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 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 top transition plate. The transition plate from the lower knuckle to the tank bottom and first course is 15/16-in. thick. The first course is 3/4-in. thick, the second course is 9/16-in. and the next two courses are 1/2-in. thick. The top transition plate is welded to a 1/2-in. thick top knuckle (see H-2-90534, for details). The dome of the tank was constructed of 3/8-in. plate welded to the top knuckle, with exception of a 6-ft. diameter 1/2-in. thick plate used in the center of the tank domes. Figure 3-1 shows the configuration of the primary tank wall and the thickness of each course.

[3] ASME is a registered trademark of American Society of Mechanical Engineers

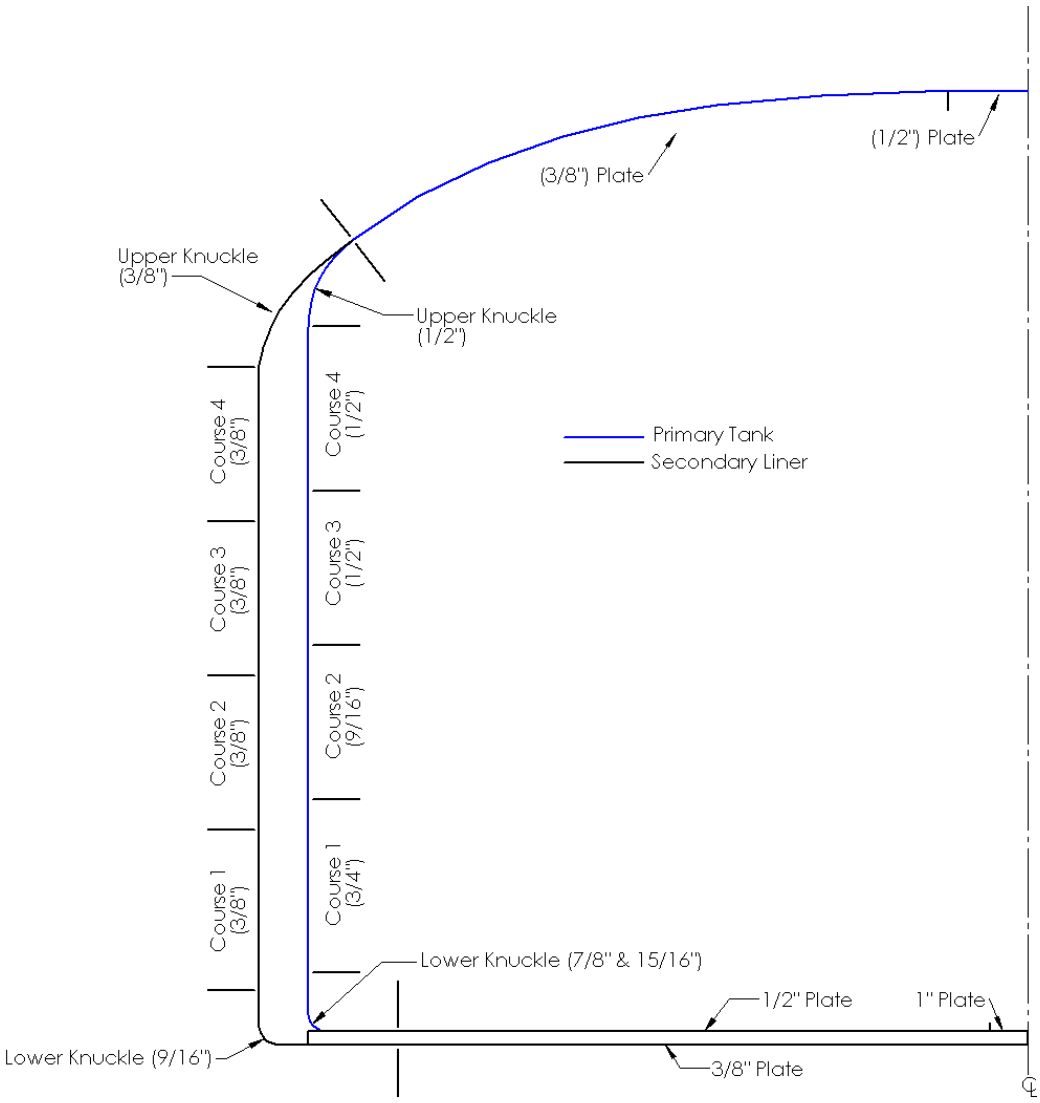


Figure 3-1. Primary Tank Wall Configuration and Thickness

3.3.3 Material Certification

Material certifications and chemical and physical test reports were required for each steel plate containing the heat and slab number. 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

Litecrete 60M was the refractory material used in the 241-AP tank farm. The refractory was required to limit the structural concrete base slab to a maximum temperature of 500°F during the post-weld stress relief. The material had to have an average (out of 5 test specimens) minimum compressive strength at or above 130 psi. The 241-AY tank farm used Kaolite 2200-LI castable refractory. Litecrete 60M was certified to comply with the physical and insulating properties specified in B-340-C4 (see App. Figure A-1).

3.5 PIPING

All pipe used for permanent risers was manufactured to ASTM A53 or ASTM A106 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 eight 241-AP tank farm tanks was awarded to American Bridge. Excavation began in 1982 and the project was completed in 1986. J.A. Jones acted as construction management for the project.

A listing of the construction sequence follows:

1. Install reinforced structural concrete foundation for each of the eight 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. When the secondary liner was fabricated over the tank foundation a plywood protective layer was installed over the tank foundation.
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. Remove plywood and 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.
9. Remove forms from refractory air slots.
10. When primary tank bottoms were fabricated over the refractory, a plywood protective layer was installed 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 course plates, as well as the upper knuckle to the primary tank.
16. Weld the secondary liner course plates up to the last course (not including the upper knuckle).
17. Fabricate tank dome and penetrations inside the primary tank.
18. Raise tank dome into place and weld it to the primary tank upper knuckle.
19. Install insulation around the primary tank walls and dome in preparation for stress relief.
20. Conduct stress relief of the primary tank.
21. Conduct hydrostatic test of the primary tank.
22. Install upper knuckle and attach metal flashing between secondary upper knuckle and primary tank dome.
23. Install annulus penetrations.
24. Place concrete in four sections, including two vertical lifts, a haunch pour, and a dome pour.
25. Install the leak detection system, including the leak detection drain piping, sump, and well.

26. Start backfilling the tank farm area.
27. Install appurtenances.
28. Backfill to top of the domes.
29. Install the waste transfer system of piping, pump pits, and valve pits.
30. Complete backfill.

4.1 CONCRETE FOUNDATION

The foundation is composed of reinforcing steel and concrete requiring a 4500 psi, 28-day compressive strength (see drawing H-2-90439, *Structural Concrete Tank Foundation Plan and Details,* and B-340-C3, *Construction Specification for the 241-AP Tank Farm Tank Foundations,* for details).

Figure 4-1. Concrete Foundation Placement (Photo 108941-8cn) (Taken 8/9/1983)

The structural reinforced concrete foundations are 89-ft. 6-in. in diameter. The foundation is 2-ft. 8-in. thick from foundation center to a diameter of 81-ft. The foundation is 2-ft. thick from a diameter of 81-ft. to the edge of the foundation. The drop in foundation thickness from 2-ft. 8-in. thick to 2-ft., creates an 8-in. thick shoulder, seen in Figure 4-1. The purpose of the shoulder was to resist inward lateral displacement of the concrete wall due to external forces (e.g. soil pressure).

Two rebar mats were installed, followed by instrumentation conduit. Concrete forms were then installed, including those for drain slots in the top of the foundation. The concrete was then placed and set. Following the concrete cure, forms were removed and high spots on the foundation were ground down.

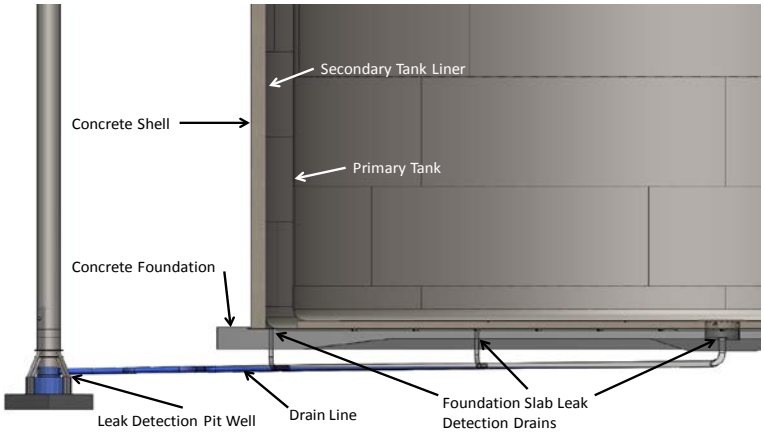


Figure 4-2. 241-AY Leak Detection Design

Structural reinforced foundations for all tanks in the 241-AP tank farm contain drain slots to direct any liquid to the leak detection drain slot. This leak detection drain slot is a change from the configuration seen in the 241-AY tank farm construction. In the 241-AY tank farm, a drain pipe was used to drain the foundation at three different locations as seen in Figure 4-2, and the drain pipe drained to the leak detection sump.

The leak detection drain slot design was first used in construction of the 241-AW tank farm foundations because a pipefitter strike threatened to delay the project, as noted in RPP-RPT-55981, *241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity*. The leak detection drain slot in the 241-AP tank farm foundations stop at the 8-in. curb where they drain into a section of drain pipe imbedded in the concrete, as seen in Figure 4-3. The drain pipe extends to the edge of the foundation where it is then connected to an encased drain line manifold, which drains to a common leak detection sump that services four tanks. In the 241-AP tank farm, there are only two leak detection sumps, with four tanks draining to each. This is an important distinguishing characteristic from all of other DST farm designs.

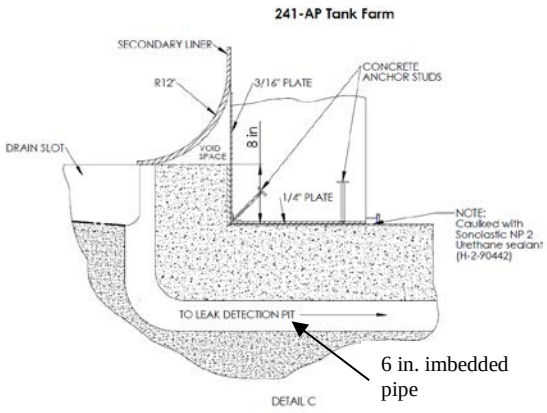


Figure 4-3. 241-AP Foundation Leak Detection System Design

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 9/16-in. thick carbon steel. This thickness is increased from the 1/4-in. thick bottoms and bottom knuckles of the 241-AY tank farm secondary liners.

Figure 4-4. Fabrication of Secondary Liner Bottom. (Photo 110871-1) (Tank 12/28/1983)

The secondary liner bottoms for the 241-AP tank farm were constructed onsite, as shown in Figure 4-4 and Figure 4-5. Many of the tank bottoms were constructed over cribbing in neighboring locations prior to being moved by crane to their final location.

Figure 4-5. Fabrication of Secondary Liner Bottom. (Photo 110871-3) (Taken 12/28/1983)

Before beginning the fabrication of a secondary liner bottom over a tank foundation, crews would place a layer of plywood over the reinforced concrete foundation. Staging was then erected to provide an elevated structure on which to fabricate the tank bottom. Elevating the tank bottom allowed access to its underside for fabrication purposes. During construction of the 241-AP tank farm, crews made use of unused level space

between tanks AP-103 and AP-105, and AP-104 and AP-106 when constructing both secondary and primary tank bottoms.

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 9/16-in. thick carbon steel, were fabricated offsite at Hogan Manufacturing, prior to being shipped to the worksite for welding to join the knuckles with the adjacent plates.

After completion and inspection of the welds, the secondary liner bottom was lowered or moved onto its foundation using two cranes. This placement can be seen in progress in Figure 4-6. Lifting lugs were installed as part of a superstructure used to support the tank liner from above to limit deformation during the move.

Figure 4-6. Transporting a Secondary Liner Bottom from Cribbing to Foundation (Photo 8400302-36cn) (Taken 1/4/1984)

4.3 REFRACTORY

The refractory design used for the 241-AP tank farm tanks specified a nominal 8-in. thick layer of refractory material to be located between the primary tank bottom and secondary liner bottom. Litecrete 60M was the refractory material used in the 241-AP tank farm. 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. The refractory would prevent the structural concrete temperature from rising above 500°F.

The refractory pad housed air supply 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-2-90440, *Structural Insulating Concrete Plan and Details*, for details). The eight air supply pipes (shown in Figure 4-7) terminate at the center of the tank at an air distribution ring.

Figure 4-7. Refractory Placement (Photo 8401213-32cn) (Taken 2/24/1984)

After reaching the center air distribution ring, the air travels toward the annulus through air distribution slots that are cast into the refractory to be exhausted through annulus risers.

Prior to placing the refractory, a 7-in. by 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. Forms were used to create the air distribution slots in the refractory. These forms can be seen in Figure 4-8.

Figure 4-8. Refractory Air Distribution Slot Forming (Photo 8402704-14cn) (Taken 4/18/1984)

To protect the refractory from damage, it was placed during the warmer months, and covered with a plastic sheeting to prevent it from getting wet. This protection was utilized to prevent degradation of the refractory material as a result of excess moisture and freezing. Damage to refractory as a result of excess moisture and freezing had occurred during previous tank farm construction projects.

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 15/16-in. thick carbon steel. The remainder of the plate in the primary tank bottom is1/2-in. thick carbon steel, except a 7/8-in. thick plate is used to transition between the 1/2-in plate and 15/16-in. knuckle. This thickness is an increase from 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. For the primary tank bottoms not using the previously erected staging between the tanks, a protective layer of plywood was placed on the refractory and staging was erected to support the liner during construction as shown in Figure 4-9. 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

Figure 4-9. Primary Tank Bottom Erection (Photo 8402306-5cn) (Taken 3/28/1984)

bottom plate. After inspection of the welds, the primary tank was then transferred to its final location and lowered onto the refractory.

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 is made up of four courses of carbon steel plates between the lower and upper knuckles. The plates in the first course are 3/4-in. thick, the next course is 9/16-in. thick and the upper two courses are 1/2 in. thick. Each course was set in place and welded to the previous course. A 7/8-in. transition plate is welded to the top of the 15/16-in. lower knuckle. The first course plates were welded to the 7/8-in. thick transition plate, while the fourth course plates were welded to the 1/2-in. thick upper knuckle.

Figure 4-10. Primary Tank Dome Erection (Photo 8405415-34cn) (Taken 8/1/1984)

The dome of the tank was constructed of two courses of 3/8-in. thick carbon steel plate welded to the upper knuckle and closed with a circular shaped, 1/2-in. thick top dollar plate. To facilitate the installation of tank dome plates, staging was erected inside the primary tank. This staging provided a resting place for the tank dome plates for proper fit-up and welding as shown in Figure 4-10. 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 as shown in Figure 4-11 and Figure 4-12.

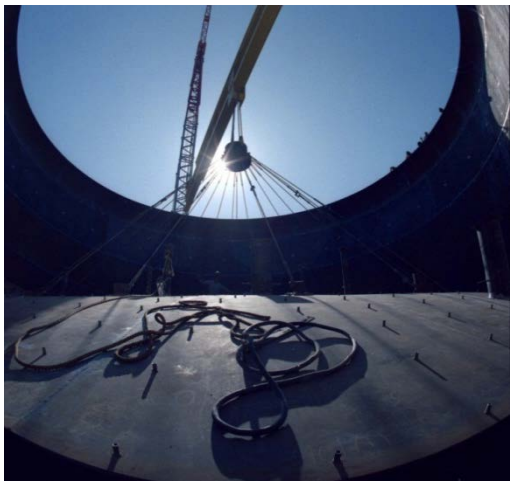


Figure 4-11. Lifting of the Primary Tank Dome (Photo 8405145-67cn) (Taken 8/1/1984)

Once construction of the primary tank was completed, the surfaces were cleaned. At this time the door sheet, a plate left out of a lower course to allow tank access, was welded into place in preparation for stress relief and hydrostatic testing.

Figure 4-12. Lifting Primary Tank Dome (Photo 8405415-85cn) (Taken 8/1/1984)

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 3/8-in. thick carbon steel plates between the lower and upper knuckles. Each course was set in place and welded to the previous course as shown in Figure 4-13. A 1/2-in. thick transition plate was welded to the top of the 9/16-in. lower knuckle. The first course plates are welded to the 1/2-in. thick transition plate, while the fourth course plates are welded to the 3/8-in. thick upper knuckle.

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.

Figure 4-13. Secondary Liner Wall Erection (Photo 8405415-37cn) (Taken 8/1/1984)

4.7 PRIMARY TANK STRESS RELIEVING

To prepare the tank 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 refractory placed to protect the structural concrete also served to insulate the bottom of the tank.

Propane gas was supplied from three 1000 gal storage tanks, passed through vaporizers, and ignited at four high velocity burners mounted on risers at the top of each tank. Figure 4-14 shows the post-weld stress relief insulation on the AP-102 primary tank. Figure 4-15 shows the burner layout utilized during stress relief.

Figure 4-14. Insulation for Post-Weld Stress Relief of Tank AP-102 (Photo 8405415-2cn) (Taken 8/1/1984)

The requirements for stress relieving were in accordance with *ASME Boiler and Pressure Vessel Code, Section VIII (1980)*, which specified a preferred holding, or "soaking," temperature of 1100° F for one hour per inch of metal thickness.

Division 15, Section 3.4, "Stress Relieving," of B-340-C4, *Construction Specification for Primary and Secondary Steel Tanks 241-AP Tank Farm Work Order X34001*, provided the following direction for stress relieving:

> *"3.4.2 Perform stress relief in accordance with ASME, Section VIII, Division 2, Article F-4, except that:*
>
> *3.4.2.1 The maximum allowable decrease in temperature below the specified temperature of 1100 F shall not exceed 100 F.*
>
> *3.4.2.2 The temperature shall be brought from ambient to 220 F and held for 6 hours.*
>
> *3.4.2.3 The rate of temperature rise and reduction between 800 F and 1100 F shall be no more than 100 F/hr.*

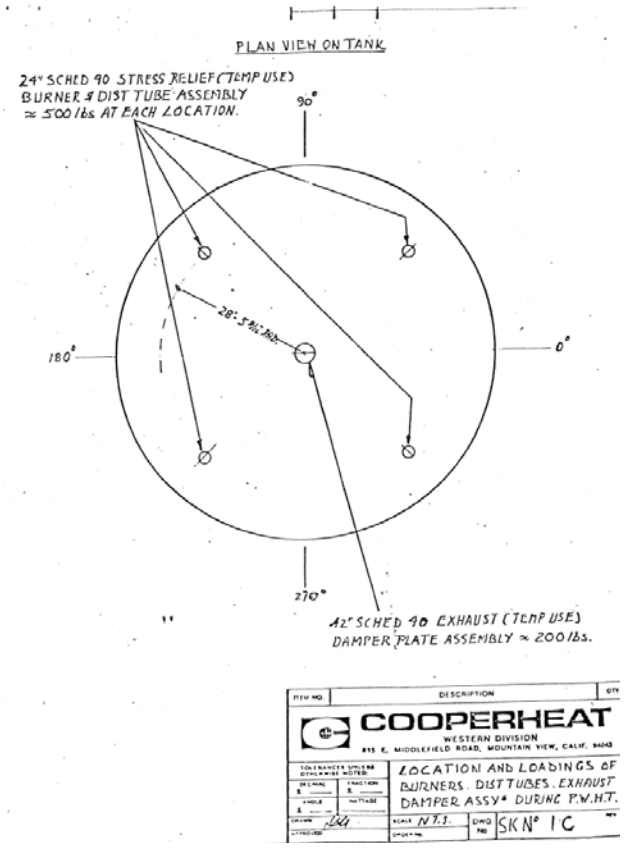


Figure 4-15. 241-AP Post Weld Stress Relief Burner Layout

> *3.4.2.4 The period of heating from 800 F to 1100 F shall consume no more than 12 hours.*
>
> *3.4.2.5 During the heating-up period, after any recorded temperature reaches 800 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."*

Although construction specification B-340-C4 specifies a stress relief temperature of 1100° F, alternative temperature and time requirements were allowed. During 241-AW tank farm construction, dome deformations in tank AW-101 due to stress relief at 1100° F triggered a change in the stress relieving procedure (see RPP-RPT-55981, *241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity*, for details). The change resulted in less severe dome distortion. To prevent similar dome distortions in the 241-AP tank farm, the requirement of a soak temperature of 1000° F for three hours was applied. Following review of the time vs. temperature logs of stress relief, it is clear that tanks AP-101 through AP-107 were stress relieved at 1000°F for at least three hours. Tank AP-108 was stress relieved at 950°F for 5 hours due to low thermocouple readings. See Section 5.2 for a description of the tank AP-108 post-weld stress relief issues.

Thermocouples were installed throughout the tank to measure the temperature on the inside. Thermocouples installed during the insulating refractory pour were used to monitor the post-weld stress relieving temperatures in the primary tank bottom during the operation. Heating occurred in several stages and key events were captured in inspection reports. See Table 4-1 for significant post-weld stress relieving highlights.

Table 4-1. Post-Weld Stress Relieving in the 241-AP Farm

Tank	Burners Turned On	Completed 6-hr Hold Time at 220°F	Completed Final 3-hr Hold Time at 1000° F	All Thermocouples Reading below 800° F, Recorders Turned Off
AP-101	6:30 a.m. August 16, 1984	2:00 p.m.[B] August 16, 1984	10:45 a.m. August 17, 1984	1:00 p.m.[A] August 17, 1984
AP-102	6:30 a.m. August 2, 1984	3:30 p.m.[B] August 2, 1984	7:30 a.m. August 3, 1984	10:30 a.m.[A] August 3, 1984
AP-103	7:00 a.m.[B] September 18, 1984	4:00 p.m. September 18, 1984	2:00 p.m.[B] September 19, 1984	7:00 p.m.[B] September 19, 1984
AP-104	7:00 a.m. September 12, 1984	4:00 p.m.[B] September 12, 1984	1:00 p.m.[B] September 13, 1984	4:00 p.m.[A] September 13, 1984
AP-105	9:30 a.m. October 2, 1984	6:30 p.m. October 2, 1984	2:00 p.m. October 3, 1984	3:30 p.m.[A] October 3, 1984
AP-106	6:30 a.m. August 28, 1984	3:30 p.m.[B] August 28, 1984	1:00 p.m.[B] August 29, 1984	5:30 p.m. August 29, 1984
AP-107	8:00 a.m. July 19, 1984	5:15 p.m. July 19, 1984	1:00 p.m. July 20, 1984	5:00 p.m. July 20, 1984
AP-108	9:00 a.m. July 6, 1984	6:00 p.m.[B] July 6, 1984	7:00 p.m.[C] July 7, 1984	11:00 p.m. July 7, 1984

[A] Last temperature recorded. Temperature not below 800°F.
[B] Estimate based on temperature log sheets and Inspection Reports.
[C] Hold time was actually 5 hours at 950°F, per NCR B-340-76 and allowed in ASME Section VIII, Div. II, Table AF-402.2.

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. Hydrostatic testing equipment can be seen in Figure 4-16.

Division 15, Section 3.5, "Hydrostatic Test," of B-340-C4, *Construction Specification for Primary and Secondary Steel Tanks 241-AP Tank Farm Work Order X34001*, provided the following direction for hydrostatic testing:

Figure 4-16. Equipment for Hydrostatic Test Water Fill on Tank AP-108 (Photo 8407495-2cn) (Taken 10/1/1984)

"3.5.1 After the tank has been stress relieved, apply a full hydrostatic test to the primary tanks by filling with water to a depth of 40 feet from the bottom of the tank to bottom of top riser plus or minus 1 inch. Use one of the vertical risers near the center of the tank dome for introduction of water. To allow air to escape from the tank during the test, provide air bleed ports in the other vertical risers. Tank surfaces to be examined shall be dry. Coat all accessible welded joints below the water level with a mixture of blue chalk and water or alcohol. All water in the primary tanks, regardless of source or length of retention, shall be treated to provide a chemical residual of OH = 0.01M and NO2 = 0.011M. Cathodic protection may be used per DT-1520 A106.

3.5.2 Maintain the hydrostatic pressure for a minimum of 24 hours.

3.5.3 Leak detection shall be by visual examination of each welded joint previously coated with a mixture of blue chalk and water or alcohol."

Corrosion inhibitors were applied to the water for hydrostatic testing. This is the first double-shell tank known to have used corrosion inhibitors in the hydrostatic testing procedure. It is noted in NCR B-340-118 (see App. Figure B-48), that 3500 pounds of sodium bicarbonate was mixed into the water.

After hydrostatic testing for each tank was complete, more water was pumped into the tank to fill it to the dome. The water would then act as support for the dome while the dome concrete was being poured. The water remained in the tanks for several months before being pumped out. Table 4-2 provides the date that each tank's hydrostatic test was accepted.

Table 4-2. Hydrostatic Test Dates

Tank	Hydrostatic Test Accepted
AP-101	November 21, 1984
AP-102	November 9, 1984
AP-103	December 14, 1984
AP-104	December 6, 1984
AP-105	December 17, 1984
AP-106	November 29, 1984
AP-107	October 26, 1984
AP-108	October 22, 1984

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 allowed 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.

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. These penetrations can be seen in Figure 4-17

Figure 4-17. Secondary Liner and Penetration Completion (Photo 8405795-1cn) (Taken 9/10/1984)

4.10 CONCRETE POUR

The concrete shell measures 83-ft. in outside diameter and is 1-ft. 5 5/8-in. thick; it rests on a 3/8-in. thick steel slide plate and 1/4-in. thick bearing plate that are supported by the tank foundation. 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.

Figure 4-18. Concrete Dome Pour on Tank AP-101 (Photo 8407523-9cn) (Taken 11/30/1984)

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. The shell was poured in four parts: two vertical lifts on the sides of the tank, one that covered the upper knuckle of the secondary liner, and one pour to cover the dome. The concrete shell is shown to be nearly complete on tank AP-101 in Figure 4-18. Keyed construction joints connected each new pour to the previous section. After hydrostatic testing was finished, more water was added to the tank to fill it to the top of the dome. The water supported the dome during the concrete dome pour and was pumped out after the concrete was set.

4.11 LEAK DETECTION SYSTEM

Once the vertical section 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 drain manifold and a shared leak detection sump, and leak detection well which extended from the sump up to ground level. There were two leak detection sumps installed for all the 241-AP tank farm tanks. Each sump services four tanks.

4.12 TANK APPURTENANCES

After completing the concrete pours, the water used to support the steel dome during concrete pouring was pumped out. The equipment to be placed in the interior of the tank was then installed. These pieces of equipment were welded to the existing penetrations that had been installed on the tank dome prior to the tank stress relief.

4.13 POST-CONSTRUCTION RISER INSTALLATION

After tank farm construction completion, a decision was made to install a single new 42-in. riser with a pit, and two additional pits on existing 42-in. risers in each of two tanks in the 241-AP tank farm. While both tank AP-107 and AP-108 were selected to receive new pits, a budget reduction reduced the scope of the project to include a new riser and pits only in tank AP-107 (see App. Figure A-2). All project design and specification documents were still required to include tank AP-108. The pits would house agitator pumps to remove liquid waste from the tanks for the waste grout project. The project was designated Project W-E01, *107-AP and 108-AP Tank Farm Riser/Pit Installation*, and the formal kickoff date was May 5, 1988.

The new 42 in. riser location encompassed the existing penetration #7, 12-in. vent line. The new 42-in. riser became penetration #7 (see H-14-010503, *Dome Penetration Schedules (WST/WSTA) Tank 241-AP-107*). Excavation was completed down to tank dome AP-107. A 7-ft. diameter section of concrete was removed without cutting or damaging the rebar. Rebar was cut out, and a hole was cut in the steel dome at approximately 19-ft. 5 3/4-in. from tank centerline and 27°-14'-11" North of East.

The riser was welded to the tank dome and rebar was welded in place using the configuration shown on H-2-77447, *STRL, Tank Dome Penetration Plan and Details.* New concrete with a required 5000 psi, 28-day compressive strength, was placed around the new riser using ASTM C150, Type II cement. The area was then backfilled, and pump pits were constructed.

A structural analysis was completed for the addition of a 42-in. riser (as seen in, Integrated Data Management System (IDMS), Queried 2/5/2014, [*241-AP-107 Riser Installation Structural Analysis Project W-E01*], http://idmsweb.rl.gov/idms/livelink.exe). The use of stress relief after the riser installation was discussed in correspondence (see App. Figure A-3); however, it is unclear if the dome was stress relieved following riser installation. The project was completed on September 30, 1988 (see App. Figure A-4).

Complete information for this project was not located. None of the documentation specified how the concrete was removed without damaging the concrete around it or without cutting the rebar, although, it was mentioned that a demonstration was planned on some mockup concrete (see App. Figure A-5). Also, there was no specific information on what method was used to cut the steel dome, or how they kept the cut piece from falling into the tank.

5.0 CONSTRUCTION ISSUES

This section provides a detailed review of the construction issues identified during the fabrication of the 241-AP tank farm. This information has been compiled from a review of the Quality Assurance (QA) construction, inspection sheets, memos, drawings, photos, construction records, and post-construction reports.

5.1 WELDING AND NON-DESTRUCTIVE EXAMINATION

5.1.1 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 5-1 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-340-C4.

Table 5-1. 241-AP Tank Farm Non-Destructive Examinations Used During Construction

	Primary Tank Inspections	Secondary Liner Inspections
Tank Bottom	• Radiography – All butt welds • 100% Magnetic particle • 100% Liquid penetrant • 100% Visual • Hydrostatic leak test – Fill to 40-ft. from bottom of the tank.	• Radiography – All butt welds • 100% Magnetic particle • 100% Liquid penetrant • 100% Visual
Bottom Knuckle	• Radiography – All butt welds • 100% Magnetic particle • 100% Liquid penetrant • 100% Visual • Hydrostatic leak test – Fill to 40-ft. from bottom of the tank.	• Radiography – All butt welds • 100% Magnetic particle • 100% Liquid penetrant • 100% Visual

Table 5-1. 241-AP Tank Farm Non-Destructive Examinations Used During Construction

	Primary Tank Inspections	Secondary Liner Inspections
Vertical Wall	• Radiography- All butt welds including the weld of the cylindrical shell to top dome knuckle. • Magnetic particle – inside and outside surfaces where clips, lugs, etc. have been removed and/or repaired by filing, welding, grinding, etc. • 100% Visual • Hydrostatic leak test – Fill to 40-ft. from bottom of the tank.	• Radiography – All butt welds including the weld of the cylindrical shell to upper knuckle. • 100% Visual
Upper Knuckle and Tank Dome	• 100% Visual • Hydrostatic leak test – Fill to 40-ft. from bottom of the tank.	• 100% Visual

5.1.2 Primary Tank Bottom Weld Film Rejection Rates

Overall primary tank bottom radiographic film rejection rates for the 241-AP tank farm are summarized below in Table 5-2. A quantitative comparison of welding success on the 241-AP tanks is shown in Table 5-3 through Table 5-6. 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 5-7 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 5-2. 241-AP Tank Farm Primary Tank Bottom Weld Rejection Rate Summary

Tank	Total Weld Reject Rate (%)
AP-101	**6%**
AP-102	**9%**
AP-103	**10%**
AP-104	**9%**
AP-105	**12%**
AP-106	**6%**
AP-107	**7%**
AP-108	**5%**

Table 5-3. Tanks AP-101 and AP-102 Primary Bottom Welding Success Comparison

	Tank AP-101			Tank AP-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	47	6%	6%	65	9%	9%
Weld rejected after first repair	2	4%	6%	8	12%	9%
Weld rejected after second repair	1	50%	6%	0	0%	9%
Weld rejected after third repair	0	0%	6%	0	N/A	N/A
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	**50**			**73**		
Total weld	**785**			**808**		
Overall weld rejection rate	**6%**			**9%**		

Table 5-4. Tanks AP-103 and AP-104 Primary Bottom Welding Success Comparison

	Tank AP-103			Tank AP-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	81	11%	11%	63	9%	9%
Weld rejected after first repair	3	4%	10%	5	8%	9%
Weld rejected after second repair	0	0%	10%	1	20%	9%
Weld rejected after third repair	0	N/A	N/A	0	0%	9%
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	**84**			**69**		
Total weld	**819**			**804**		
Overall weld rejection rate	**10%**			**9%**		

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

	Tank AP-105			Tank AP-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	90	12%	12%	44	6%	6%
Weld rejected after first repair	9	10%	12%	2	5%	6%
Weld rejected after second repair	0	0%	12%	0	0%	6%
Weld rejected after third repair	0	N/A	N/A	0	N/A	N/A
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	**99**			**46**		
Total weld	**834**			**781**		
Overall weld rejection rate	**12%**			**6%**		

Table 5-6. Tanks AP-107 and AP-108 Primary Bottom Welding Success Comparison

	Tank AP-107			Tank AP-108		
	Length of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)	Feet of Weld (ft)	Reject Rate per Repair Cycle (%)	Total Reject Rate (%)
Weld prior to inspection	735	N/A	N/A	734	N/A	N/A
Weld rejected after original weld	50	7%	7%	38	5%	5%
Weld rejected after first repair	3	6%	7%	1	3%	5%
Weld rejected after second repair	0	0%	7%	0	0%	5%
Weld rejected after third repair	0	N/A	N/A	0	N/A	N/A
Weld rejected after fourth repair	0	N/A	N/A	0	N/A	N/A
Total weld rejections	**53**			**39**		
Total weld	**788**			**773**		
Overall weld rejection rate	**7%**			**5%**		

Table 5-7. 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%	10%	229	34%	34%
Weld rejected after first repair	7	10%	10%	86	38%	35%
Weld rejected after second repair	1	14%	10%	27	31%	35%
Weld rejected after third repair	1	100%	10%	1	4%	34%
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%**			**34%**		

When compared to the 241-AP tank farm, the overall radiographic film rejection rate for tank AY-102 was higher, at 34%. Weld rejections were a noted issue in RPP-ASMT-53793, leading to repeated re-welding, a contributing factor to bottom flatness out-of-tolerance conditions. 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-AP tank farm construction, one weld section was repaired twice in both tank AP-101 and AP-104.

Overall, weld rejection rates do not appear to be a significant issue in the 241-AP tank farm with some of the lowest weld rejection rates seen throughout all of Hanford's double-shell tanks. All initially rejected welds were eventually approved, following acceptable repair.

5.1.3 Welding Related Nonconformance Reports

During welding operations, several recurring issues existed. These issues generally fell into the following categories:

- Inadequate preparation of surface prior to weld operations (e.g. rust removal).
- Failure to conduct visual inspection of seams between weld passes.

These issues were documented in various NCRs, outlined in Table 5-8.

Table 5-8. Nonconformance Reports Related to Welding Quality

NCR #[A]	Tank	Description	Disposition
B-340-33	AP-106	Weld joints on secondary bottom plates for first weld pass by SMAW are not being cleaned of rust prior to welding. Welds and/or tack welds were made on the BNS 2, 4, and 5 seams on tank A.	Rework - Remove all welds that have not been properly cleaned. Perform required preparation and re-weld. (App. Figure B-1)
B-340-34	AP-106	Welds BNS 4 and BNS 5 were made on 10-27-83 with no visual examination between the second and third weld pass.	Conditional accept - Review NDE on welds BNS 4 and BNS 5. If NDE is acceptable, accept the weld. If NDE does not pass, repair welds as required by the C-4 construction specification. (App. Figure B-2)
B-340-58	AP-107	Unacceptable surface preparation (i.e., insufficient rust removal) prior to field welding first SMAW overhead pass on BRS seams of primary tank bottom "J".	Rework - Remove the first SMAW weld pass (exterior of primary) that was made on seams specified above that were not cleaned of rust prior to welding. Perform the necessary joint preparation, NDE, and re-weld using approved procedures. (App. Figure B-3)
B-340-61	AP-108	2 feet of weld on R-15 at the intersection of RRS2 on tank 108 dome was welded with no interpass inspection on two overpass weld seams.	Conditional accept - Radiograph the above completed weld joint area per approved procedures and conditional acceptance dependent upon acceptance of radiographs. Alt - Remove weld that was not inspected and replace per approved procedures. (App. Figure B-4).
B-340-62	AP-107	Primary shell, tank 107, C3V3 area 0 to 3 and C3V4 area 0 to 6: Contractor examining personnel did not visually examine each weld pass prior to deposit of subsequent weld passes.	Conditional accept - Acceptance of the welds will be dependent upon the radiographic examination of those weld joints.(App. Figure B-5).
B-340-63	AP-108	On the interior of primary tank "I" (108 base), the contractor welded four ladder brackets approximately six feet east of the north centerline without the required tank surface or attachment surface cleanliness preparation.	Conditional accept - Acceptable on the condition that after attachments are no longer needed, they shall be removed, the primary tank inner surfaces restored, and non-destructive testing performed. Weld joints shall be properly cleaned before welding.(App. Figure B-6)

Table 5-8. Nonconformance Reports Related to Welding Quality

NCR #[A]	Tank	Description	Disposition
B-340-66	AP-103	At primary tank "O", course 1 vertical weld seams C1V4 and C1V5: 2 internal surface attachments at each seam welded without prior approval of government's representative. (Approval was given for 4 attachments per seam - 6 attachments were welded per seam.) 6 internal surface attachments at C1V4 welded without surface(s) preparation, i.e., rust not removed.	Rework - Remove attachments and restore primary tank inner surfaces to original shape and contour. Perform non-destructive testing on the attachment area per specification.(App. Figure B-7)
B-340-70	AP-101	Tank "E", seam C2V6, Area 2 to 8: contractor examining personnel did not visually examine each weld pass prior to deposit of coverpass on the outside of the seam.	Conditional accept - Acceptance of the welds will be dependent upon the radiographic examination of that weld joint.(App. Figure B-8)

A. NCRs included as App. Figure B-1 through App. Figure B-8.
BNS – Bottom North-South weld seam
BRS – Bottom Round Seam
C(x)V(y) – Course(x)Vertical(y)
RRS – Roof Round Seam
SMAW – Shielded Metal Arc Welding

As noted in NCRs B-340-33, 58, 63, and 66, the contractor failed to adequately prepare material surfaces for welding on several occasions. Repetition of this type of issue is of concern due the fact that it often resulted in rework when addressed by NCRs. This rework can contribute to an increase in weld rejection rates and also represents a lack of adherence to procedure by the contractor in this regard. In addition to the NCRs listed in Table 5-8, an interoffice memorandum from Kaiser Engineers Hanford to address the recurrence of this issue.

The memorandum on March 23, 1984, included as App. Figure B-9, stated the following:

> *"According to NCR B-340-58 we are still experiencing problems in the field with the contractor welding over rust. Also, the Title III inspector informs me that this is a daily trouble area.*
>
> *Since the contractor has elected to ignore his agreement to clean the plate surfaces in a manner that has been demonstrated to him, it is obvious that corrective action measures are in order. Therefore a letter from KEH QA Manager is being forwarded to JAJ QA Corp. Manager for a corrective action and response.*

Also, in the interest of the assurance of Welding Quality, the KEH QA Department feels that we are bound to initiate quality measures which will bring this problem under control. This measure appears to be that the inspection plan for the Tank Construction Phase be amended to include a hold-point for Title III inspection to verify that plate welding surfaces have been properly cleaned prior to welding. Please initiate a DFC which will institute this measure.

Nonconformance reports B-340-33 and B-340-58 included attached pictures to provide evidence of improperly prepared joint surfaces. These have been included with the attached NCRs in Appendix B as well as below as Figure 5-1, Figure 5-2, and Figure 5-3.

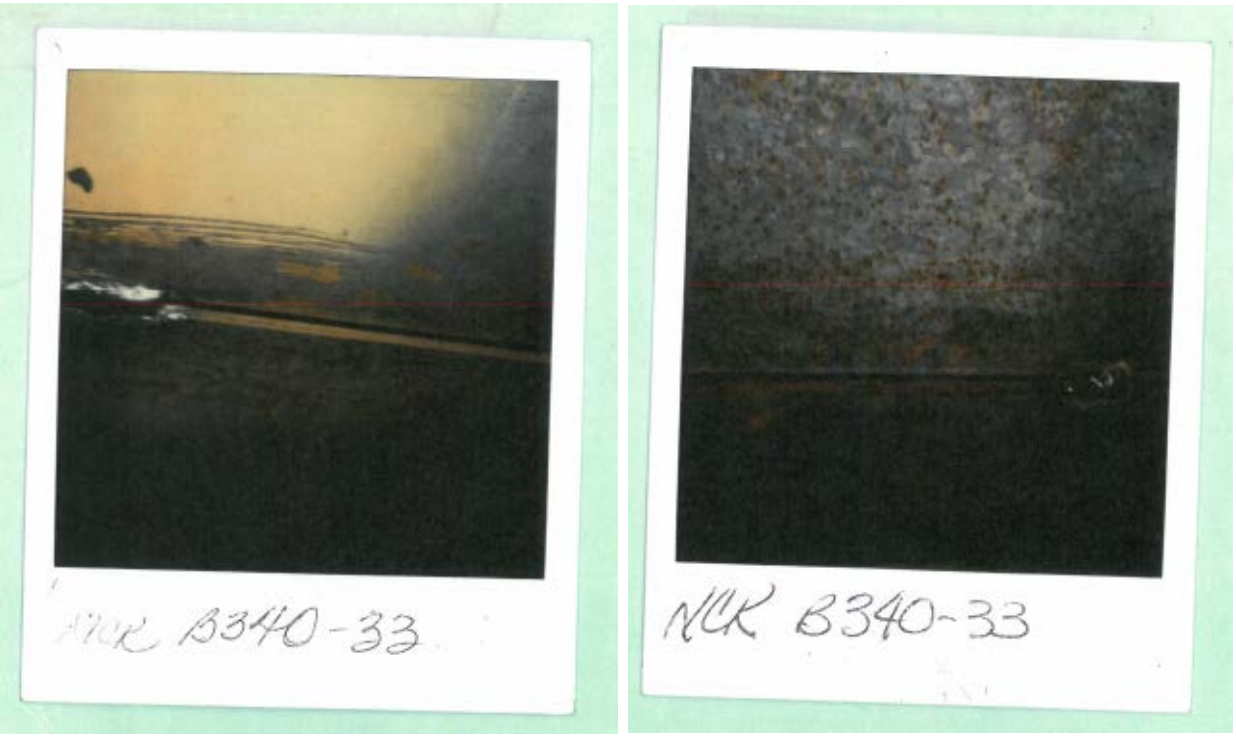


Figure 5-1. NCR B-340-33 Joint Preparation Evidence

3·22·84 / DJR

KAISER ENGINEERS HANFORD

FIELD ~~SKETCH~~ PHOTO

Attachment To Or Description:
REFERENCE NCR B-340-58

Sheet 1 of 2

ALL PHOTOS OF BRS 2@
'J' TANK BOTTOM

TYPICAL JOINT
PRIOR TO WELDING.

WELDING IN PROGRESS
NOTE (LACK OF) JOINT
PREPARATION.

KEH-159.2 (4-82)

Figure 5-2. NCR B-340-58 Joint Preparation Evidence (1/2)

3-22-84 DJR

KAISER ENGINEERS HANFORD | FIELD SKETCH

Attachment To Or Description: REFERENCE NCR B-340-58

Sheet 2 of 2

FURTHER EVIDENCE OF INSUFFICIENT JOINT PREPARATION.

MORE OF SAME

KEH-159.2 (4-82)

Figure 5-3. NCR B-340-58 Joint Preparation Evidence (2/2)

As noted in NCRs B-340-34, 61, 62, and 70, the contractor failed to allow for visual inspection between weld passes of a seam on several occasions. Repetition of this type of issue is of concern due the fact that it often resulted in conditional acceptance where future rework would be dependent on flatness tolerances and radiography proving to be acceptable. These actions represent an additional lack of adherence to procedure on the part of the contractor. The included NCRs are the only discovered documentation describing this issue. Ultimately, any issues discovered at a later date through radiography or flatness surveying would have been addressed per approved procedures and the quality of the tank would not have been adversely affected.

5.2 POST-WELD STRESS RELIEVING

During stress relief operations in the 241-AP tank farm, there were several temperature-related issues:

- Some thermocouple locations did not reach the required soak temperature of 1000°F.
- Thermocouple failure.
- 12 hour allowed period for raising temperature from 800°F to 1100°F[4] was exceeded.

These issues were documented in the NCRs that are outlined in Table 5-9.

Table 5-9. Post-Weld Stress Relieving Nonconformance Reports

NCR #[a]	Tank	Description	Disposition
B-340-76	AP-108	The tank 108 permanent bottom thermocouples, with few exceptions, remained lower than the 200°F spread permitted while the tank was heated from 800°F to 1050°F as indicated by the temporary thermocouples. The tank 108 permanent bottom thermocouples remained below 1000°F during the entire 4 hours that the temporary thermocouples remained near 1050°F.	Accept as is – because it met the alternate code requirement of 950°F for 5 hours.

[4] The holding(soak) temperature was specified to be 1100°F in Specification B-340-C4, however, 1000°F was used.

Table 5-9. Post-Weld Stress Relieving Nonconformance Reports

NCR #[a]	Tank	Description	Disposition
B-340-81	AP-107	The tank 107 permanent bottom thermocouples, with few exceptions, remained lower than the 200°F spread permitted while the tank was heated from 800°F to 1050°F as indicated by the temporary thermocouples. The tank 107 permanent bottom thermocouples remained below 1000°F during the entire 3 hours that the temporary thermocouples remained near 1050°F. All temporary thermocouples installed on the interior bottom and lower portion of the exterior bottom knuckle indicated temperatures that conformed to the stress relief procedure.	Accept as is – for future tanks to be stress relieved, the permanent thermocouples installed through the insulating concrete shall not be used to monitor the primary tank bottom temperature response during the stress relief cycle. Temporary thermocouples shall be used to determine the primary tank bottom temperatures. The temporary thermocouple readings substantiate a successful stress relief cycle. The permanent thermocouple readings do not appear to perform as intended for the stress relief cycle, but no problems are anticipated when the tank contains liquid waste. (App. Figure B-11)
B-340-88	AP-102	Thermocouples CC, GG, HH, and JJ failed approximately 4 hours before the beginning of the final soak. This resulted in no temperature monitoring for fairly large area of the tank bottom (tank 102).	Accept as is – The temperature data has been reviewed for the inside and outside temporary thermocouples attached to the primary tank bottom. Before the failure of the four thermocouples, the temperature readings were closely grouped with the other temporary thermocouples covering the similar tank bottom areas. After the loss of the four temporary thermocouples, the remaining temporary thermocouples indicated that the primary tank bottom completed a successful stress relief cycle. After studying the temperature versus time data of the adjacent thermocouples, it is obvious that area of the tank bottom where the thermocouples were lost also completed a successful stress relief cycle. (App. Figure B-12)

Table 5-9. Post-Weld Stress Relieving Nonconformance Reports

NCR #[a]	Tank	Description	Disposition
B-340-95	AP-106	Establish stress relief temperatures of 1000°F minimum and hold time of one hour per inch of thickness. Tank 106: thermocouples II and JJ did not meet these requirements.	Accept as is – Add 5 additional temporary thermocouples per the attached sketch for the tanks remaining to be stress relieved. It is obvious from studying the stress relief cycles for previous tanks that the primary tank bottom center is the area recording the lowest temperatures and the area that determines the completion of the stress relief cycle. Additional thermocouple instrumentation is required in this area to offer redundancy in case of further thermocouple failure or erratic thermocouple data and adequately monitor the temperature distribution in that area. (App. Figure B-13)
B-340-96	AP-104	At tank 104, the first recorded temperature of 800°F was recorded at 8:20 p.m. on 9-12-84 and the last thermocouple reached 1000°F at 10:20 a.m. on 9-13-84. Therefore the specified heat-up time was exceeded by 2 hours.	Accept as is – The minimum requirements for stress relief of the tank have been met. The excessive heat-up time could affect the yield strength results which will be addressed at a later time. (App. Figure B-14)

a. NCRs included as App. Figure B-10 through App. Figure B-14.

During stress relief of the 241-AP farm tanks, there were several instances of some thermocouples not reaching the required soak temperature of 1000°F. On two occasions (NCR B-340-76 for tank AP-108 and B-340-81 for tank AP-107), the permanently installed thermocouples embedded in the refractory failed to reach the 1000°F soak temperature. However, temperatures of 1050°F were recorded from temporary thermocouples, installed between the tank and refractory. Each of these events was "*accepted as is*" because the temporary thermocouples, in nearly the same location, reached the soak temperature. After tank AP-107 stress relieving, NCR B-340-81 states

> "*For future tanks to be stress relieved, the permanent thermocouples installed through the insulating concrete shall not be used to monitor the primary tank bottom temperature response during the stress relief cycle.*"

Two thermocouples did not reach the 1000°F soak temperature in tank AP-106. NCR B-340-95 was generated, and the low temperatures were "*accepted as is*" with the following justification:

> *"Add 5 additional temporary thermocouples per the attached sketch for the tanks remaining to be stress relieved. It is obvious from studying the stress relief cycles for previous tanks that the primary tank bottom center is the area recording the lowest temperatures and the area that determines the completion of the stress relief cycle.*

> *Additional thermocouple instrumentation is required in this area to offer redundancy in case of further thermocouple failure or erratic thermocouple data and adequately monitor the temperature distribution in that area."*

NCR B-340-88 was generated because four thermocouples in tank AP-102 failed prior to reaching the soak temperature, and there was no temperature monitoring for a large area of the primary tank bottom. The nonconformance was "*accepted as is*" based on the following:

> *"The temperature data has been reviewed for the inside and outside temporary thermocouples attached to the primary tank bottom. Before the failure of the four thermocouples, the temperature readings were closely grouped with the other temporary thermocouples covering the similar tank bottom areas. After the loss of the four temporary thermocouples, the remaining temporary thermocouples indicated that the primary tank bottom completed a successful stress relief cycle. After studying the temperature versus time data of the adjacent thermocouples, it is obvious that area of the tank bottom where the thermocouples were lost also completed a successful stress relief cycle."*

A failure to increase the tank temperature from 800°F to 1000°F in the specified 12 hour period (specification B-340-C4, paragraph 3.4.2.4), resulted in NCR B-340-96. The issue was "*accepted as is*" because, "*The minimum requirements for stress relief of the tank have been met."* However, the justification also states that "*The excessive heat-up time could affect the yield strength results which will be addressed at a later time.*" There is no reference to any other documents that discuss the effects on the yield strength of the plate material.

The stress relieving issues discussed in this section are judged to be minor compared to the stress relieving issues found in tank AY-102 construction. During tank AY-102 stress relieving, work crews had trouble keeping burners lit for the first three days of attempted stress relieving and intermittently during stress relief. Erratic thermocouples readings along with speculation that thermocouples were reading the temperatures of water from the refractory, rather than the primary tank bottom temperature, lead to large uncertainties in the actual tank bottom temperatures. Tank bottom thermocouples reading as low as 915°F were accepted as being 1000°F and a 3 hour soak was started. These AY-102 stress relief issues bring into question whether the primary tank was fully stress relieved.

In the 241-AP tank farm, fewer thermocouple problems and no burner issues bring a higher degree of certainty to achieving proper stress relief of the primary tanks.

5.3 TANK BOTTOM FLATNESS

Specification B-340-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.

Only one instance of tank bottom flatness in the 241-AP tank farm was reported.
NCR B-340-115 (see App. Figure B-15) was generated for a bulge in the AP-104 primary tank bottom on 11/15/1984 with the following description and disposition:

"Tank N (104) Survey of the primary tank bottom after stress relief showed two areas were out of the 3/8" per foot tolerance. The contractor put dead weight on the two areas. Survey was then performed. The new survey showed the two areas that were out of tolerance were now acceptable. However, an area on BEW4 adjacent to the centering post was then found 1/8" out of tolerance per foot for three feet.

Disposition: Accept as is

Justification: The 1/2"/ft slope (3/8" + 1/8") exceeds the specification requirements but falls within the 3/4"/ft limit substantiated in SAM-76-1 report by Battelle Pacific Northwest Laboratory, titles 'Analysis of Stresses Due to the Flattening of Bumps in the Bottom and Knuckle Regions of Million Gallon Waste Storage Tanks.'

Any repair procedure of the primary tank bottom is not recommended to insure maximum integrity of that boundary be maintained."

No further information was discovered regarding tank bottom bulging in the 241-AP tank farm.

5.4 REFRACTORY

On February 29, 1984, NCR B-340-56 (see App. Figure B-16) was generated because of a lack of refractory protection. The NCR has the following description and disposition:

"Castable refractory placement at tank bottom C (108) quadrants 2 and 4, 2nd lift, on 2/28/1984 was not protected during curing to minimize the formation of plastic shrinkage cracks. Impervious sheet plastic was supported approximately 1 to 3 feet above the refractory placement, however, the cover was open on a majority of the perimeter allowing the wind to blow across the refractory placement. Heaters were situated to blow between cover and refractory placement. Excessive plastic shrinkage cracks developed.

Disposition: *Fill all cracks 1/16" wide or greater to a depth of 3/4" min. with plastic refractory material. Additional precautions should be taken to prevent the formation of plastic shrinkage cracks on future pours.*

Justification: *During stress relief the refractory material will expand and fill a 1/16" crack. The maximum depth of cover over the air pipe is 3/4" per specification."*

Protection of refractory is specified in Section 3.2 of Specification B-340-C4 and provides the following:

"3.2.1 *Adequately protect the refractory from physical damage due to mechanical injury, material breakdown at temperatures below 40 F, and material degeneration at temperatures above 90 F.*

3.2.1.1 *Protect the refractory surface from the injurious action of rain.*

3.2.1.2 *When the atmospheric temperature is below 40 F, the air in contact with the surface of the refractory shall be maintained at a temperature not less than 50 F*

for the full curing period stipulated by the refractory manufacturer. A protective enclosure of sheet plastic, plywood, or other approved construction shall be provided to maintain temperature control. The method of heating the enclosure shall be in accordance with the approved submittals. Supplemental protection from freezing after the full curing period shall be provided in compliance with the manufacturer's recommendations.

3.2.1.3 *When the atmospheric temperature is above 90 F, extra care shall be taken to prevent rapid drying of the newly placed refractory. The fresh refractory shall be shaded as soon as possible after depositing and curing procedures shall be started as soon as the refractory surface is sufficiently hard to permit application without damage to the surface.*

3.2.1.4 *Allow no loads on the refractory surface until compressive tests indicate the required compressive strength has been attained."*

5.5 ISSUES UNIQUE TO 241-AP TANK FARM

5.5.1 Steel Plate Damages

During tank and liner inspections, many instances of plate damage were discovered, including laminations, scabs, gouges, or pits. In most cases, these issues were caught during inspection by American Bridge, resulting in approximately 83 NCRs (Integrated Data Management System (IDMS), Queried 2/5/2014, [*241-AP Tank Farm Steel Plate Damage NCRs*], http://idmsweb.rl.gov/idms/livelink.exe). In all cases these were repaired per approved methods.

In one instance from July 30, 1984, material was discovered in the AP-101 and AP-104 primary tank bottom that was suspected to be reject material. Following investigation and communication with the vendor, it was determined that what were thought to be laminations in the material were just scabs. All material with sharp gouges or scratches less than 1/32-in. deep was repaired by minor grinding (not to exceed 1/32-in.) and accepted for use. For gouges and scratched deeper than 1/32-in., imperfections were filled with weld metal and inspected per Specification B-340-C4. This event was documented via NCR B-340-85 (App. Figure B-17) and described as follows:

"2a. Per Hogan Manufacturing, Inc. Nonconformance Reports No. 197 and No. 200, 1/2 inch material with control numbers H-183 and H-186 are reject material and are found in 101 primary bottom and 104 primary bottom."

This NCR description is followed up by the following instructions*:*

"Provide evidence of original documentation showing material acceptability per project requirements. If such documentation is not available, repair or replace reject material with acceptable materials."

Communication from Hogan Manufacturing to American Bridge (App. Figure B-18) on the same day of the NCR, July 30, 1984, explained the use of the material and the steps taken to achieve acceptability. It states the following:

> *"Further review of the subject plates indicated that what was perceived to be laminations were in fact scabs. These scabs were repaired by minor grinding by Hogan Mfg. in lieu of returning to vendor, Kaiser Steel. Pits were acceptable in existing condition.*
>
> *This was done in an effort to reduce overall costs and shop requirements of subject material. This determination was made after the NCR had been returned from the Project Manager to the Q.C Department.*

Overall, steel plate damage of various kinds was commonplace during 241-AP tank farm construction. All plates were repaired using an Engineering-approved repair procedure. Given the information discovered, adequate attention and disposition was given to ensure plate quality and tank integrity.

5.5.2 Tank Dome Distortions

Tank AP-107 was the second in the 241-AP tank farm to be post-weld stress relieved beginning on July 19, 1984. After stress relieving, it was noted in NCR B-340-89 (see App. Figure B-19) that the AP-107 dome exhibited a drop of up to 5 in. around riser #5 at 180° and 270°. To resolve the dome deformations, additional anchor studs were added per NCR attachment.

NCR B-340-98, as seen in App. Figure B-20, notes a similar issue with tank AP-104. Tank AP-104 was stress relieved on September 12, 1984, and was the sixth tank to be stress relieved. NCR B-340-98 says that the dome dropped 3 to 4 in. around riser #5, and 2 in. around riser #12 and riser #27. Additional anchor studs were utilized to provide an additional margin of safety for stress reduction in welds around the risers.

Tank AP-103 was stress relieved directly after tank AP-104, followed by tank AP-105. NCR B-340-102 and B-340-105 (see App. Figure B-21 and App. Figure B-22, respectively), for tanks AP-103 and AP-105 respectively, documented 2 to 3 in. drops in the dome plate around riser #5. Both cases were "*accepted as is*" and additional anchor studs were added for safety.

Similar issues took place after stress relieving tank AW-101 during 241-AW tank farm construction, as noted in RPP-RPT-55981, *241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity*. Tank AW-101 saw significant distortions around the risers used for the stress relief burners after reaching a soaking temperature of 1100°F. The soak temperature was reduced to 1000°F for the rest of the 241-AW tank farm tanks.

5.5.3 Tank Foundation

During tank foundation concrete placement, there were several recurring structural integrity, surface finish, and patching-related issues:

- Concrete deposited in large quantities, and vibrators used to transport concrete between forms.
- Slow rate of concrete placement.
- Bonding grout placed over curing compound.
- Repair patches not protected from freezing temperatures.

These issues, along with other tank foundation related issues, were documented in the NCRs that are outlined in Table 5-10.

Table 5-10. Tank Foundation Nonconformance Reports

NCR #[A]	Tank	Description	Disposition
B-340-13	AP-102	Perimeter formwork installed for tank foundation D (102) did not withstand the lateral loading. Inadequate form braces gave way during concrete placement.	Accept as is – The contractor shall outline how he plans to correct the formwork failure problem and specify his plan for adhering to the contract specifications prior to placement of the next foundation. Slippage of forms did not affect the structural integrity of the slab. (App. Figure B-23)
B-340-14	AP-102	A layer of concrete placed in the north side of tank 102 foundation hardened to the point it was not plastic prior to placing the subsequent layer.	Core drill slab with 4” diameter bit to depth of 16” for 2’ thick slab and 24” for 2’8” thick slab at locations determined in field and referenced on attachment #1. Evaluation of cores will determine disposition of this NCR. Ref. NCR B-340-24. (App. Figure B-24)

Table 5-10. Tank Foundation Nonconformance Reports

NCR #[A]	Tank	Description	Disposition
B-340-15	AP-102	Concrete pour of tank foundation D (102) on 9-9-83. Internal vibrators were operated by inexperienced workmen. At several locations, concrete was deposited in large quantities in one area and vibrators were used to transport concrete within the forms. Some concrete received excessive vibration and others not enough. Inadequate vibration was performed around embeds and forms, causing air voids and stone pockets. The embedded angles installed along the leak detection drain have voids under the angle at several locations. The floated finish required for tank foundation 102 does not have a uniform sandy texture. At various locations, the surface is irregular and has air voids and visible surface aggregate.	Rework – Repair defect areas to contract specification requirements. Contractor shall take appropriate action to insure that concrete placement and finishing is performed according to contract specification. Method of patching to be approved by the government representative prior to patching. (App. Figure B-25)
B-340-17	AP-101	At several large areas within the slab, the rate of concrete placement was not such that the concrete to be integrated with fresh concrete was still plastic. Excessive over-vibration was used to re-establish plasticity of the hardening concrete prior to placement and integration with the subsequent layer of concrete.	Accept as is – The contractor should take precautions to prevent the formation of cold joints by maintaining adequate rate of concrete placement. Re-vibration is acceptable as long as running the vibrator will sink of its own weight into the concrete and liquefy it momentarily. (App. Figure B-26)
B-340-21	AP-108	The floated finish required for tank foundation C (108) does not have a uniform sandy texture. At various locations, the surface is irregular and has air voids and visible surface aggregate. The contractor was repeatedly notified about the condition of the finish in sufficient time to correct the problem.	Rework – Repair defect areas to contract specification requirements. Contractor Shall take appropriate action to insure that concrete placement and finishing is performed according to contractor specification. Method of patching to be approved by the government rep prior to patching. (App. Figure B-27)

Table 5-10. Tank Foundation Nonconformance Reports

NCR #[A]	Tank	Description	Disposition
B-340-23	AP-108	Concrete pour of tank foundation C (108) on 8-30-83. At several locations, concrete was deposited in large quantities in one area and vibrators were used to transport concrete within the forms. In several instances, this resulted in excessive vibration and segregation.	Accept as is – Contractor shall provide means of placing concrete at its final location. Concrete shall be moved by vibration no further thank 2 to 3 ft. to prevent segregation of aggregate. Repair any defects caused by segregation to contract specification requirements. (App. Figure B-28)
B-340-24	AP-102	Upon evaluation of concrete cores taken from tank D (102) foundation, a cold joint was indicated at core # 3, 11-1/2” from the surface and core # 9, 12-1/2” from the surface.	Rework – Locate all cores with angle and distance from center of tank. Identify rebar cut when coring, radial or circumferential for each core hole. Repair all core holes by filling with non-shrink grout. Remove cold joint in the area around cores # 3 and 9. The extent of the cold joint will be determined by the government rep. during rework. There is no evidence of rock pockets in cores taken outside the cold joint area. A few large (1/2” dia. Max) air bubbles were seen, but not of a frequency to affect the structural integrity of the concrete tank foundation. (App. Figure B-29)
B-340-29	AP-108	Daraweld-C bonding grout was placed over curing compound during repair at tank bases B (103) and C (108), In telephone conversations with the manufacturer of Daraweld-C and A C Horn, the manufacturer of the curing compound, it was stressed that the curing compound must be removed to obtain the desired bond.	Rework – Remove all patches applied over curing compound. Prior to applying new patches, remove all traces of curing compound in accordance with the manufacturer’s instructions. The patch and concrete must bond together to produce an acceptable patch. (App. Figure B-30)

Table 5-10. Tank Foundation Nonconformance Reports

NCR #[A]	Tank	Description	Disposition
B-340-30	AP-101, AP-103, AP-104, AP-108	Repair patching on the surface of tank bases 101, B (103), 104 and C (108) have areas that are soft and indicate lack of strength. Areas at tank base C (108) have excessive cracking in the repair patch.	Rework – Determine the cause of the low strength patching material and excessive cracking. Verify through the manufacturer of the bonding agent that materials and methods used will not be detrimental to the development of bond and compressive strength. Remove unsound material, etch and clean surface, and apply patching material, in accordance with the manufacturer's instructions. (App. Figure B-31)
B-340-40	AP-105	Repair patches placed in the drain slots of tank base "B" (105) on 11/29/1983 were not protected from freezing temperature. Temperatures as low as 26°F were recorded at approximately 7:30 a.m., 11/30/83.	Conditional accept – Remove and replace all patched areas exhibiting lack of strength or bond to the concrete base after 350°F days[B]. Re-evaluate patched areas prior to placement of secondary tank bottom. (App. Figure B-32)
B-340-42	AP-101, AP-102, AP-104	Repair patches placed on tank base 101, 104, and 102 have not been adequately protected from cold weather. Repair patches on tank base 101 on 11/29/83 and 12/2/83 had recorded overnight and morning temperatures ranging from 31°F to 36°F on 5 consecutive days after placement. Repair patches on tank base 104 placed on 12/2/83 ranged from 33°F to 36°F for 3 consecutive days after placement. Repair patches placed on tank base 102 on 12/7/83 ranged from 36°F to 37°F the first morning after placement. –until the patching has cured the 350°F days[B].	Conditional accept – Provide 40°F min temperature of the environment for 350°F days[B] required by the bonding grout manufacturer. Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350°F days[B]. Re-evaluate all patched areas prior to placement of secondary tank bottom. The contractor shall provide evidence that he can provide an environment capable of maintaining a ≥40°F temperature before and after placement of any patching, prior to patching continuing. The foundation shall be heated to maintain a ≥40°F temperature. (App. Figure B-33)

Table 5-10. Tank Foundation Nonconformance Reports

NCR #[A]	Tank	Description	Disposition
B-340-43	AP-102	Repair patches placed on 12-19-83 at tank base "D" (102) have not been adequately protected from cold weather. Morning temperatures on 12-22-83 revealed patch temperatures ranging from 28°F to 34°F. Ice formations were apparent on several patches. The ambient overnight low within the heated shelter was 25°F. – Conditional accept: Provide 40°F min temperature of the environment for 350°F days[B] required by the bonding grout manufacturer.	Rework – Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350°F days[B]. Re-evaluate patched areas prior to placement of secondary tank bottom. Areas of low strength or bond should be reworked. The contractor shall provide evidence that he can provide an environment capable of maintaining a minimum temperature of 40°F before and after placement of any patching, prior to patching continuing. The foundation shall be heated for a time interval adequate to maintain a minimum temperature of 40°F during placement of the patching material. After placement of patching, the environment shall be maintained at 40°F min for 350°F days[B]. (App. Figure B-34)
B-340-46	AP-101	At tank foundation 101, there are 11 locations on the top of the concrete foundation that are out of tolerance by 0.01 of a foot (1/8 inch). At tank foundation 101, there are 20 areas that do not meet the required flatness tolerances. These areas exceed either or both the 1/4 inch in 10 foot or 1/8 inch in 2 foot flatness tolerance.	Conditional accept – Take corrective measures to assure primary tank bottom will be at specified elevation within specified tolerances. The slight deviation from specified elevation will not impact the design requirements for the tank. Repair – grind surface or patch per approved repair procedures to meet required flatness tolerances. Flatness requirements for the tank bottoms must be maintained. (App. Figure B-35)
B-340-47	AP-105	Reference B-340-40. Repair patches placed in the drain slots of tank base 105 on 11/29/83 were not protected from freezing temperature. Temperatures as low as 26°F were recorded at approximately 7:30 a.m., 11/30/83. Re-evaluation of patches was performed on 1/9/84 and 1/11/84. At 2 locations, the patches are soft and lack strength.	Rework – Replace patch #1 prior to placement of the secondary tank bottom…a minimum strength of 500 psi shall be attained. Accept as is – The patch #2 in the immediate area occupies about 35% of the surface area. This would not block the trench if it became detached. (App. Figure B-36)

Table 5-10. Tank Foundation Nonconformance Reports

NCR #[A]	Tank	Description	Disposition
B-340-49	AP-102	Repair patches placed on tank base "D" (102) on 1/13/84, 1/16/84, and 1/17/84 have not been adequately protected from cold weather. On 1/19/84, at approximately 9:30 a.m., recorded patch temperatures ranged from 33°F to 39°F. Morning temperatures were again below 40°F for these repaired areas on 1/20/84.	Condition accept – Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350°*F* days[B]. Re-evaluate all patched areas prior to placement of secondary tank bottom. Areas of low strength or poor bond shall be reworked. (App. Figure B-37)
B-340-51	AP-102	At tank foundation "D" (102), the elevation of the finished drain slots vary from the allowable tolerance.	Accept as is – all slots have adequate cross sectional areas and alternate directions of flow to provide adequate leak detection drainage in event of leakage. (App. Figure B-38)
B-340-53	AP-102	Concrete placed on 2/1/84 for pour back of cold joint on tank base 102 [NCR B-340-14 and B-340-24] was a 6" slump. Approximately one cubic yard of concrete was placed.	Conditional accept – acceptance shall be based on break strength of cylinders at 28 days. (App. Figure B-39)

A. NCRs included as App. Figure B-23 through App. Figure B-39.
B. "Degree-Days" (e.g. 350°F days) is a time-temperature factor used to estimate the in-place strength of concrete to allow the continuance of construction activities such as termination of cold weather protection (see ASTM C1074, *Standard Practice for Estimating Concrete Strength by the Maturity Method*, for details).

The NCRs listed in Table 5-10, have several common issues along with a couple of minor unique issues.

It is noted in NCR B-340-13 (see App. Figure B-23) that perimeter formwork installed for tank AP-102 foundation, did not withstand the lateral loading. The cause was determined to be inadequate braces. Although it states that "*Slippage of forms did not affect the structural integrity of the slab*", the contractor was still required to outline a plan to correct the formwork failure prior to concrete placement in future tank foundations.

Three NCRs are related to slow concrete placement, where concrete was placed at a rate that allowed hardening of the concrete and the possible formation of cold joints. NCR B-340-14 (see App. Figure B-24) requires core drills of the tank AP-102 foundation in the location of possible cold joint formations, and references NCR B-340-24 for disposition, see App. Figure B-29. NCR B-340-24 evaluates the concrete cores taken for NCR B-340-14 and notes that some repair was required in these locations due to cold joints. Approximately 1 cubic yard of concrete was used for pour back in these repair areas. The concrete used had a slump of 6 in., which was greater than the 4 in. maximum slump stated in Specification B-340-C3. The high slump was accepted based on the 28-day concrete cylinder breaks (NCR B-340-53). In NCR B-340-17 (see App. Figure B-26), it is noted that excessive vibration was used to re-establish plasticity due to

slow concrete placement for tank AP-101 foundation. Over-vibration was accepted as is, and the contractor was cautioned about over-vibration.

On two separate occasions (NCR B-340-15, and B-340-23 for tank AP-102 foundation and tank AP-108 foundation, respectively), concrete was deposited in large quantities in one area within the forms. Vibrators were used to transport concrete within the forms. Some concrete received over-vibration while some did not receive enough vibration. In NCR B-340-15 (see App. Figure B-25), tank foundation AP-102 received inadequate vibration around embeds and forms, causing air voids and stone pockets. The floated finish was irregular and had air voids and visible surface aggregate. The defect areas were repaired by an approved patching method. In NCR B-340-23 (see App. Figure B-28), Concrete placed for tank foundation AP-108 received excessive vibration in an attempt to transport concrete within the forms. The excessive vibration resulted in segregation of the concrete. Limits were then set on the distance that concrete could be transported, and any defects caused by segregation were repaired.

There were two instances of out-of-tolerance tank foundations. NCR B-340-46 (see App. Figure B-35) notes that tank AP-101 foundation had 11 locations on top of the concrete foundation that are out of tolerance by 1/8-in., and 20 areas that did not meet the required flatness tolerances. Grinding and patching was used to bring the tank foundation within tolerances specified in B-340-C3. In tank AP-102, the variance of the finished drain slots from the allowable tolerance, prompted NCR B-340-51 (see App. Figure B-38). The slots were accepted as is based on the following justification:

> "*All slots have adequate cross section areas and alternate directions of flow to provide adequate leak detection drainage in event of leakage.*"

Several concrete patching-related NCRs were generated during construction of the 241-AP tank farm tank foundations. Initial concrete patching failed because the bonding grout used to patch the concrete was placed over the curing compound. The curing compound does not allow the bonding grout to bond to the original concrete. The patch was removed, curing compound was cleaned off, and bonding grout was reapplied. Some initial patching was soft, and showed excessive cracking. The patch was removed, and the bonding grout manufacturer was consulted for re-application of the grout. Most of the patching-related NCRs were due to improper protection of the patch during freezing temperatures. All patches affected by cold temperatures were conditionally accepted. All patches exhibiting lack of strength or bond to the concrete base after a 350°F day[5] curing period were removed and replaced. All patches were re-evaluated prior to placement of the secondary liner bottom.

[5] "Degree-Days" (e.g. 350°F days) is a time-temperature factor used to estimate the in-place strength of concrete to allow the continuance of construction activities such as termination of cold weather protection (see ASTM C1074, *Standard Practice for Estimating Concrete Strength by the Maturity Method*, for details).

5.5.4 Tank Concrete Shell

During placement of the concrete shells, low field-cured concrete cylinder breaks were a recurring issue. Concrete related issues were documented in the NCRs that are outline in Table 5-11.

Table 5-11. Concrete Shell Nonconformance Reports

NCR #[a]	Tank	Description	Disposition
B-340-101	AP-108	Tank 108 – during placement of concrete, forms gave way. Also, vibration was not performed adequately, causing some rock pockets on the surface approximately 4 inches deep.	Repair – remove concrete as necessary to allow proper installation of polysulfide sealant. Provide improved formwork support to prevent future formwork displacement. Repair rock pockets and verify vibration will be improved on future pours. Excess concrete will not affect the structural integrity of the tank walls and repair of rock pockets is required per specification. (App. Figure B-40)
B-340-107	AP-107	Tank 107 lower shell concrete breaks at 28-days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-41)
B-340-108	AP-108	Tank 108 upper shell concrete breaks at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is: based on lab-cured cylinders which meet specified requirements. (App. Figure B-42)
B-340-109	AP-102	Tank 102 lower shell concrete breaks at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-43)
B-340-111	AP-101	Tank 101 lower shell concrete breaks at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-44)
B-340-114	AP-101	Tank 101 upper shell concrete breaks at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-45)
B-340-116	AP-102	Tank 102 upper shell concrete breaks at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-46)

Table 5-11. Concrete Shell Nonconformance Reports

NCR #[a]	Tank	Description	Disposition
B-340-117	AP-106	Tank 106 lower shell concrete breaks at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-47)
B-340-118	AP-102	During concrete placement on tank 102 dome, water inside the tank came out of the filler holes [dome penetrations] and entered the concrete. The amount of water is not known. The tank was full of water treated with 3500 pounds of sodium bicarbonate.	Accept as is – the water washed over the surface of a completed area of the pour, washing away sand and cement and exposing aggregate. This damaged surface area will be repaired. The concentration of sodium bicarbonate in the tank water is significantly less than the concentration which may cause reduction in setting time and 28-day concrete strength. The tank water was not used for mixing and was not allowed to mix with the fresh concrete, causing no chemical damage to the fresh concrete. (App. Figure B-48)
B-340-120	AP-106	Tank 106 upper shell concrete break at 28 days: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on lab-cured cylinders which meet specified requirements. (App. Figure B-49)
B-340-121	AP-106	Temperature of concrete placed on dome of tank 106 dropped below 50°F to a low of 43°F in one location.	Conditional accept – provide additional protection time to develop compressive strength comparable to those areas better protected. Seven day field strength tests indicated no damage to concrete due to low initial curing temperature. (App. Figure B-50)
B-340-124	AP-107	Concrete cylinder breaks for tank 107 dome area: field-cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – lab results show that concrete will develop the required strength to perform properly. (App. Figure B-51)
B-340-125	AP-105	Tank 105 lower shell concrete breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is – based on engineering judgment, ignore the results of tests on one of three field-cured cylinders. It must not have received the same curing and protection as the others, since all three lab-cured cylinders show consistency in strength. (App. Figure B-52)

Table 5-11. Concrete Shell Nonconformance Reports

NCR #[a]	Tank	Description	Disposition
B-340-126	AP-103, AP-104, AP-105, AP-106	Form ties were not removed immediately after removal of concrete forms on tanks 103, 104, 105, and 106. Form ties on tank 106 (haunch pour area) were removed 12/18/84. Concrete was heated up prior to patching with grout mix. After patch was placed, no curing was performed. (overnight temperatures was 0°F).	Repair – remove and replace all patched areas exhibiting lack of strength or bond to the original concrete. The repair must develop adequate strength and bond to provide a watertight joint to protect reinforcing steel. (App. Figure B-53)
B-340-127	AP-102	Concrete cylinder breaks for tank 102 dome area: field curing cylinders failed to make 5000 psi of laboratory-cured cylinders.	Accept as is – lab results show that concrete will develop the required strength to perform properly. (App. Figure B-54)
B-340-129	AP-101	Concrete cylinder breaks for tank 101 dome area: field-cured cylinders to make 5000 psi or 85% of laboratory-cured cylinders.	Accept as is: lab results show that concrete will develop the required strength to perform properly. (App. Figure B-55)
B-340-130	AP-104	Concrete cylinder breaks for tank 104 haunch area: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.	Conditional accept – acceptance of curing and protection of the concrete shall be based on the additional field cured cylinders held for a 45 day break. (App. Figure B-56)
B-340-132	AP-103	Field cured cylinders for the tank 103 haunch area failed to make 5000 psi or 85% of the laboratory-cured cylinders.	Conditional accept – acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break. (App. Figure B-57)
B-340-134	AP-103	Tank 103 dome concrete cylinder breaks at 28 days: field cured cylinders failed to make 500 psi or 85% of laboratory-cured cylinders.	Accept as is – lab results show that concrete will develop the required strength to perform properly. (App. Figure B-58)

a. NCRs included as App. Figure B-40 through .

Several NCRs listed in the above table were generated because of a lack of compressive strength in the field-cured concrete cylinders. In each case, the issue was "*accepted as is*" because the lab-cured cylinders met the compressive strength specifications provided in Specification B-340-C4.

NCR B-340-118 (see App. Figure B-48) was written when an unknown amount of water inside the tank spilled out of the filler holes (filler holes are assumed to be dome penetrations known as risers) and entered the concrete during tank 102 dome concrete placement. The tank was full of

water treated with 3500 pounds of sodium bicarbonate. Sand and cement were washed away as a result of the spill, exposing some aggregate. The disposition of the NCR states that "*This damaged surface area will be repaired.*" The justification of the NCR says that the concentration of sodium bicarbonate was significantly less than the concentration which could have caused a reduction in settling time and 28-day concrete strength. It is also noted that the water was not used for mixing and was not allowed to mix with concrete, causing no chemical damage to the fresh concrete.

On 12/6/1984, NCR B-340-121 (see App. Figure B-50) was generated when temperature of the concrete placed on tank dome 106 dropped below the specified 50°F (B-340-C4) to a low of 43°F in one location. The disposition of this issue was to provide additional protection time to develop compressive strength comparable to areas better protected.

6.0 CONCLUSION

The leak assessment report for tank AY-102, RPP-ASMT-53793, identified first-of-a-kind construction difficulties and trial-and-error repairs that compromised the intended robustness of the 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-AP tank farm were completed.

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

The secondary liner bottom thickness was increased from 1/4-in. in the 241-AY tank farm to 3/8-in. in the 241-AP tank farm and the primary tank bottom thickness was increased from 3/8-in. to 1/2-in. The American Society for Testing and Materials (ASTM) A537-79 carbon steel plate material utilized in the 241-AP tank farm also varied from the ASTM A515-65 carbon steel plate used in the 241-AY tank farm. ASTM A537 provides higher yield strength.

The 241-AP tank farm experienced primary tank bottom weld rejection rates ranging between 5% and 12%. 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-AP tank farm, this does not appear to be a significant issue with some of the lowest weld rejection rates seen throughout all of Hanford's double-shell tanks. All initially rejected welds were eventually approved, following acceptable repair, and post-weld stress relief of the primary tank was accepted as successfully completed. There were two out-of-specification bulges in primary tank AP-104. Dead weight was placed on the bulges, which brought the primary bottom into specification. No bulges were found in any of the secondary liner bottoms.

The construction specification of 1100° F for one hour per one inch thickness was not met, but the alternate code requirement of 1000° F for three hours per one inch thickness was adopted as standard practice after problems with dome deformation were seen in previous tank farms (241-AW and 241-AN). There is a higher certainty of proper stress relief in the 241-AP tank farm than was noted for tank 241-AY-102. However, tank AP-108 post-weld stress relief was accepted based on a holding temperature of 950°F for a period of 5 hours, because the permanent thermocouples installed in the refractory below the primary tank bottom did not reach 1000°F.

Litecrete 60M was the castable refractory material utilized in the 241-AP tank farm tanks. For tanks AP-101 through AP-107, no indication of out-of-specification refractory was found. In tank AP-108, plastic shrinkage cracks were found in the refractory, caused by rapid curing. The minor cracks were filled with refractory material and the refractory was accepted.

Other issues, unique to the 241-AP tank farm, were noted. Surface defects and plate damage was discovered during inspection of the material. This damage was directed to be repaired per approved procedures. These defects included laminations, scabbing, and pitting. Tank dome distortions were observed and noted on the domes of tanks AP-103, AP-104, AP-105, and

AN-107 following stress relief. Additional anchor studs were added to adequately support the dome and the conditions were accepted as is.

The 241-AP tank farm was the sixth DST farm constructed; American Bridge was chosen to construct the tank farm. American Bridge also constructed the 241-AW and 241-AN tank farms. Tank bottom bulging, out-of-tolerance conditions were non-existent, and refractory material quality and post-weld stress relief were much improved over that seen in tank AY-102. Lower weld rejection rates occurred in the 241-AP tank farm compared to tank AY-102. These issues, along with others that were judged to be minor (e.g. concrete foundation and encasement repairs and weld joint preparation). Overall condition of the 241-AP tank farm following construction is judged to be better than that of tank AY-102.

Table 6-1. Summary Comparison 241-AP Tank Farm Construction to Tank AY-102

Tank	AY-102	AP-101	AP-102	AP-103	AP-104	AP-105	AP-106	AP-107	AP-108
Evaluation Document	RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*	RPP-RPT-55983, *241-AP Tank Farm Construction Extent of Condition Review for Tank Integrity*							
Construction Order	1st DST constructed	4th DST in 6th Farm	3rd DST in 6th Farm	7th DST in 6th Farm	6th DST in 6th Farm	8th DST in 6th Farm	5th DST in 6th Farm	2nd DST in 6th Farm	1st DST in 6th 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 out-of-tolerance bulges identified.							
Primary Bottom Material	0.375-in. plate, ASTM 515, Gr 60	0.5-in. plate, ASTM A537, Class 1							
Primary Bottom Weld Rework	33.8%	6%	9%	10%	9%	12%	6%	7%	5%
	Ultimately all welds were accepted and stress relieved, although problems with that process were noted.	Ultimately all welds were accepted and stress relieved.							
Primary Liner Bottom Bulges	Primary bottom flatness described as “generally good.”	No out-of-tolerance bulges identified			Two out of tolerance areas noted until dead weight was placed on them. Re-survey showed the tank bottom to be within specified tolerances.	No out-of-tolerance 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 hour hold at 1000°F.	Three hour hold at 1000°F. Four thermocouples, representing a large portion of the primary bottom, failed prior to final soak.	Three hour hold at 1000°F.	Three hour hold at 1000°F. Specified heat-up time was exceeded by 2 hours.	Three hour hold at 1000°F.	Three hour hold at 1000°F. Two thermocouples in measure tank bottom temperature failed to reach the 1000°F hold temperature.	Three hour hold at 1000°F. Permanent bottom thermocouples never reached the 1000°F hold temperature. Temporary thermocouples did reach the required temperature.	Five hour hold at 950°F. Permanent bottom thermocouples never reached the 1000°F hold temperature. Temporary thermocouples did reach the required temperature. An alternate code requirement of 950°F for 5 hours was satisfied.
Refractory	Kaolite 2200-LI	Litecrete–60M							

Tank	AY-102	AP-101	AP-102	AP-103	AP-104	AP-105	AP-106	AP-107	AP-108
Refractory Protection	Allowed to saturate with rain water, not protected from freezing.	Heaters were used to keep the cast refractory from freezing. Plastic sheeting was used to protect the refractory from rain, and wind that might cause plastic shrinkage of the refractory from curing to fast.							
Refractory Condition	After hydro test refractory found to be degraded, extensively cracked and spalled. Samples showed excessive carbonation.	No reports on post cured refractory inspection were found							Plastic shrinkage cracks were found in the refractory caused by poor weather protection. The refractory was covered with plastic, however, the ends were left open and wind was allowed to blow across the refractory, causing the refractory to cure too quickly and develop plastic shrinkage cracks.
Refractory Repair	21 inches of perimeter removed and replaced with concrete and rebar	None reported							Minor repairs were made to fill the cracks found in the refractory during initial pour.
Other Issues	Unsupported areas of primary bottom filled with foam.	Excessive foundation concrete vibration resulted in segregation. Out-of-tolerance concrete foundation. Low compressive strength in field-cured concrete shell testing.	Slow rate of foundation concrete placement resulted in cold joint. Inadequate foundation concrete vibration resulted in air voids and stone pockets. Concrete foundation repair patches were not adequately protected from cold temperatures and repairs were made. Foundation drain slots varied from elevation tolerances. Low compressive strength in field-cured concrete shell testing. Dome deformations occurred near riser #5 and additional anchor studs were added.	Low compressive strength in field-cured concrete shell testing. Dome deformations occurred near riser #5 and additional anchor studs were added. Inadequate preparation of surface prior to weld operations.	Low compressive strength in field-cured concrete shell testing. Dome deformations occurred near riser #5 and additional anchor studs were added.	Concrete foundation repair patches were not adequately protected from cold temperatures and repairs were made. Low compressive strength in field-cured concrete shell testing. Dome deformations occurred near riser #5 and additional anchor studs were added.	Low compressive strength in field-cured concrete shell testing. Tank dome concrete dropped below 50°F prior to cure. Dome concrete was accepted based on seven day field-cure strength tests.	Visual inspection did not occur between weld passes on several occasions. Dome deformations occurred near riser #5 and additional anchor studs were added. Inadequate preparation of surface prior to weld operations.	Inadequate use of moisture-retaining membrane. Excessive foundation concrete vibration resulted in segregation. Low compressive strength in field-cured concrete shell testing. Visual inspection did not occur between weld passes on several occasions. Inadequate preparation of surface prior to weld operations.

Tank	AY-102	AP-101	AP-102	AP-103	AP-104	AP-105	AP-106	AP-107	AP-108
Overall Conclusion on Construction Difficulties	Difficultly 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.	In the 241-AP tank farm, weld rejection rates do not appear to be a significant issue, with some of the lowest seen throughout all of Hanford's double-shell tanks. There were two out-of-specification bulges in primary tank AP-104. Dead weight was placed on the bulges, which brought the primary bottom into specification. No bulges were found in any of the secondary liner bottoms. There is a higher certainty of proper stress relief in the 241-AP tank farm than was noted for tank 241-AY-102 and fewer overall stress relief difficulties were noted. No indication of out-of-specification refractory was found. No information on post-weld heat treatment condition of refractory was recovered from the records archives. In tank AP-108, plastic shrinkage cracks were found in the refractory, caused by rapid curing. The minor cracks were filled with refractory material and the refractory was accepted. The 241-AP tank farm was the third tank farm constructed by American Bridge. Difficulties seen during tank AY-102 construction were avoided through the 241-AP tank farm construction and overall condition is judged to be better.							

7.0 REFERENCES

B-340-C1, 1982, *Construction Specification for the 241-AP Tank Farm Site Preparation,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C2, 1982, *Construction Specification for the 241-AP Tank Farm Site Excavation,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C3, 1982, *Construction Specification for the 241-AP Tank Farm Tank Foundations,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C4, 1982, *Construction Specification for Primary and Secondary Steel Tanks 241-AP Tank Farm,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C5, 1982, *Construction Specification for the 241-AP Tank Farm Tank Encasement,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C6, 1982, *Construction Specification for the 241-AP Tank Farm Backfill,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C7, 1982, *Construciton Specification for the 241-AP Tank Farm Completion,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C8, 1982, *Construction Specification for the 241-AP Tank Farm – 242A Evaporator Modifications,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C9, 1984, *Construction Specification for 241-AP Tank Farm Cathodic Protection Systems,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-C10, 1986, *Construction Specification for 241-AP Tank Farm Additional Pipe Line,* Kaiser Engineers Hanford Company, Richland, Washington.

B-340-D1, 1981, *Design Specification for Primary and Secondary Steel Tanks 241-AP Tank Farm,* Kaiser Engineers Hanford Company, Richland, Washington.

H-2-77447, 1988, *STRL Tank Dome Penetration Plan and Details,* Kaiser Engineers Hanford Company, Richland, Washington.

H-2-90439, 1982, *Structural Concrete Tank Foundation Plan and Details,* Kaiser Engineers Hanford Company, Richland, Washington.

H-2-90441, 1982, *Structural Dome Reinforcement Plan and Details,* Kaiser Engineers Hanford Company, Richland, Washington.

H-2-90442, 1982, *Structural Tank Section and Haunch Reinforcement,* Kaiser Engineers Hanford Company, Richland, Washington.

H-2-90534, 1981, *Tank Cross Section 241-AP Tanks*, Kaiser Engineers Hanford Company, Richland, Washington.

H-14-010503, 2010, *Dome Penetration Schedules (WST/WSTA) Tank 241-AP-107*, U.S. Department of Energy Office of River Protection, Richland, Washington.

RPP-RPT-55981, 2013, *241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity*, Washington River Protection Solutions, Richland, Washington.

Integrated Data Management System (IDMS), Queried 2/5/2014, [*241-AP-107 Riser Installation Structural Analysis Project W-E01*], http://idmsweb.rl.gov/idms/livelink.exe.

Integrated Data Management System (IDMS), Queried 2/5/2014, [*241-AP Tank Farm Steel Plate Damage NCRs*], http://idmsweb.rl.gov/idms/livelink.exe.

SD-340-FDC-001, Rev. 2, 1986, *Functional Design Criteria*, Rockwell Hanford Operations, Richland, Washington.

APPENDIX A SUPPORTING DOCUMENTATION

App. Figure A-1. Refractory Certificate of Compliance

VERTECS CORPORATION
(EST. 1949)

P.O. BOX 675 (206) 823-2505
12601 - 132ND AVE. N.E. • KIRKLAND, WASHINGTON 98033

July 18, 1983

American Bridge
P O Box 1407
Richland WA 99352

Re: T-3036 Eight Waste Storage Tanks
Tank Farm 241-AP
Richland Washington

Gentlemen:

Submittals for Section 3341 - Castable Refractory

1.2.1 Certificate of Compliance
Enclosure A - North American Refractories

1.2.2 Refractory Proportioning and Mixing Data:
Enclosure A - North American Refractories

1.2.3 Depositing Procedures

a. General - Dry refractory will be mixed with water (see paragraph 1.2.2. above) in a dual drum rotating paddle mixer, dumped into a hopper feeding a progressing cavity (Moyno type) pump discharging through a three inch hose, approximately 100 ft long, ending with a flexible whip.
It is planned to use a pre-set fabricated steel tubing block-out assembly to produce the air slots.

b. Cold weather - Castable Refractory generates substantial heat during the setting reaction. Heating the mixing water will increase the reaction rate and temperature rise. (see paragraph 1.2.5.2 below) otherwise no change in procedure.

c. Hot weather - no change in procedure (see paragraph 1.2.5.3 below)

1.2.4 Block diagram - Drawing 4520 represents ¼ of a tank base, Enclosure B. One quadrant should be poured in one day.

1.2.5 Protection Procedures -

1.2.5.1 Mechanical injury - Barracades and a watchman if needed will prevent mechanical injury during the setting period.

1.2.5.2 Atmospheric temperature below 40° -

a. Temperature during pour expected to remain between 32° and 40°. Heat mixing water so that temperature of mix is between 50° and 70°F. When set, cover with sheet plastic or plywood.

SPECIALTY INSULATION CONTRACTORS
POLYURETHANE FOAM AND COATINGS
LIGHTWEIGHT CONCRETE ROOFDECK SYSTEMS
SPRAY-ON ACOUSTICAL AND FIREPROOFING TREATMENT
PREINSULATED OR FIELD INSTALLED UNDERGROUND PIPE CONDUITS
WASHINGTON STATE CONTRACTORS REG. NO. 223-02-VE-RT-E*-*370NO

VERTECS CORPORATION

American Bridge

T-3036 Eight Waste Storage Tanks

1.2.5.2 b. Temperature during pour expected to rise above 40° within three hours. No special protection required.

c. Temperature during pour below 40°F and expected to drop below 32°F., overnight. Heat mixing water as in a. above, place 2 in. thick expanded polystyrene board over surface, and cover with tarpaulin or plywood sheets.

1.2.5.3 Protection when atmospheric temperature is above 90°.

a. After set, place burlap over surface and keep wet with water until surface temperature drops below 90°F.

1.2.5.4 Method of heating protective enclosure.

a. Electric resistance strip heaters 110/220V AC, 5 to 10 watts per L.F. will be placed under insulation board in direct contact with refractory surface to maintain 40°F minimum temperature.

1.2.6 Curing Procedure

Surface protection after set shall be provided as recommended by North American Refractories Company and as suggested in paragraph 3.3 curing.

1.2.6.1 For normal atmospheric temperatures, 40-90°F, moisture retention to prevent surface drying will be provided by water spray after set, 24 hours to full cure.

1.2.6.2 For abnormal air temperatures, below 40°F and above 90°F, curing procedures follow the submittals, paragraph 1.2.5 Protection Procedures. 48 hours is the time for full cure at low temperatures below 40°F.

Sincerely,
VERTECS CORPORATION

L. L. Loper

Enclosures
LLL:go

ENCL A

North American Refractories Co.
An ALLIED Company

WESTERN DIVISION
1555 N. Parkside Drive
Pittsburg, CA. 94565
(415) 432-4741

July 15, 1983

Vertecs Corp.
P.O. Box 675
12601 132nd N.E.
Kirkland, Wa. 98033

ATTN: Mr. Les Loper, President

RE: U.S. Department of Energy Contract #DE-AC06-82RL10367 KEH Jon R295A2, B-340-C4, Section 03341. (Construction Specifications for the 241-AP Tank Farm Tank Foundations. Work Order X34002, prepared by Kaiser Engineers Hanford Company, Richland, Washington.)

This is to certify that Litecrete 60M produced by North American Refractories Co. in Renton, Washington complies with physical and insulating properties as specified by B-340-C3, Section 03341. C4

Test data developed by the Pittsburg Laboratory of North American Refractories Co. and from Northwest Laboratories, an independent testing laboratory in Seattle, Washington are submitted as evidence of compliance with this specification. Test samples were obtained from samples pump placed by Vertecs Corporation on 4/15/83.

All material to be supplied for this project will be manufactured at Renton, Washington of the same type and quality as samples submitted for certification qualification. The product is designated Litecrete 60M.

Recommendations for mixing and curing Litecrete 60M are attached.

Suzanne E. Laurich

Suzanne E. Laurich
Senior Project Engineer
Pittsburg Laboratory

State of Calif. } ss.
County of Contra Costa }

On this the 15 day of July 1983, before me,

Beatrice Bettencourt,

the undersigned Notary Public, personally appeared

Suzanne E. Laurich,

☐ personally known to me
☒ proved to me on the basis of satisfactory evidence
to be the person(s) whose name(s) is subscribed to the within instrument, and acknowledged that she executed it.
WITNESS my hand and official seal.

OFFICIAL SEAL
BEATRICE BETTENCOURT
NOTARY PUBLIC-CALIFORNIA
CONTRA COSTA COUNTY
My Commission Expires Dec. 17, 1985

Beatrice Bettencourt
Notary's Signature Beatrice Bettencourt

GENERAL ACKNOWLEDGMENT FORM 7110052 NATIONAL NOTARY ASSOCIATION • 23012 Ventura Blvd. • Woodland Hills, CA 91364

App. Figure A-2. 107-AP Riser/Pit Installation Scope and Status Update

107297

Westinghouse
Hanford Company

P.O. Box 1970 Richland, WA 99352

8755402

Mr. J. R. Mills, Project Engineer
Kaiser Engineers Hanford Company
Post Office Box 888
Richland, Washington 99352

Dear Mr. Mills:

ER-4350, 107-AP AND 108-AP RISER/PIT INSTALLATION, SCOPE AND STATUS UPDATE

The purpose of this letter is to modify the scope of the upcoming construction, clarify the issues discussed in recent status meetings, and to approve the transition of the structural analysis from phase I to phase II.

Due to funding limitations construction will be performed on only the 107-AP tank in fiscal year 1988. However, the design media should show both 107-AP and 108-AP modifications. The project cost estimate and schedule should only reflect the modifications to 107-AP.

Several issues have arisen in recent status meetings concerning the pump lowering mechanism and its interface with the new risers and pits. Based on the current conceptual design media generated by Westinghouse Hanford Company (WHC) the following items should be considered in the design media for this project:

- The lowering mechanism will weigh 27,500 pounds and will be supported by an overhead structure.
- The project design media should show only a standard pit cover. A revised pit coverblock will be designed at a later date incorporating a penetration.

As more information becomes available on the lowering mechanism you will be updated on any pertinent modifications required for the design.

The WHC review of phase I of the structural analysis has begun and, based on the method of analysis, WHC concurs with the approach taken and approves the continuance of the analysis into phase II. Formal approval or a request to modify assumptions, of the phase I analysis will be made after further review. Please forward any information on phase II to me as soon as possible.

Hanford Operations and Engineering Contractor for the US Department of Energy

Please call me at 373-1802 if you have any questions pertaining to this project.

Very truly yours,

Gregory E Hansen

G. E. Hansen
Waste Management Project
Definition Section

ran

App. Figure A-3. 107-AP Post-Construction Riser Installation Stress Relief Discussion

Redistribution/JRM/6-11-87
M. D. Chang
C. J. Denson
E. A. Goakey
Y. Ingram/Central Files
R. M. Iten **(for info. only)**
J. R. Nicholson
JRM File

Rockwell Hanford Operations
P.O. Box 800
Richland, WA 99352

Rockwell International

JUN 0 8 1987

In reply, refer to letter R87-2493

J. R. Mills, Project Engineer
Kaiser Engineers Hanford Company
Post Office Box 888
Richland, Washington 99352

Dear Mr. Mills:

107-AP AND 108-AP RISER/PIT INSTALLATION, ADDITIONAL DESIGN INFORMATION

Attached is the information your organization requested for the subject design effort. This information pertains to operating specifications for the mixer pump and the Quality Assurance recommendations for stress relief.

Attachment (1) provides the specifications for the normal operating torque, the starting torque, and the worst case bending moment and rotor torque. These values are based on the 102-AP mixer pump and may change dependent on the final design of the agitator pumps.

Attachment (2) is one opinion on the requirement for stress relief. This attachment is provided for your information only and is currently not Rockwell's formal position. Other Rockwell organizations must review the need to stress relieve both on the basis of the ASME codes and using a risk analysis type evaluation. If a satisfactory resolution cannot be reached an independent reviewer/consultant will be obtained to perform the analysis and make recommendations. Pending resolution of this issue, Kaiser Engineers Hanford Company (KEH) should evaluate methods for local stress relief at the location of the riser penetration. In particular, KEH should evaluate non-thermal techniques for stress relief and the feasibility of pre-heating the penetration area instead of post weld heat treatment.

If you have any questions pertaining to the information attached, please call me at 373-1802.

Very truly yours,

Gregory E Hans

G. E. Hansen, Cognizant Engineer
Waste Management Capital Projects Unit
Support Facilities Group

GEH/raa

Att.

cc: L. E. Johnson, Rockwell Project Engineer

RECEIVED
JUN 1 1 1987
PROJ. MGMT

ATTACHMENT 1
Page 1

Attachment to letter R87-2493

DON'T SAY IT -- WRITE IT

To: Greg Hansen

From: Leslie Stegen

Subject: Pump Specifications AP Farm

Date: May 29, 1987

Ref: External Letter, R87-2231, Greg Hansen to J. R. Mills, "SCOPE MODIFICATION TO 107-AP AND 108-AP RISER/PIT INSTALLATION, DEFINITIVE DESIGN"

Per Kaisers request, the worst case bending moment and torques which the AP Mixer Pump may experience during operations have been developed. The two worst case scenarios would occur if: one of the nozzles plugged during operations, or the motor rotor locked. The maximum bending moment due to nozzle plugging is 112,050 ft. lbs., and the maximum motor torque due to a locked rotor is 6468 ft. lbs.

The bending moment was calculated assuming that the distance between the top of the pump assembly and the nozzle is 50 feet. If this distance changes then the bending moment will have to be adjusted accordingly. The motor torques were calculated assuming the locked rotor torque is 4 times the normal operating torque and the start up torque is 2 times the normal operating torque. A service factor of 1.15 was added to the normal operating torque prior to making the calculations. Attached are the calculations and assumptions for both the bending moment and the torque.

Other motor torques which may be of interest to Kaiser are:

- 1406 ft lbs, normal operating torque
- 2812 ft lbs, starting torque

Motor Pump Specifications

- 300 HP
- 1170 RPM
- 3 phase, 460 volt, TEFC, Class H

The entire assembly, pump/motor, column, and rotational assembly will rotate between .2 and .5 RPM.

cc: A. J. DiLiberto

BENDING MOMENT FROM NOZZLE PLUG

ASSUME: ONE NOZZLE PLUGS
FLOW FROM TWO NOZZLES = 5000 GPM
FLOW FROM ONE NOZZLE
(ASSUME ONE NOZZLE IS PLUGGED) = 3150 GPM
DIAMETER OF NOZZLE = 3.75 INCHES
DISTANCE FROM THE
DISTANCE FROM RAMMING HEAD TO NOZZLE = 65 FT
(ASSUMES: PUMP PIT = 10 FT IN HEIGHT
COVER BLOCK = 2 FT THICK
PUMP EQUIPMENT ABOVE
COVER BLOCK = 3 FT)

SPECIFIC GRAVITY OF THE WASTE = 1.8

AREA OF THE NOZZLE = 11.04 IN^2

EQUATIONS:

(1) $F_J = Q\rho V$

(2) $M_B = F_J d$

F_J = FORCE OF JET AT THE NOZZLE
Q = FLOW
ρ = DENSITY OF FLUID
V = VELOCITY

M_B = BENDING MOMENT
d = DISTANCE FROM NOZZLE TO BOTTOM MECHANISM

USING EQUATION (1)

$F_J = \rho V$ $\qquad V = Q/A = 3150 \frac{GAL}{MIN}\left(\frac{1}{11.04 IN^2}\right)\left(\frac{144 IN^2}{FT^2}\right)\left(\frac{FT^3}{7.48 GAL}\right)\left(\frac{MIN}{60 SEC}\right)$

$= 91.55 \frac{FT}{SEC}$

$F_J = 3150 GAL\ (1.8)(62.4 LB)\ (1\ LB\text{-}SEC^2)$ (illegible)

(2) $M_B = F_j d$

$= 2241\ lb_f\ (50\ FT) = 112{,}050\ lb_f\ FT$

ATTACHMENT 2
Page 1

Attachment to letter R87-2493

5/27/87

G.E. HANSEN

L.R. HALL Lamy R. Hall

Subject: Stress relief requirements for 107-AP and 108-AP tank risers.

A review of ASME section VIII Div. 2 and construction spec. B-340-C4 (original spec. for 241-AP tank farm) has been preformed and Quality Assurance feels that some form of stress relief is required for the riser additions to tanks 107-AP and 108-AP.

The orignal construction spec. for the AP tank farm required stress relief following completion of all high temperature work such as welding, cutting, ect. (Reference attached page from B-340-C4 spec.)

ASME section VIII Div. 2 requires postweld heat treatment in accordance with article AF-402, AG-301(c) and table AF-402.1. (See attached references)

Quality Assurance feels that satisfactory stress relief can be obtained by the use of one of the following: 1. Postweld heat treatment in accordance with table AF-402.1

2. Postweld heat treament for a longer period of time at a lower temperature in accordance with table AF-402.2 3. Alternative to postweld heat treatment using a higher preheat temp. 4

ding area adjacent to the weld and one adjacent to the weld at the of the reading area.

.6 Documentation of Nondestructive Examinations Rev 1

3.3.6.1 Deliver completed NDE/Weld Record and "As-Built" weld identification drawings to the Government's Representative one day after completion of hydrostatic testing. Rev 1

3.3.7 Final acceptance of all welds will be by the Government's Representative. Rev 1

3.4 STRESS RELIEVING

3.4.1 Primary tanks are to be fully stress relieved following completion of all high temperature work such as welding, cutting, gouging, repairs, etc. Heat tanks internally and use indicating and recording temperature devices to aid in control and maintenance of a uniform distribution of temperature in the tank walls and to indicate the pressure within the tank. Insulate tanks for the stress relieving operation; remove insulation after completion of stress relief.

3.4.2 Perform stress relief in accordance with ASME, Section VIII, Division 2, Article F-4, except that:

3.4.2.1 The maximum allowable decrease in temperature below the specified temperature of 1100 F shall not exceed 100 F.

3.4.2.2 The temperature shall be brought from ambient to 220 F and held for 6 hours.

3.4.2.3 The rate of temperature rise and reduction between 800 F and 1100 F shall be no more than 100 F/hr.

3.4.2.4 The period of heating from 800 F to 1100 F shall consume no more than 12 hours.

3.4.2.5 During the heating-up period, after any recorded temperature reaches 800 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.

3.4.3 Do not allow direct impingement of flame on any part of the tank. Control gases introduced into the tank during heating and holding periods, so as to avoid excessive oxidation of the interior surface of the vessel.

3.4.4 Perform a stress relieving operation based on a holding temperature of 1100 F for one hour per inch of metal thickness, that will

ARTICLE F-4
HEAT TREATMENT OF WELDMENTS

AF-400 HEAT TREATMENT OF WELDMENTS

AF-401 Requirements for Preheating

The Welding Procedure Specification for the material being welded shall specify the minimum preheating requirements in accordance with the weld procedure qualification requirements of Section IX. Where preheating is not required by the welding procedure, preheating may be employed during welding to assist in completion of the welded joint. The need for and temperature of preheat are dependent on a number of factors, such as the chemical analysis, degree of restraint of the parts being joined, elevated temperature physical properties, and material thicknesses. Specific rules for preheating are not given in this Division. Some practices used for preheating are given in nonmandatory Appendix D, as a general guide for the materials listed by P-Numbers of Section IX. It is cautioned that the preheating listed therein does not necessarily ensure satisfactory completion of the welded joint, and requirements for individual materials within the P-Number listing may have preheating more or less restrictive than this general guide.

AF-402 Requirements for Postweld Heat Treatment[1]

Before applying the detailed requirements and exemptions in these paragraphs, satisfactory qualification of the welding procedures to be used shall be performed in accordance with all the variables of Section IX and AF-321, including conditions of postweld heat treatment or its omission, and the restrictions listed below. Except for nonferrous materials and except as otherwise provided in Table AF-402.1 and Table AF-402.2 for ferrous materials, all welded pressure vessels or pressure vessel parts shall be given a postweld heat treatment at a temperature not less than that specified in those Tables when the nominal thickness, including corrosion allowance, of any welded joint in the vessel or vessel parts exceeds the limits in those Tables. The exemptions for postweld heat treatment, as provided for in Tables AF-402.1 and AF-402.2, are not permitted when the vessel is designed for lethal service as defined in footnote 3 to AG-301.1(c) or when welding ferritic materials greater than ⅛ in. thick with the electron beam welding process. The materials in Table AF-402.1 are listed in accordance with QW-422 of Section IX and are also listed in the Tables of stress intensity values in Part AM.

AF-402.1 When Holding Temperatures and Times May Be Exceeded. Except where prohibited in Table AF-402.1, holding temperatures and/or holding times in excess of the minimum values given in Table AF-402.1 may be used (see AM-202). A time-temperature recording of all postweld heat treatments shall be provided for review by the Inspector. The holding time at temperature specified in Table AF-402.1 need not be continuous. It may be an accumulation of time of multiple postweld heat treat cycles.

AF-402.2 Heat Treatment of Pressure Parts Consisting of Different P-Number Groups. When pressure parts of two different P-Number groups are joined by welding, the postweld heat treatment shall be that specified in Table AF-402.1 with applicable notes for the material requiring the higher postweld heat treatment temperature. When nonpressure parts are welded to pressure parts, the postweld heat treatment temperature of the pressure part shall control.

[1] Additional postweld heat treatment requirements may result from the requirements of Article T-2.

TABLE AF-402.1
REQUIREMENTS FOR POSTWELD HEAT TREATMENT OF PRESSURE PARTS AND ATTACHMENTS

Material	Normal Holding Temperature, °F, Minimum	Minimum Holding Time at Normal Temperature for Nominal Thickness (See AF-402.1)		
		Up to 2 in.	Over 2 in. to 5 in.	Over 5 in.
P-No. 1 Group Nos. 1,2,3	1100	1 hr/in., 1 hr minimum	2 hr plus 15 min for each additional inch over 2 in.	2 hr plus 15 min for each additional inch over 2 in.

NOTES:
(1) When it is impractical to postweld heat treat at the temperature specified in this Table, it is permissible to carry out the postweld heat treatment at lower temperatures for longer periods of time in accordance with Table AF-402.2.
(2) Except for exemptions in Note (3), postweld heat treatment is mandatory under the following conditions:
(a) for material over 1½ in. nominal thickness. Postweld heat treatment is mandatory on materials over 1¼ in. nominal thickness through 1½ in. nominal thickness unless preheat is applied at a minimum temperature of 200°F during welding.
(b) on material of all thicknesses if required by AG-301.1(c);
(c) on material over ⅝ in. thickness for pressure parts subject to direct firing.
(3) Postweld heat treatment is not mandatory under the conditions specified below:
(a) for groove welds not over ½ in. in size and fillet welds with a throat over ½ in. that attach nozzle connections that have a finished inside diameter not greater than 2 in. provided the connections do not form ligaments that require an increase in shell or head thickness, and preheat to a minimum temperature of 200°F is applied;
(b) for groove welds not over ½ in. in size or fillet welds having a throat thickness of ½ in. or less used for attaching nonpressure parts to pressure parts and where preheat to a minimum temperature of 200°F is applied when the thickness of the pressure part exceeds 1¼ in.;
(c) for studs welded to pressure parts provided preheat to a minimum temperature of 200°F is applied when the thickness of the pressure part exceeds 1¼ in.

Material	Normal Holding Temperature, °F, Minimum	Minimum Holding Time at Normal Temperature for Nominal Thickness (See AF-402.1)		
		Up to 2 in.	Over 2 in. to 5 in.	Over 5 in.
P-No. 3 Group Nos. 1,2,3	1100	1 hr/in., 1 hr minimum	2 hr plus 15 min for each additional inch over 2 in.	2 hr plus 15 min for each additional inch over 2 in.

NOTES:
(1) When it is impractical to postweld heat treat at the temperatures specified in this Table, it is permissible to carry out the postweld heat treatment at lower temperatures for longer periods of time in accordance with Table AF-402.2. When postweld heat treatment is performed in accordance with this Note, the vessel test plate required by Article T-2 shall receive the same treatment.
(2) Postweld heat treatment is mandatory for P-No. 3, Gr. No. 3 material in all thicknesses.
(3) Except for the exemptions in Note (4), postweld heat treatment is mandatory under the following conditions:
(a) on P-No. 3, Gr. No. 1 and P-No. 3, Gr. No. 2 material over ⅝ in. nominal thickness. For these materials, postweld heat treatment is mandatory on material up to and including ⅝ in. nominal thickness unless a welding procedure qualification described in AF-210.4 has been made in equal or greater thickness than the production weld.
(b) on material in all thicknesses if required by AG-301.1(c) or if for pressure parts subject to direct firing.
(4) For welding connections and attachments to pressure parts, postweld heat treatment is not mandatory under the conditions specified below:
(a) for attaching to pressure parts which have a specified maximum carbon content of not more than 0.25% (SA Material Specification carbon content, except when further limited by the purchaser to a value within the Specification limits) or to nonpressure parts with groove welds not over ¾ in. in

TABLE AF-402.1 (CONT'D)
REQUIREMENTS FOR POSTWELD HEAT TREATMENT OF PRESSURE PARTS AND ATTACHMENTS

Material	Normal Holding Temperature, °F, Minimum	Minimum Holding Time at Normal Temperature for Nominal Thickness (See AF-402.1)		
		Up to 2 in.	Over 2 in. to 5 in.	Over 5 in.
P-No. 10B Group No. 2	1100	1 hr/in., 1 hr minimum	1 hr/in.	1 hr/in.

NOTES:
(1) Postweld heat treatment is mandatory for P-No. 10B materials for all thickness.
(2) If during the holding period of postweld heat treatment, the maximum time or temperature of any vessel component exceeds the provisions of AM-202, additional test coupons shall be made and tested.

Material	Normal Holding Temperature, °F, Minimum	Minimum Holding Time at Normal Temperature for Nominal Thickness (See AF-402.1)		
		Up to 2 in.	Over 2 in. to 5 in.	Over 5 in.
P-No. 10F Group No. 6	1100	1 hr/in., 1 hr minimum	1 hr/in.	1 hr/in.

NOTES:
(1) Postweld heat treatment is mandatory for P-No. 10F materials for all thicknesses.
(2) If during the holding period of postweld heat treatment, the maximum time or temperature of any vessel component exceeds the provisions of AM-202, additional test coupons shall be made and tested.

TABLE AF-402.2
ALTERNATIVE REQUIREMENTS FOR POSTWELD HEAT TREATMENT OF PRESSURE PARTS AND ATTACHMENTS[1]

Decrease in Temperature Below Normal Holding Temperature, °F	Minimum Time at Decreased Temperature, hr/in. of Thickness
50	2
100	3
150	5
200	10

NOTE:
(1) Postweld heat treatment at lower temperatures for longer periods of time, in accordance with this Table, shall be used only where permitted in Table AF-402.1.

ARTICLE G-3
RESPONSIBILITIES AND DUTIES

AG-300 GENERAL

The various parties, i.e., User, Manufacturer, and Inspector, involved in the work of producing vessels under this Division, have definite responsibilities or duties in meeting Code requirements. The responsibilities set forth hereinafter relate only to Code compliance and are not to be construed as involving contractual relations or legal liabilities.

AG-301 USER'S RESPONSIBILITY

AG-301.1 User's Design Specification. It is the responsibility of the user or an agent[1] acting on his behalf, who intends that a pressure vessel be designed, constructed, tested, and certified to be in compliance with these rules, to provide or cause to be provided for such vessel or vessels a User's Design Specification. This shall set forth requirements as to the intended operating conditions in such detail as to constitute an adequate basis for selecting materials and designing, fabricating, and inspecting the vessel or vessels as required to comply with these rules. The User's Design Specification shall include the method of supporting the vessel (see AD-110).

(a) It is the user's responsibility to specify, or cause to be specified, whether or not a fatigue analysis of the vessel shall be made for cyclic service,[2] and, when a fatigue analysis is specified, to provide, or cause to be provided, information in sufficient detail so that an analysis for cyclic operation (see also 5-102) can be carried out in accordance with Appendix 5. If the User's Design Specification lists expected operating conditions for which the service evaluation rules in AD-160 indicate need for a fatigue analysis, then such fatigue analysis shall be mandatory and shall be incorporated in the Manufacturer's Design Report. If the User's Design Specification states that no fatigue analysis is required, the Design Specification shall include a statement that the intended vessel operation satisfied the requirements of AD-160.

(b) It is the user's responsibility to specify, or cause to be specified, whether or not a corrosion and/or erosion allowance shall be provided, and, if so, the amount.

(c) When a vessel is to contain fluids of such a nature that a very small amount mixed or unmixed with air is dangerous to life when inhaled, it shall be the responsibility of the user and/or his designated agent to determine if it is lethal.[3] If determined as lethal, the user and/or his designated agent shall so state in the User's Design Specification. It shall be the responsibility of the Manufacturer to comply with the applicable Code provisions [see AM-204, Table AD-155.1, AF-402, and AF-820(d)].

(d) The User's Design Specification need not provide information other than that required in AG-301.1, AG-301.1(a), AG-301.1(b), and AG-301.1(c).

AG-301.2 Certification of User's Design Specification. A professional engineer, registered in one or more of the States of the United States of America or the Provinces of Canada and experienced in pressure vessel design, shall certify to the compliance of the User's Design Specifications with the above requirements.

[1] Wherever *user* appears in this document, it may be considered to apply also to an agent acting in his behalf.

[2] AD-160 covers the evaluation of service conditions to establish the need of a vessel fatigue analysis as provided by Appendix 5.

[3] By *lethal substances* are meant poisonous gases or liquids of such a nature that a very small amount of the gas or of the vapor of the liquid mixed or unmixed with air is dangerous to life when inhaled. For purposes of this Division, this class includes substances of this nature which are stored under pressure or may generate a pressure if stored in a closed vessel.

App. Figure A-4. Project W-E01 Completion

107297

Westinghouse
Hanford Company

P.O. Box 1970 Richland, WA 99352

September 30, 1988 8856151

Mr. R. E. Gerton, Director
Waste Management Division
U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

Dear Mr. Gerton:

COMPLETE TANK 107-AP NEW RISER INSTALLATION TO ALLOW DEMONSTRATION OF DOUBLE-SHELL WASTE RETRIEVAL

This letter reports completion of the U.S. Department of Energy - Richland Operations Office controlled milestone to "Complete Tank 107-AP New Riser Installation to Allow Demonstration of Double-Shell Tank Waste Retrieval." Because of the large costs associated with work done on a contaminated tank, the riser installation has been performed prior to waste transfers into the tank.

Riser and pit installation activities on this tank have been completed, as of the close of business on September 30, 1988. A new riser was added to the tank, the two existing construction risers were modified and new mixer pump pits were installed on each of these three risers. Shielding plugs have been placed in the three 42-inch risers. Some painting, backfilling, site stabilization and the removal of the temporary fence are construction exceptions which will be completed in early October 1988. Demonstration of prototype retrieval equipment will be completed as an outyear activity.

If you have any questions, please contact Mr. K. W. Owens of my staff on 3-1632.

Very truly yours,

R. D. Wojtasek, Manager
Defense Waste Program Integration
Defense Waste Management Division

peb

DOE-RL - R. D. Izatt
A. W. Kellogg

54-7600-075

Hanford Operations and Engineering Contractor for the US Department of Energy

App. Figure A-5. Project W-E01 Concrete Demolition Demonstration

W-E01

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution

DATE October 30, 1987

FROM J. R. Mills
Project Management

COPIES TO S. W. Bork, C. J. Denson, E. A. Dukleth, Y. Ingram, D. S. Mager, C. D. Maxson, T. A. Przbylski, JRM File

JOB NO.

SUBJECT ER-1081, 107-AP AND 108-AP TANK RISER/PIT INSTALLATION - SITE DEMONSTRATION

A demonstration of the demolition technique and equipment for concrete removal proposed for use on the subject project will be performed Wednesday, November 4, 1987, beginning at 9:00 a.m. at A-Farm in the 200E Area. The equipment will be rented from Advanced Mining and Construction System, Inc. (AMAC, Inc.) from Kent, Washington and delivered to the site Monday, November 2, 1987. The equipment will be available to Construction Forces personnel to operate in demolishing a concrete mockup, in many ways similar to the concrete to be removed during construction. The demonstration is planned to be video taped and circulated for viewing by any interested parties, (engineering, construction, demolition, etc.).

My thanks to Construction Forces (D. J. Heberlein, H. L. Maygra and R. Kelso-Weatherly) and Purchasing (D. D. Mcdonald, A. M. Prindiville and S. O. Stecker) for their help in putting this demonstration together on such short notice.

JRM:lbm

Distribution: D. J. Heberlein
R. M. Iten
R. Kelso-Weatherly
H. L. Maygra
D. D. Mcdonald
A. M. Prindiville
S. O. Stecker
T. L. Walton

APPENDIX B TANK DEFICIENCY DOCUMENTATION

App. Figure B-1. Nonconformance Report B-340-33

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-33 (1520-18)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Section 15176, Paragraph 2.3.1: Fabricate in accordance with ASME Section VIII Division 2 Part AF.

ASME Section VIII Division 2 Part AF 141 states, "The surfaces of the parts to be welded shall be clean and free of scale, rust, oil, grease and other deleterious foreign material for a distance of at least 1/2 inch from the welding joint preparation for ferrous materials."

NONCONFORMANCE DESCRIPTION

Weld joints on secondary bottom plates for first weld pass by SMAW are not being cleaned of rust prior to welding. Welds and/or tack welds were made on the BNS seams on Tank A.

2,4 & 5 RTH 11/1/83

(1J) Distribution

DOE
*G S Rokkan

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*M D Robbins
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
YES	M.D. ROBBINS 10-27-83 KEH FIELD ENGINEERING MDR (1)	

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☒ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) Remove all welds that have not been properly cleaned. Perform required preparation and reweld. See note below for clarification.

(2C) Weld joints shall be properly cleaned before welding. Cleanliness requirements of ASME Section VIII Division 2 Code and C-4 Specification shall be met.

NOTE FOR CLARIFICATION
Remove the first SMAW weld pass that was made on seams BNS 2, 4 and 5 that was not cleaned of rust prior to welding. Perform the necessary joint preparation, NDE in accordance with C-4 specification and reweld using approved procedures.

*NOTE: Rockwell QA was given the opportunity to review and sign if they agreed with the disposition. They chose not to sign. NCR disposition to be carried out as indicated.

GS Rokkan 11/4/83

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. NA	Design S.R. Nicholson 10/31/83	Safety D Carlton 10/31/83	Engr. C A Rieck 11/2/83	AT (ASME) NA
QA NA	QA Ken Brayman 10-31-83	PE J W Viita 11-2-83	QA *	DOE GS Rokkan 11/4/83

(3A)
- ☒ Disposition Effected As Directed, NCR Closed
- ☐ Other (Specify)

Michael D Robbins — Originator or Representative — 12-28-83 — Date

(4A) List of Documents Affected	(4B) Documents Revised
	By _____ Date _____

☆ GPO 697-805

TABLE AF-142.1
MAXIMUM ALLOWABLE OFFSET IN WELDED JOINTS
See AF-614.1 for Special Requirements for Quenched and Tempered Steels

Section Thickness, in.	Direction of Joints in Cylindrical Shells	
	Longitudinal	Circumferential
Up to ½, incl.	¼ t	¼ t
Over ½ to ¾, incl.	⅛ in.	¼ t
Over ¾ to 1 ½, incl.	⅛ in.	5/16 in.
Over 1 ½ to 2, incl.	⅛ in.	⅓ t
Over 2	1/16 t (⅜ in. max.)	⅓ t (¾ in. max.)

NOTE:
(1) t = nominal thickness of the thinner section at the joint.

AF-141 Cleaning of Surfaces to Be Welded

The surfaces of the parts to be welded shall be clean and free of scale, rust, oil, grease, and other deleterious foreign material for a distance of at least ½ in. (13 mm) from the welding joint preparation for ferrous materials and at least 2 in. (51 mm) for nonferrous materials. Detrimental oxide shall be removed from the weld metal contact area. When weld metal is to be deposited over a previously welded surface, all slag shall be removed by a roughing tool, chisel, air chipping hammer, or other suitable means so as to prevent inclusion of impurities in the weld metal.

AF-141.1 Cleaning of Cast Surfaces to Be Welded. Cast surfaces to be welded shall have been machined, chipped, or ground to remove foundry scale and to expose sound metal.

AF-142 Alignment Tolerances for Edges to Be Butt Welded W82

Alignment of sections at edges to be butt welded shall be such that the maximum offset is not greater than allowed in AF-142.1 and AF-142.2. Alternatively, offsets greater than permitted by AF-142.1 and AF-142.2 are allowable provided that the maximum offset is acceptable to the Inspector prior to welding and the requirements of Appendix 4 and AF-142.3 are met. See AF-614 for alignment requirements for quenched and tempered steels.

AF-142.1 For Cylindrical Shells. The maximum allowable offset in welded joints in cylindrical shells shall be as given in Table AF-142.1.

AF-142.2 For Spherical Shells and for Hemispherical Heads Welded to Cylindrical Shells. Joints in spherical vessels, joints within heads, and joints between cylindrical shells and hemispherical heads shall meet the requirements in Table AF-142.1 for longitudinal joints in cylindrical shells.

AF-142.3 Fairing of Offsets Within Allowable Tolerances. Any offset within the allowable tolerance provided above shall be faired at a three to one taper over the width of the finished weld or, if necessary, by adding additional weld metal beyond what would have been the edge of the weld. Such additional weld metal build-up shall be subject to the requirements of AF-229.

B340 Phase IV

NCR B340-33

NCR B340-33

App. Figure B-2. Nonconformance Report B-340-34

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE IV)

(1C) NCR No.: B-340-34 (1520-19)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Section 15176, Paragraph 3.3.2.1:

Each welding pass on multi-pass seams shall be visually examined by the Contractor's examining personnel prior to deposit of subsequent passes.

NONCONFORMANCE DESCRIPTION

Welds BNS 4 and BNS5 were made on 10-27-83 with no visual examination between the second and third weld pass.

(1J) Distribution

DOE
*G S Rokkan

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*M D Robbins
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date, M.D. ROBBINS 10-27-83 MDR (1)
KEH FIELD ENGINEERING

(1H) Supervisors Review: [signature]

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☒ ~~Rework~~
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

~~(2B) Grind our pases that have not had the visual examination and reweld and perform inspection as required by the specification.~~

~~(2C) Visual examination shall meet the C-4 Construction Specification requests.~~

[signature] 11/1/83

(2B) Review NDE on welds BNS 4 and BNS 5.
1. If NDE is acceptable, accept the weld
2. If NDE does not pass, repair welds as required by the C-4 construction specification.

(2C) The visual examinations are required to minimize weld repairs. If the Radiographs reflect sound welds, the final objective has been reached.

~~* NOTE: ROCKWELL QA WAS GIVEN THE OPPORTUNITY TO REVIEW & SIGN IF THEY AGREED W/ THE DISPOSITION, THEY CHOSE NOT TO SIGN.~~

~~NCR DISPOSITION TO BE CARRIED OUT AS INDICATED.~~ [signature] 11/4/83

CAR 11/7/83

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. NA	Design [signature] 11/2/83	Safety [signature] 11-2-83	Engr. [signature] 11/4/83	AI (ASME) NA
QA NA	QA [signature] 11/3/83	PE [signature] 11-2-83	QA * [signature]	DOE [signature] 11/4/83

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

[signature] 12-28-83
Originator or Representative — Date

(4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-805

App. Figure B-3. Nonconformance Report B-340-58

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-58 (1520-38)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Section 15176, Paragraph 2.3.1: Fabricate in accordance with ASME Section VIII Division 2 Part AF. (which states: ". . . surfaces of the parts to be welded shall be clean and free of scale, rust, . . . for a distance of at least 1/2 inch from the welding joint preparation for ferrous materials.")

NONCONFORMANCE DESCRIPTION

Unacceptable surface preparation (i.e., insufficient rust removal) prior to field welding first SMAW overhead pass on BRS seams of Primary Tank Bottom "J". Affected seams and approximate area footage as follows:

Seam BRS 1 @ areas 47-53
Seam BRS 2 @ areas 0-3, 13-30, & 40-53
Seam BRS 3 @ areas 0-23

(1J) Distribution

DOE
* K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*D J Rymarz
*D M Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary copies

(1F) Tag No.	(1G) Originator, Company and Date	(1H) Supervisors Review
N/A	D.J. RYMARZ 3-22-84 KEH FIELD ENGINEERING	MDRobbins

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☒ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Remove the first SMAW weld pass (exterior of primary) that was made on seams specified above that were not cleaned of rust prior to welding. Perform the necessary joint preparation, NDE in accordance with C-4 specification and reweld using approved procedures.

2C) Weld joints shall be properly cleaned before welding. Cleanliness requirements of ASME Section VIII Division 2 Code and C-4 Specification shall be met.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 3/23/84	Safety 3-23-84	Engr. 3/23/84	AI (ASME) — NA —
QA	QA 3/23/84	PE 3-23-84	QA 3/23/84	DOE 3/23/84

(3A)

- ☒ Disposition Effected As Directed NCR Closed
- ☐ Other (Specify)

D. J. Rymarz 3-29-84
Originator or Representative Date

(4A) List of Documents Affected

(4B) Documents Revised
By _____ Date _____

GPO 697-905

3·22·84 / DJR

KAISER ENGINEERS HANFORD

FIELD ~~SKETCH~~ PHOTO

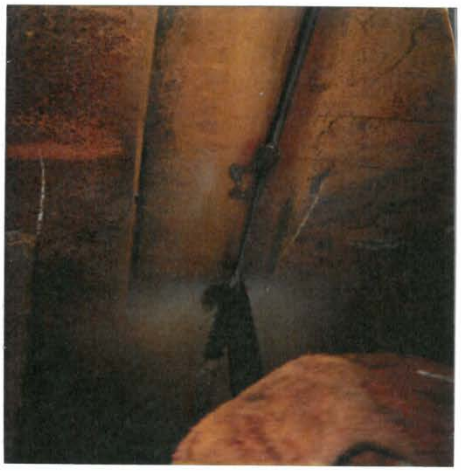
Attachment To Or Description:
REFERENCE NCR B-340-58

Sheet 1 of 2

ALL PHOTOS OF BRS 2@
'J' TANK BOTTOM

TYPICAL JOINT
PRIOR TO WELDING.

WELDING IN PROGRESS
NOTE (LACK OF) JOINT
PREPARATION.



KEH-159.2 (4-82)

3-22-84 DJR

KAISER ENGINEERS HANFORD | FIELD SKETCH

Attachment To Or Description: REFERENCE NCR B-340-58

Sheet 2 of 2

FURTHER EVIDENCE OF INSUFFICIENT JOINT PREPARATION.

MORE OF SAME

KEH-159.2 (4-82)

App. Figure B-4. Nonconformance Report B-340-61

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-61 (1520-41)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 0, Section 15176, Paragraph 3.3.2.1: "Each welding pass on multipass seams shall be visually examined by the contractor's examining personnel prior to deposit of subsequent passes.

NONCONFORMANCE DESCRIPTION

2 feet of weld on R-15 at the intersection of RRS2 on Tank 108 dome was welded with no interpass inspection on two coverpass weld seams.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*M D Robbins
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm
*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	M.D. ROBBINS 5-1-84 KEH FIELD ENGINEERING	5/1/84

(2A) Disposition

- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Radiograph the above completed weld joint area per approved procedures and conditional acceptance dependent upon acceptance of radiographs.

2C) Since specification requires no additional NDE other than visual for the weld joint, the additional radiograph will provide assurance of the weld integrity.

2B alternate) Remove weld that was not inspected and replace per approved procedures.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 5/3/84	Safety 5/3/84	Engr. 5/10/84	QA (ASME) N/A
QA	QA 5-3-84	PE 5-4-84	QA 5/9/84	DOE 5/14/84

(3A)

- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify) weld removed per 2B(alternate)

Michael D Robbins 5-29-84
Originator or Representative Date

(4A) List of Documents Affected

(4B) Documents Revised
By _____ Date _____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

App. Figure B-5. Nonconformance Report B-340-62

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE IV)

(1C) NCR No.: B-340-62 (1520-42)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 0, Section 15176, Paragraph 3.3.2.1: "Each welding pass on multi-pass seams shall be visually examined by the contractor's examining personnel prior to deposit of subsequent passes."

NONCONFORMANCE DESCRIPTION

Primary Shell, Tank 107, C3V3 Area 0 to 3 and C3V4 Area 0 to 6: Contractor examining personnel did not visually examine each weld pass prior to deposit of subsequent weld passes.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: E.L. "BUD" BACKER 5-2-84 KEH FIELD ENGINEERING EdB (2)

(1H) Supervisors Review: MDLobbins

(2A) Disposition

- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of the welds will be dependent upon the radiographic examination of those weld joints (B-340-C4, paragraph 3.3.5.1).

2C) The visual inspection requirements have been imposed to minimize the number of rejections and repairs identified by radiographic examination. The radiographic examination will provide the evidence of the weld integrity.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No.
- ☐ Other Specify
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 5/4/84	Safety 5-4-84	Engr. 5/9/84	AI (ASME) N/A
QA	QA 5-4-84	PE 5-4-84	QA 5/9/84	DOE 5/17/84

(3A)

- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

E.L. Backer — Originator or Representative — 5/24/84 — Date

(4A) List of Documents Affected

(4B) Documents Revised By Date

GPO 697-905

App. Figure B-6. Nonconformance Report B-340-63

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No B340-63 (1520-43) B-340-2E-5-3007
B-340	241-AP TANK FARM (PHASE IV)	

(1D) Requirements
(1E) Nonconformance Description

(1D) REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Section 15176, Paragraph 3.1.1.17 (Reference DFC B-340-151): All temporary attachments welded to the primary tank interior surface shall have the surface to be welded (attachment and tank surface) clean and free of rust, oil, grease and other deleterious material for a distance of 1/2" from the weld joint.

(1E) NONCONFORMANCE DESCRIPTION

On the interior of primary tank "I" (108 base) the contractor welded four ladder brackets approximately six feet east of the north centerline without the required tank surface or attachment surface cleanliness preparation.

(1J) Distribution

DOE
K K Lucas

RHO
D J Bjorklund
R J Hennig
S Joncus
C A Rieck

JAJ
T R Cloud
W T Frisbee

KEH
D L Brown
R L Hand
R M Iten
J R Nicholson
J W Viita
T L Walton
Central File
Field Project File/
Trl-3/241-AP Tk Fm

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	T. D. Hays, JAJCSC, 5/8/84	E. L. Adamson per Telecon

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptable on the condition that after attachments are no longer needed they shall be removed, the primary tank inner surfaces restored, and nondestructive testing performed per the B-340-C4 specification.

2C) Weld joints shall be properly cleaned before welding. Cleanliness requirements of ASME Section VIII Division 2 and the B-340-C4 construction specification shall be met.

RECORD COPY

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 5/10/84	Safety Q. R. Mussler 5/10/84	Engr.	AI (ASME) N/A
QA	QA 5/11/84	PE J W Viita 5-11-84	QA L W Roberts 5/17/84	DOE R L Lucas per Telecon 5/17/84

(3A)
- ☒ Disposition Effected As Directed, NCR Closed
- ☐ Other (Specify)

M D Robbins 6/5/84

T. D. Hays 6/5/84
Originator or Representative Date

(4A) List of Documents Affected

(4B) Documents Revised
By _____ Date _____

GPO 697-905

App. Figure B-7. Nonconformance Report B-340-66

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE IV)

(1C) NCR No.: B-340-66 (1520-46)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Section 15176:

I. Paragraph 3.1.1.5 (per DFC #22): ". . . clips, lugs, etc., welded to plates. . . may not be welded to internal primary tank surfaces except with prior approval by the Government's Representative."

II. Paragraph 3.1.1.17 (per DFC #151): "All temporary attachments welded to the primary tank internal surface shall have the surface to be welded (attachment & tank surface) clean and free of rust, oil, grease and other deleterious material for a distance of 1/2" from the weld joint."

NONCONFORMANCE DESCRIPTION

At Primary Tank "O", Course 1 vertical weld seams C1V4 & C1V5:

I. 2 internal surface attachments at each seam welded without prior approval of Government's Representative. (Approval was given for 4 attachments per seam - 6 attachments were welded per seam.)

II. 6 internal surface attachments at C1V4 welded without surface(s) preparation, i.e., rust not removed.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*CA Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*D J Rymarz
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date, KEH 07: D.J. RYMARZ 5-16-84, KEH FIELD ENGINEERING

(1H) Supervisors Review: MD Robbins

(2A) Disposition
- ☐ Accept As Is
- ☐ Conditional Accept
- ☒ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Remove attachments and restore primary tank inner surfaces to original shape and contour. Perform nondestructive testing on the attachment area per specification.

2C) I. Attachment welds to the inside of the primary tank require approval by the governments representative prior to welding.

II. Attachment welds shall be properly cleaned before welding. Cleanliness requirements ~~or ASME Section VIII Division 2 of code and~~ C-4 specification shall be met. CAK 5/31/84

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: J.R. Kindel 5/22/84	Safety: D Rathbun 5/23/84	Engr: Robert Van Beek 5/30/84	AI (ASME): N/A
QA	QA: Wm. Brayman 5-23-84	PE: JWV 5-24-84	QA: O Wendel 5/24/84	DOE: Kay K Lucas 6/1/84

(3A)
- ☒ Disposition Effected As Directed, NCR Closed
- ☐ Other (Specify)

David R. Rymarz 6.7.84
Originator or Representative — Date

4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-905

App. Figure B-8. Nonconformance Report B-340-70

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-70 (1520-49)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 0, Section 15176, Paragraph 3.3.2.1: "Each welding pass on multi-pass seams shall be visually examined by the contractor's examining personnel prior to deposit of subsequent passes."

NONCONFORMANCE DESCRIPTION

Tank "E", Seam C2V6, Area 2 to 8: Contractor examining personnel did not visually examine each weld pass prior to deposit of coverpass on the outside of the seam.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
* ~~S Joncus~~ E. Kollermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date	(1H) Supervisors Review
NO	E.L. BACKER 6-20-84 KEH FIELD ENGINEERING ELB (1)	MDRobbins

(2A) Disposition

- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of the welds will be dependent upon the radiographic examination of that weld joint (B-340-C4 paragraph 3.3.5.1)

2C) The visual inspection requirements have been imposed to minimize the number of rejections and repairs identified by radiographic examination. The radiographic examination will provide the evidence of the weld integrity.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design [signature] 6/21/84	Safety [signature] 6/21/84	Engr. [signature] 6/28/84 [signature] 6/27/84	AI (ASME) — N/A —
QA	QA Wm. Bragmen 6-22-84	RE [signature] 6-26-84	QA [signature] 6/28/84 [signature] 6-27-84	DOE [signature] 7/2/84

(3A) ☒ Disposition Effected As Directed. NCR Closed
☐ Other (Specify)

E.L. Backer 7/9/84
Originator or Representative — Date

(4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-905

App. Figure B-9. Memorandum Regarding Welding Surface Preparation

97604

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO J. W. VIITA
AT

DATE MARCH 23, 1984
FROM W. H. BRAYMEN
B-340-QAE

COPIES TO
G. W. HAHN
R. L. HAND
G. P. OSBORNE
FILE/LB
CENTRAL FILES

AT

JOB NO. B-340

SUBJECT PROJECT B-340 AP TANK FARM "WELDING OVER RUST"

According to NCR B-340-58 we are still experiencing problems in the field with the contractor welding over rust. Also, the Title III inspector informs me that it is a daily trouble area.

Since the contractor has elected to ignore his agreement to clean the plate surfaces in a manner that has been demonstrated to him, it is obvious that corrective action measures are in order. Therefore a letter from KEH QA Manager is being forwarded to JAJ QA Corp. Manager for a corrective action and response.

Also, in the interest of the assurance of Welding Quality, the KEH QA Department feels that we are bound to initiate quality measures which will bring this problem under control. This measure appears to be that the inspection plan for the Tank Construction Phase be amended to include a hold-point for Title III inspection to verify that plate welding surfaces have been properly cleaned prior to welding. Please initiate a DFC which will institute this measure.

WHB/slw

App. Figure B-10. Nonconformance Report B-340-76

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE IV)

(1C) NCR No.: B-340-76 (1520-53)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. Construction Specification B-340-C4, Section 15176, Paragraph 3.4.2.5 requires that the temperature difference between all parts of the tank not exceed 200°F after any temperature reaches 800°F.

2. Construction Specification B-340-C4, Section 15176, Paragraph 3.4.2.1 requires all temperatures to remain above 1000°F during stress relief operation.

NONCONFORMANCE DESCRIPTION (Reference Table Below)

1. The Tank 108 permanent bottom thermocouples, with few exceptions, remained lower than the 200°F spread permitted while the tank was heated from 800°F to 1050°F as indicated by the temporary thermocouples.

2. The Tank 108 permanent bottom thermocouples remained below 1000°F during the entire 4 hours that the temporary thermocouples remained near 1050°F.

(CONTINUED ON PAGE 2 OF 2)

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Kollermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*F W Shaffer
*D L Brown
R M Iten
R L Hand
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: F.W. SHAFFER 7-10-84 (8)
KEH FIELD ENGINEERING

(1H) Supervisors Review: M D Rahlwes

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification: NCR B-340-76 Final Disposition

2B) Accept the Stress Relief Cycle for Tank 108

2C) Assumption:
The relationship of temperature difference between the bottom of the primary tank and the top of the primary bottom knuckle is similar for tanks 107 and 108.

From studying the temperature data for both the temporary and permanent thermocouples for Tank 107 and comparing it to Tank 108, this appears to be a reasonable assumption.

Figure #1 represents compiled data for Tank 107 relating average temperatures for thermocouples representing various regions of the tank. The bottom two curves (+, □) represent the permanent thermocouples installed in the insulating concrete (locations 1 & 2). The next curve (◇) up (location 3), represents the top of the lower primary tank knuckle. The temporary thermocouples (temp. location 1) for the center of the primary Tank (21 ft. radius) is indicated below location 3.

con't page 3

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 8/8/84	Safety 8-9-84	Engr 8/22/84	VAI (ASME) N/A
QA	QA 8-13-84	PE 8-14-84	QA 8/22/84	DOE 8/27/84

(3A)
- [ ] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

F.W. Shaffer
Originator or Representative

8-29-84
Date

4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-905

NCR B-340-76

PAGE 2 OF 4

NONCONFORMANCE DESCRIPTION (continued)

NOTE: On 7-6-84 at 2100 hrs. the permanent tank bottom thermocouples averaged 265°F while the lower side thermocouples averaged 375°F and the remaining side and top thermocouples averaged 475°F. At that time, a portable thermocouple was inserted through the mineral wool insulation until it contacted the tank base, below the knuckle, at the refractory foundation. This thermocouple indicated 400°F. It was then connected to recorder #5, and recorded through the remainder of the stress relief operation.

Data Transmittal #1520-A48 contains the entire heat treat temperature records.

T/C #	Bottom T/C Heatup Temps 7-7-84 1300 hrs.	Bottom T/C Stress Relief Temps 7-7-84 1830 hrs.
1	705	860
2	720	880
3	740	900
4	745	895
5	725	870
6	750	900
7	775	890
8	680	825
9	720	870
10	660 low	860
11	660	850
12	745	855
13	690	890
14	720	900
15	800	935
16	695	875
17	805 high	950
18	760	910
19	680	855
20	770	910
21	740	890
22	735	865
23	760	920
24	750	915
Highest Side T/C:	975	Avg. Side/Top Temp: 1049

Figure #2 represents the data for Tank 108.

From the temperatures recorded on the bottom of Tank 107 by the temporary and permanent thermocouples, it is evident that the permanent thermocouples are not giving an accurate reading of the tank steel temperatures during stress relief. To determine if Tank 108 was at sufficient temperature for a sufficient period of time to relieve the tank stresses, we compare the results shown in figures 1 and 2.

To align both curves the point at which the stress relieving operation starts is approximately 12 hours for Tank 107 (figure 1) and approximately 23-1/2 hours for Tank 108 (figure 2).

The curve (figure 2) identified as "Primary Bottom (TK 107 Related)" represents the temperature difference between the temporary thermocouples on the inside primary bottom and the primary tank bottom knuckle for Tank 107 from the start of the stress relieving cycle superimposed on the Tank 108 temperature time history. As indicated, the Tank 108 bottom did not maintain the 1000°F requirement for the three hour minimum time in accordance with the specification and ASME Section VIII, Div. II, Table AF-402.2.

Table AF-402.2 allows a decrease in temperature of 150°F below the normal stress relieving temperature of 1100°F if the holding time is increased to five hours per inch of material thickness. Figure 2 shows that the temperature differential relationship between Tank 107 and 108 (TK 107 related curve in fig 2), that the temperature of Tank 108 remained above 950°F in excess of the minimum five hour holding time required by the Code.

In addition, the line labeled TEMPORARY THERMOCOUPLE "A" on figure 2 shows the temperatures recorded by the single temporary thermocouple installed near the bottom of the lower knuckle during stress relief of Tank 108.

Although the permanent thermocouples did not perform as expected during stress relief it is felt that they will perform as intended during operation of the tanks. The temperature readings of The permanent thermocouples were gradually closing in on the readings given by the temporary thermocouples. Given sufficient time they would have converged (see figures 1 and 2). During operation (1) the temperatures will not be as high as those of the stress relief, (2) they will be held for periods of days, weeks and months not minutes, and (3) they will not be subject to rapid changes of 100°F per hour.

The design installation of the permanent bottom thermocouples (Drawing H-2-90465 Sh 2 Section B) probably is the cause of the problem. The steel "can" that the thermocouple is mounted in is probably conducting heat away from the thermocouple and into the refractory. Combined with the fact that the "can" is not fixed to the tank bottom (there could even be an air gap if the bottom has a wave in it) could easily result in temperature readings from the thermocouple lower that that actually seen by the bottom steel. As the refractory heats up this difference will decrease.

In conclusion; it is doubtful from the data available that Tank 108 met the minimum specification requirement for stress relief of 1000°F for three hours but the code option of 950°F for five hours has been met and the tank stress relief can be accepted on that basis. The permanent thermocouples did not perform as intended during stress relief but should perform as intended during tank operations.

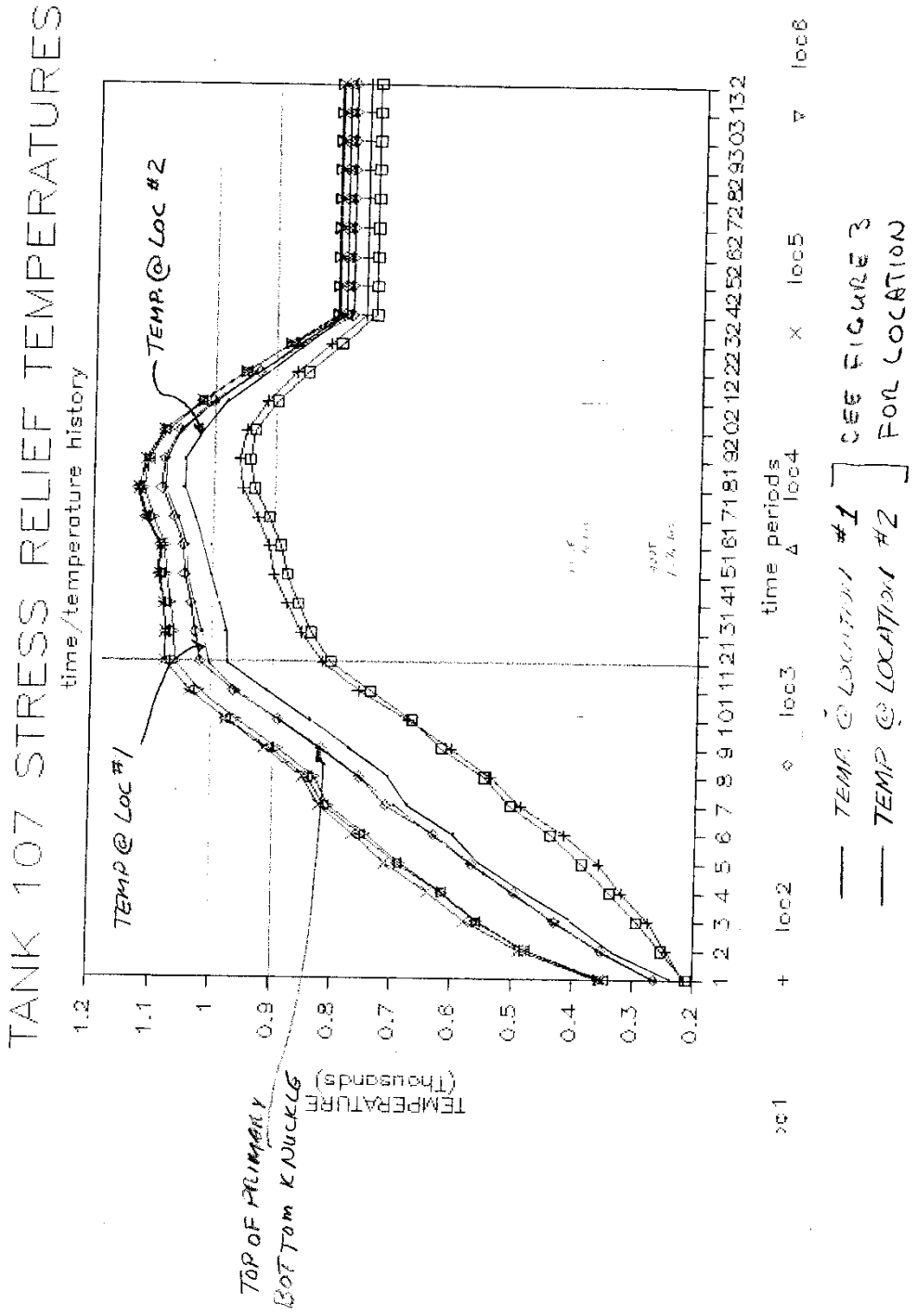
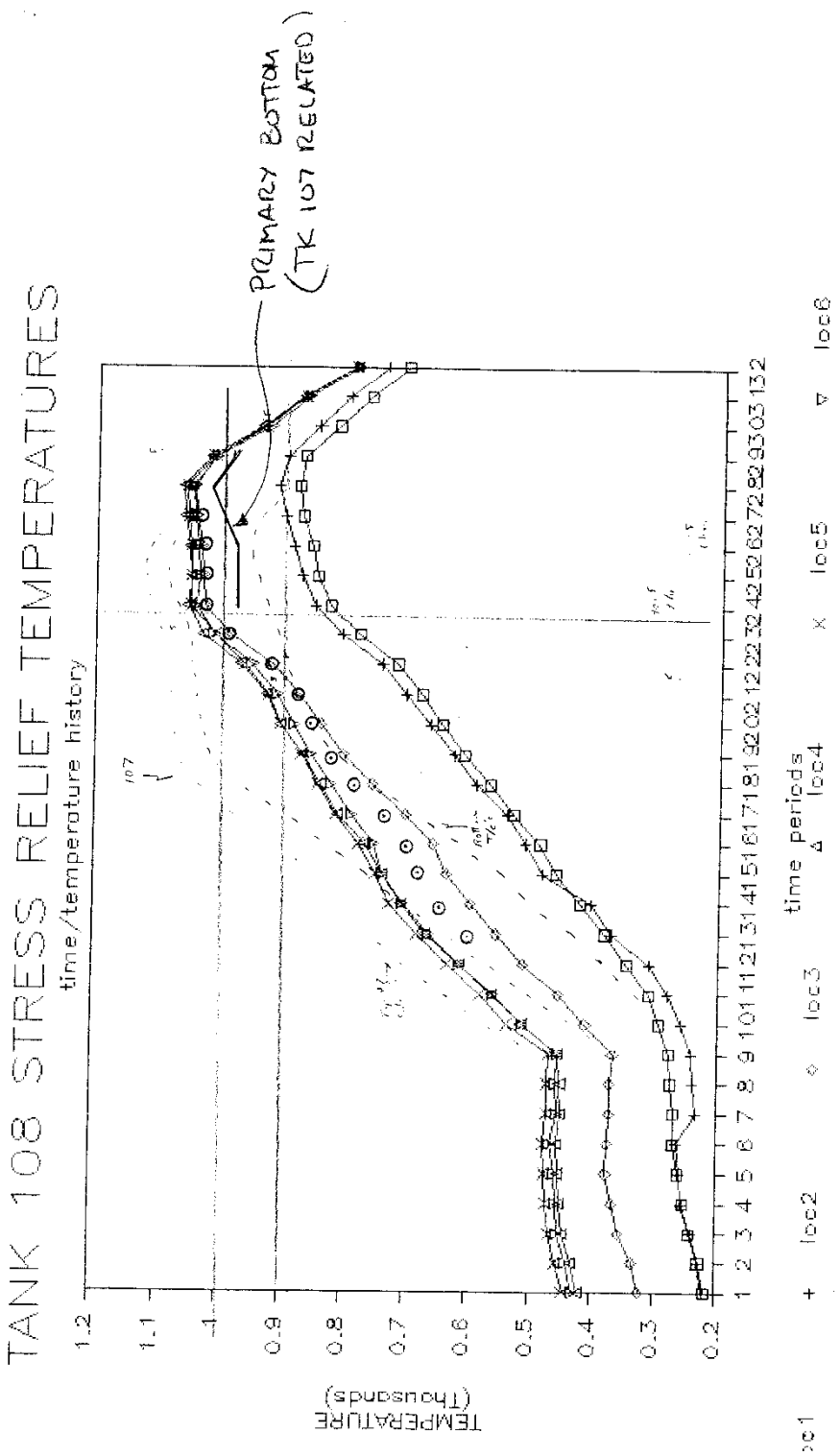
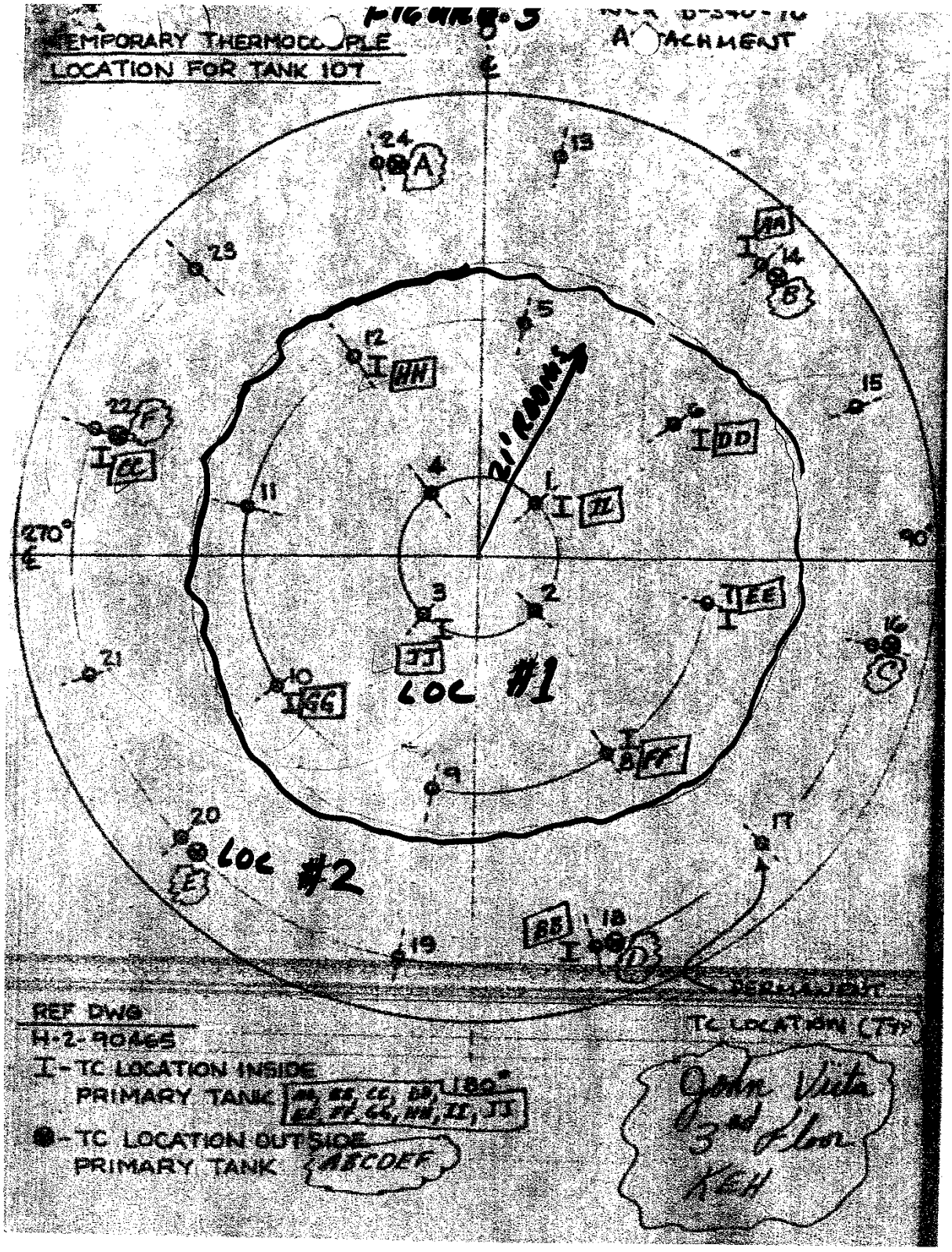


FIGURE 1
TANK 107 STRESS RELIEF TEMPERATURES
time/temperature history
TEMP @ Loc #1
TEMP. @ Loc #2
TOP OF PRIMARY BOTTOM KNUCKLE
TEMPERATURE (Thousands)
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
1 2 3 4 5 6 7 8 9 10 11 21 31 41 51 61 71 81 92 02 12 22 32 42 52 62 72 82 93 03 13 2
time periods
loc1
loc2
loc3
loc4
loc5
loc6
TEMP @ LOCATION #1
TEMP @ LOCATION #2
SEE FIGURE 3 FOR LOCATION

FIGURE 2.


TANK 108 STRESS RELIEF TEMPERATURES
time/temperature history
PRIMARY BOTTOM
(TK 107 RELATED)
TEMPERATURE
(Thousands)
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
time periods
+ loc2
◇ loc3
△ loc4
× loc5
▽ loc6
o — TEMPORARY THERMOCOUPLE "A"


TEMPORARY THERMOCOUPLE
LOCATION FOR TANK 107
ATTACHMENT
LOC #1
LOC #2
270°
90°
21' RADIUS
PERIMETER
REF DWG
H-2-90465
I - TC LOCATION INSIDE PRIMARY TANK
● - TC LOCATION OUTSIDE PRIMARY TANK
TC LOCATION (TYP)

App. Figure B-11. Nonconformance Report B-340-81

RL-604 (2-80)
(54-2039-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 4

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-81 (1520-54)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. Construction Specification B-340-C4, Section 15176, Paragraph 3.4.2.5, requires that the temperature difference between all parts of the tank not exceed 200°F after any temperature reaches 800°F.

2. Construction Specification B-340-C4, Section 15176, Paragraph 3.4.2.1, requires all temperatures to remain above 1000°F during stress relief operation.

NONCONFORMANCE DESCRIPTION

1. The Tank 107 permanent bottom thermocouples, with few exceptions, remained lower than the 200°F spread permitted while the tank was heated from 800°F to 1050°F as indicated by the temporary thermocouples installed per DT-1520-C43 and NCR-B-340-76. (Reference Chart A, Page 3 of 4).

(CONTINUED ON PAGE 2 OF 4)

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Kollermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*L E Peterson
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	L.E. PETERSON 7-24-84 KEH FIELD ENGINEERING	

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is
For future tanks to be stress relieved the permanent thermocouples installed thru the insulating concrete shall not be used to monitor the primary tank bottom temperature response during the stress relief cycle. Temporary thermocouples shall be used to determine the primary tank bottom temperatures.

2C) From the attached data it is evident that the permanent thermocouples are not tracking the primary tank bottom temperatures. The temporary thermocouple readings substantiate a successful stress relief cycle meeting the requirements of the B-340-C4 construction specification.

The permanent thermocouples do not appear to perform as intended for the stress relief cycle but no problems are anticipated when the tank contains liquid waste.

(2D) Additional Doc Required

- [ ] As-Builts
- [X] DFC No. B-340-190
- [ ] Other Specify
- [ ] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design R. 7/26/84	Safety 7/27/84	Engr 8/3/84	AI (ASME)
QA	QA 7-30-84	PE 7-30-84	QA 8/3/84	DOE 8/2/84

(3A)

- [X] Disposition Effected As Directed, NCR Closed
- [ ] Other (Specify)

Originator or Representative 8/8/84 Date

(4A) List of Documents Affected	(4B) Documents Revised
	By Date

GPO 697-905

NCR B-340-81

Page 2 of 4

NONCONFORMANCE DESCRIPTION (continued)

2. The Tank 107 permanent bottom thermocouples remained below 1000°F during the entire 3 hours that the temporary thermocouples remained near 1050°F. (Reference Chart B, Page 3 of 4)

NOTE: All temporary thermcouples installed per NCR B-340-76 on the interior bottom and lower portion of the exterior bottom knuckle indicated temperatures that conformed to the stress relief procedure.

Data Transmittal #1520-A48.1 contains the entire Tank 107 Heat Treat Temperature Records.

NCR B-340-81
Page 3 of 4

T/C #	Permanent Bottom T/C Heatup Temps of 2400 hrs., 7-19-84	Associated Temporary T/C installed per NCR B-340-76. Heatup Temps °F, 2400 hrs., 7-19-84 See Page 4 of 4 for locations
1	550	(II) 650
2	520	
3	415	(JJ) 700
4	530	
5	480	
6	550	(DD) 675
7	560	(EE) 650
8	470	(FF) 675
9	540	
10	520	(GG) 650
11	435	
12	470	(HH) 675
13	550	
14	475	(B) 555, (AA) 720
15	450	
16	520	(C) 730
17	470	
18	530	(D) 715, (BB) 705
19	475	
20	425	(E) 730
21	440	
22	420	(F) 725, (CC) 720
23	560	
24	530	(A) 680

Highest Side T/C: 850

CHART "A"

T/C #	Permanent Bottom T/C Stress Relief Temps °F 1200 hrs., 7-20-84	Associated Temporary T/C installed per NCR B-340-76. Stress Relief Temps °F, 1200 hrs., 7-20-84 See Page 4 of 4 for locations
1	945	(II) 1030
2	950	
3	895	(JJ) 1065
4	975	
5	935	
6	965	(DD) 1050
7	970	(EE) 1030
8	925	(FF) 1030
9	965	
10	950	(GG) 1030
11	920	
12	925	(HH) 1055
13	990	
14	940	(B) 1050, (AA) 1090
15	925	
16	975	(C) 1100
17	965	
18	990	(D) 1100, (BB) 1090
19	955	
20	920	(E) 1100
21	945	
22	985	(F) 1075, (CC) 1090
23	995	
24	960	(A) 1050

Average Side/Top Temp: 1103

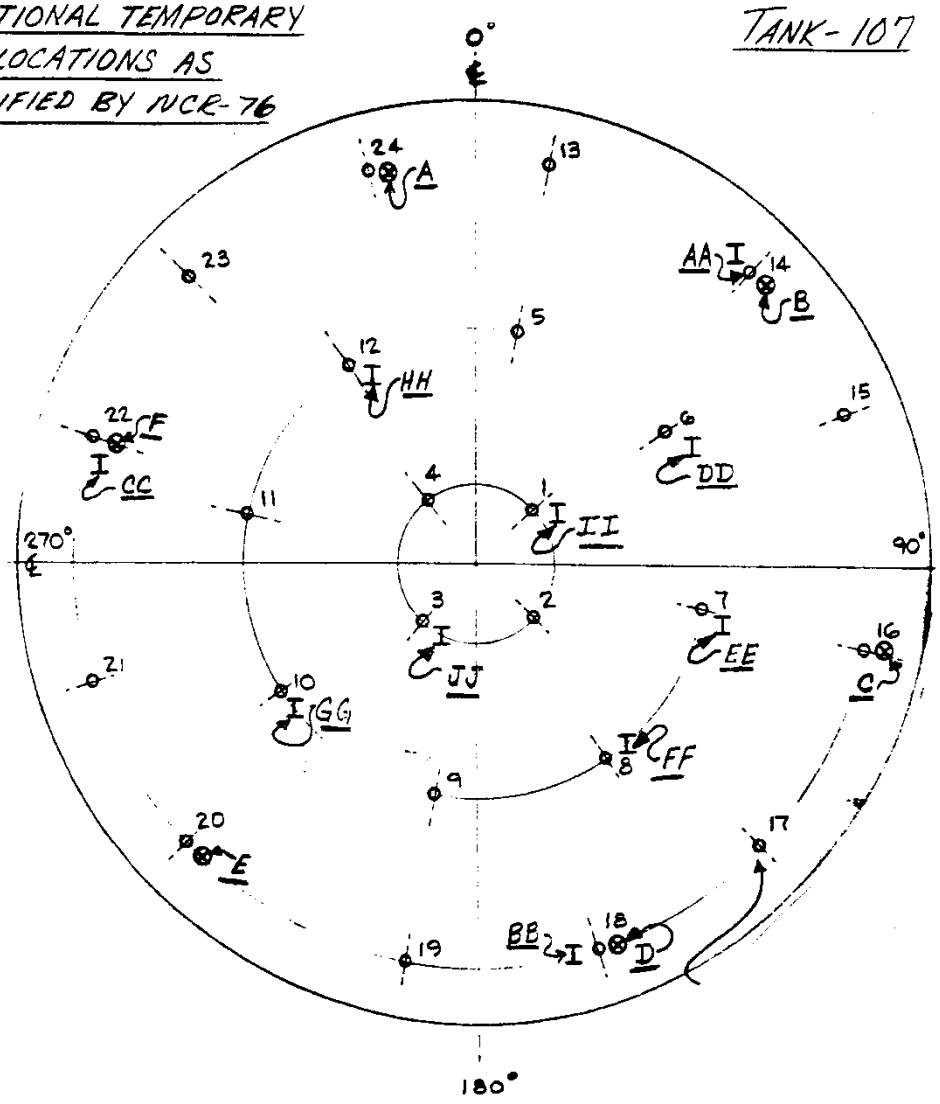
CHART "B"

KAISER ENGINEERS HANFORD | FIELD SKETCH

Attachment To Or Description: PAGE 4 OF 4 NCR B-340-81 | Sheet ____ of ____

ADDITIONAL TEMPORARY T/C LOCATIONS AS SPECIFIED BY NCR-76

TANK-107



REF DWG
H-2-90465

I - TC LOCATION INSIDE PRIMARY TANK - AA, BB, CC, DD, EE, FF, GG, HH, II, JJ

● - TC LOCATION OUTSIDE PRIMARY TANK - A, B, C, D, E, F

KEH-159.2 (4-82)

App. Figure B-12. Nonconformance Report B-340-88

RL-604 (2-80)
(SW-209S9-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241 AP Tank Farm (Phase IV)	B-340-88

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Install 16 temporary bottom thermocouples (10 internal, 6 external) to be used in place of the permanent bottom thermocouples, for stress relief temperature monitoring per NCR-B340-76, NCR-B340-81 and DFC-B340-190.

NONCONFORMANCE DESCRIPTION

Thermocouples CC, GG, HH and JJ failed approximately 4 hours before the beginning of the final soak. This resulted in no temperature monitoring for a fairly large area of the tank bottom. Reference the attachment to this NCR. (TANK 102) MDRobbins

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E M Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*F W Shaffer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
NO	F. W. Shaffer KEH Field Engineering 8/3/84	

(2A) Disposition
- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

(2B) Accept as is.

(2C) The temperature data has been reviewed for the inside and outside temporary thermocouples attached to the primary tank bottom. Before the failure of the four thermocouples the temperature readings were closely grouped with the other temporary TC's covering the similar tank bottom areas. After the loss of the four temporary thermocouples the remaining temporary thermocouples indicated that the primary tank bottom completed a successful stress relief cycle. After studying the temperature versus time thermocouples data of the adjacent thermocouples, it is obvious that area of the tank bottom where the thermocouples were lost also completed a successful stress relief cycle.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. _____
- [ ] Other Specify _____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 8/17/84	Safety 8/17/84	Engr. 8/24/84	AI (ASME)
QA	QA 8-22-84	PE 8-22-84	QA 8/27/84	DOE 8/28/84

(3A)
- [ ] Disposition Effected As Directed, NCR Closed
- [ ] Other (Specify)

F. W. Shaffer — Originator or Representative — 8-29-84 — Date

(4A) List of Documents Affected

(4B) Documents Revised By _____ Date _____

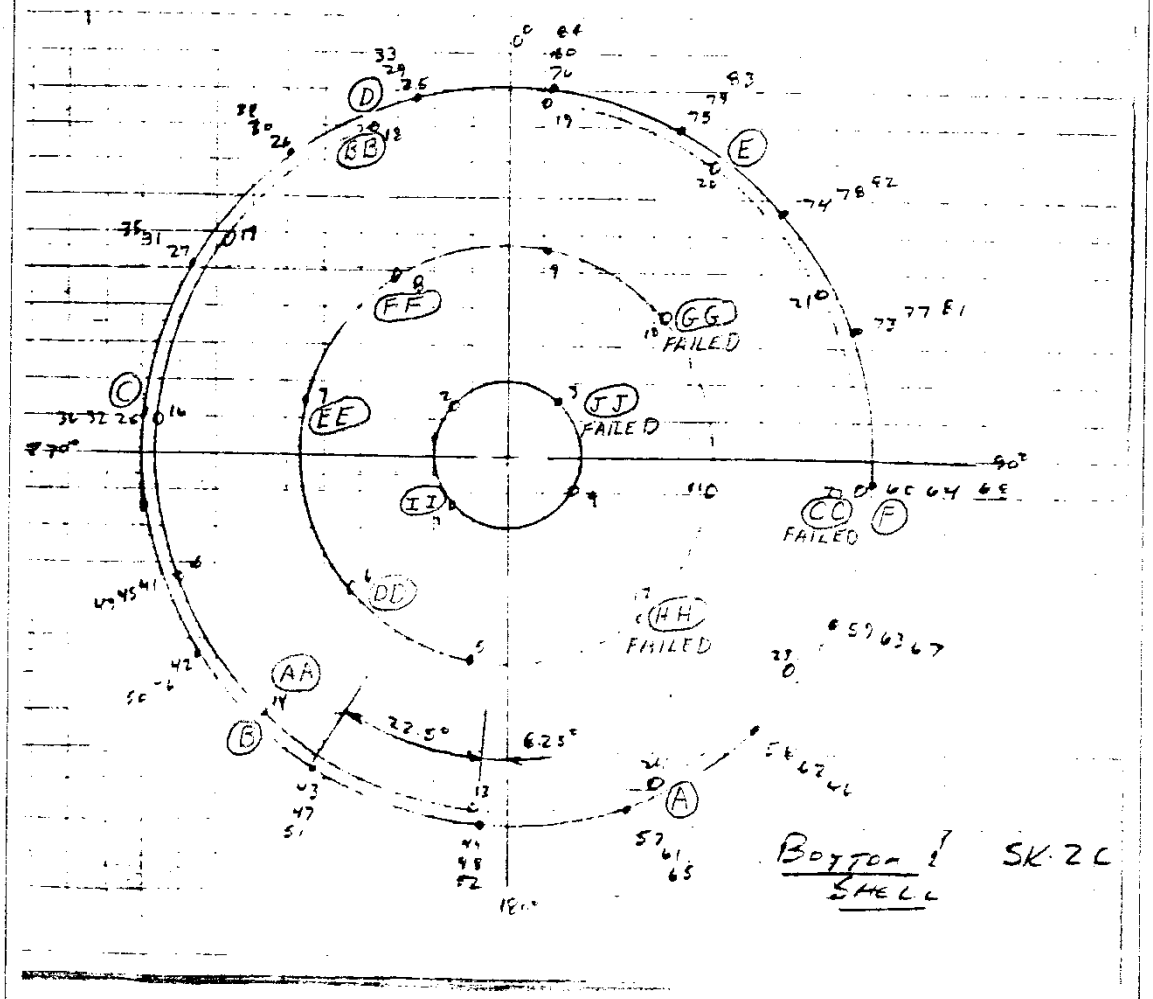
U.S. GOVERNMENT PRINTING OFFICE 1983-695-150/102

KAISER ENGINEERS
HANFORD

FIELD SKETCH

Attachment To Or Description:
NCR# B-340-88

Sheet 2 of 2



KEH-159.2 (4-82)

App. Figure B-13. Nonconformance Report B-340-95

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP Tank Farm

(1C) NCR No.: B-340-95 (1520-61)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev 1, Section 15176 Paragraphs 3.4.2.1 and 3.4.4, establish stress relief temperatures of 1000°F MINIMUM and hold time of one hour per inch of thickness.

NONCONFORMANCE DESCRIPTION

Tank 106: Thermocouples "II" and "JJ" did not meet these requirements.

(1J) Distribution

DOE
*KK Lucas

ROCKWELL
*DL Bjorklund
*RJ Hennig
*E Keollermeier
*CA Rieck

KEH
*FW Shaffer
*DL Brown
RL Hand
RM Iten
*JR Nicholson
*JW Viita
*TL Walton
Central File
*Field Project File (3)

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: F. W. Shaffer 8/30/84 (1)
KEH Field Engineering

(1H) Supervisors Review: MD Robbins

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is. Add five (5) additional temporary thermocouples per the attached sketch for the tanks remaining to be stress relieved.

2C) The temporary thermocouples (II & JJ) located at 7' radius from the tank center, monitored low temperatures throughout the stress relief cycle. During the soak period they did not meet the 1000°F minimum temperature. ASME Section VIII Div 2, Part AF, Table AF-402.2 lists alternative reductions in temperatures versus minimum time at the decreased temperatures. (See Figure 1)

ASME Section VIII Div 2, AF-402.3 states that when welded joints connect parts of different thicknesses, the thickness used in applying the requirements for post-welded heat treatment in AF-402 shall be the thinner of the two adjacent butt-welded plates.

(con't page 2)

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 11-16-84	Safety 11-19-84	Engr. 11/27/84	AI (ASME) -NA-
QA	QA 11-19-84	PE 11-20-84	QA 11/28/84	DOE 11/29/84

(3A)
- [X] Disposition Effected As Directed/ NCR Closed
- [ ] Other (Specify)

F. W. Shaffer — Originator or Representative — 11/29/84 — Date

(4A) List of Documents Affected: NONE

(4B) Documents Revised: By ____ Date ____

GPO 697-905

NCR B-340-95
Page 2

JUSTIFICATION (con't)

The temporary thermocouples (II & JJ) monitored 1/2" plate primary tank bottom temperatures and this thickness shall govern the stress relieving requirements for welds in this area.

A review of the lowest reading thermocouple (II) data indicates the following:

TIME	TEMP
4 hours	900°F +
3 hours	950°F +

Table AF 402.2 allows a 150°F decrease in temperature from the 1100°F specification requirement which yields 950°F minimum temperature and requires a minimum holding time of five (5) hours per inch of metal thickness. For the area that the temporary thermocouples monitored (1/2" thick plate), this translates to 2 1/2 hours at 950°F (150°F decrease below 1100°F), which satisfies the minimum requirements for stress relieving that area of the tank.

It is obvious from studying the stress relief cycles for previous tanks that the primary tank bottom center is the area recording the lowest temperatures and the area that determines the completion of the stress relief cycle. Additional thermocouple instrumentation is required in this area to offer redundancy in case of further thermocouple failure or erratic thermocouple data and adequately monitor the temperature distribution in that area.

NCR B-340-95

TABLE AF-402.2
ALTERNATIVE REQUIREMENTS FOR POSTWELD HEAT TREATMENT OF PRESSURE PARTS AND ATTACHMENTS[1]
Exemptions Provided in the Note Are Not Applicable to Vessels in Lethal Service. See AG-301.1(c)

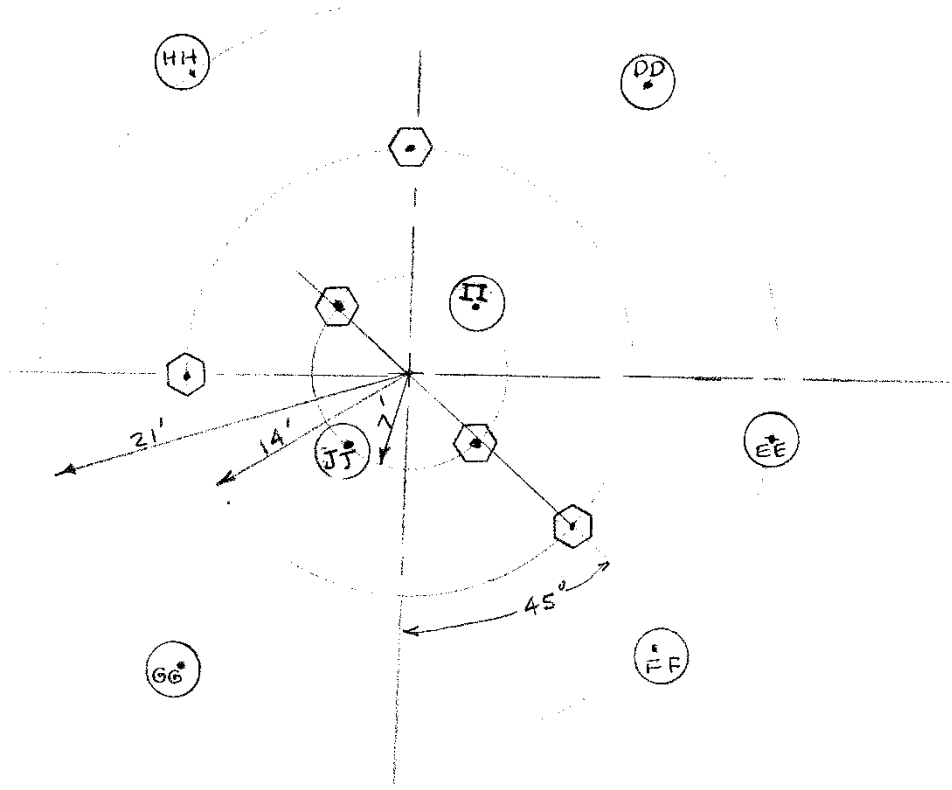
Decrease in Temperature Below Normal Holding Temperature,°F	Minimum Time at Decreased Temperature, hr/in. of thickness
50	2
100	3
150	5
200	10

NOTE:
(1) Postweld heat treatment at lower temperatures for longer periods of time, in accordance with this Table, shall be used only where permitted in Table AF-402.2.

FIGURE 1

ICR-B-340-95
ATTACHMENT #1

PRIMARY TANK BOTTOM
(INSIDE SURFACE)



(HH) - EXISTING TEMPORARY THERMOCOUPLES (DD, EE, FF, GG, HH, II, & JJ)

(·) - PROPOSED TEMPORARY THERMOCOUPLE LOCATIONS

App. Figure B-14. Nonconformance Report B-340-96

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-96 (1520-62)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Paragraph 3.4.2.4: Specifies that the period of heating from 800°F to 1100°F shall not exceed 12 hours. Paragraph 3.4.2.1 permits the stress relief temperatures to be as low as 1000°F.

NONCONFORMANCE DESCRIPTION

At Tank 104, the first recorded temperature of 800°F was recorded at 8:20 p.m. on 9-12-84 and the last thermocouple reached 1000°F at 10:20 a.m. on 9-13-84. Therefore, the specified heatup time was exceeded by 2 hours.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Koellermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*F W Shaffer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date	(1H) Supervisors Review
N/A	F.W. SHAFFER 9-14-84 KEH FIELD ENGINEERING	

(2A) Disposition

- [X] Accept As Is
- [ ] ~~Conditional~~ Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

~~2B) Acceptance of the stress relief is dependent upon the test results of the yield strength coupons for tank 104 and the maintenance of the minimum yield strength requirements.~~

~~2C) The above referenced mechanical test will verify the acceptability of the tank.~~

2B) Accept as is

2C) The minimum requirements for stress relief of the tank have been met. The excessive heat up time could effect the yield strength results which will be addressed at a later time.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. _____
- [ ] Other Specify _____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Resident Engr. 9/20/84	Safety 9-21-84	Engr. 10-16-84	A/ (ASME) -NA-
QA	QA 9-21-84	PE 10-16-84	QA 10-16-84	DOE 10/18/84

(3A)

- [ ] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

F.W. Shaffer — Originator or Representative — 10/24/84 — Date

(4A) List of Documents Affected

(4B) Documents Revised

By _____ Date _____

GPO 697-905

App. Figure B-15. Nonconformance Report B-340-115

97604

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE IV)

(1C) NCR No. (1520-77): B-340-115

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Section 15176-12, Paragraph 3.2.2.2: "Bottoms: Tank bottom tolerances are defined in Figure 15176-1. The tolerances apply to the flat portion of the bottom encircled by the bottom knuckle tangent. The curvature tolerances (RR and CR) apply under all conditions except within three (3) plate thicknesses of welds. The maximum deviation height (H), (peak to valley) is 3 inches. The maximum deviation slope (S) is 3/8 inch/foot regardless of peak height. The perimeter of the deviation may not exhibit any re-entrant radius of curvature smaller than 8.0 inches. Figure 15176-2 gives examples of re-entrant curves.

NONCONFORMANCE DESCRIPTION

Tank N (104) Survey of the primary tank bottom after stress relief showed two areas were out of the 3/8" per foot tolerance. The contractor put dead weight on the two areas. Survey was then performed. The new survey showed the two areas that were out of tolerance were now acceptable. However, an area on BEW4 adjacent to the centering post was then found 1/8" out of tolerance per foot for three feet.

NOTE: This NCR replaces NCR B-340-100

(1J) Distribution

DOE
*K. K. Lucas

ROCKWELL
*D. L. Bjorklund
*R. J. Hennig
*E. Koellermeier
*C. A. Rieck

JAJ
*T. R. Cloud
*W. T. Frisbee

KEH
*E. L. Backer
*D. L. Brown
R. L. Hand
R. M. Iten
*J. R. Nicholson
*J. W. Viita
*T. L. Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date, E. L. Backer 11/15/84 (1) KEH Field Engineering

(1H) Supervisors Review: MD Robbins

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is

2C) The 1/2"/ft slope (3/8" + 1/8") exceeds the specification requirements but falls within the 3/4"/ft limit substantiated in SAM-76-1 report by Battelle Pacific Northwest Laboratory, titled "Analysis of Stresses Due to the Flattening of Bumps in the Bottom and Knuckle Regions of Million Gallon Waste Storage Tanks."

Any repair procedure of the primary tank bottom is not recommended to insure maximum integrity of that boundary be maintained.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design R. M. Bell 11/29/84	Safety D Parthree 11/29/84	Engr. [illegible] 12/3/84	AI (ASME) N/A
QA	QA [illegible] 11-29-84	PE JWS 11-30-84	QA E Lombard 12/4/84	DOE K K Lucas 12/5/84

(3A)
- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

E. L. Backer — Originator or Representative — Date 12/5/84

(4A) List of Documents Affected: NA

(4B) Documents Revised By ____ Date ____

rs GPO 697-905

App. Figure B-16. Nonconformance Report B-340-56

85218

.04 (2-80)
-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP Tank Farm (Phase IV)	B-340-56 (1520-37)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Submittal 1520-17A castable refractory curing procedure - surface protection after set shall be provided as recommended by North American Refractories and as suggested in paragraph 3.3 curing in specification B-340-C4.

Construction Specification B-340-C4, Rev. 0, Section 03341, Paragraph 3.3.1: Provide surface protection during curing to minimize the formation of plastic shrinkage cracks. Curing may be accomplished by moist curing, impervious sheet curing, or by application of liquid chemical or liquid membrane-forming compound (as recommended by the Refractory manufacturer).

NONCONFORMANCE DESCRIPTION

Castable refractory placement at tank bottom C(108) quadrants 2 and 4, 2nd lift, on 2/28/84 was not protected during curing to minimize the formation of plastic shrinkage cracks. Impervious sheet plastic was supported approximately 1 to 3 feet above the refractory placement.

(Continued on Page 2)

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
*D L Brown
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File
Trl-3/241-AP Tk Fm (3)

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
NA	John C. Cummings 4HC KEH Field Engineering 2/29/84	L. Rippy

(2A) Disposition
- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Fill all cracks 1/16" wide or greater to a depth of 3/4" min. with plastic refractory material. Additional precautions should be taken to prevent the formation of plastic shrinkage cracks on future pours.

2C) During stress relief the refractory material will expand and fill a 1/16" crack. The maximum depth of cover over the air pipe is 3/4" per Spec paragraph 3.1.1.3c.

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: 3/1/84	Safety: 3/1/84	Engr.	AI (ASME): N/A
QA	QA: 3-1-84	PE: 3-1-84	QA: 3-7-84	DOE: 3/8/84

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative 3/12/84 Date

(4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-905

Page 2 of 2
NCR #B-340-56 (1520-37)

however, the cover was open on a majority of the perimeter allowing the wind to blow across the refractory placement. Heaters were situated to blow between cover and refractory placement. Excessive plastic shrinkage cracks developed. See attached photos.

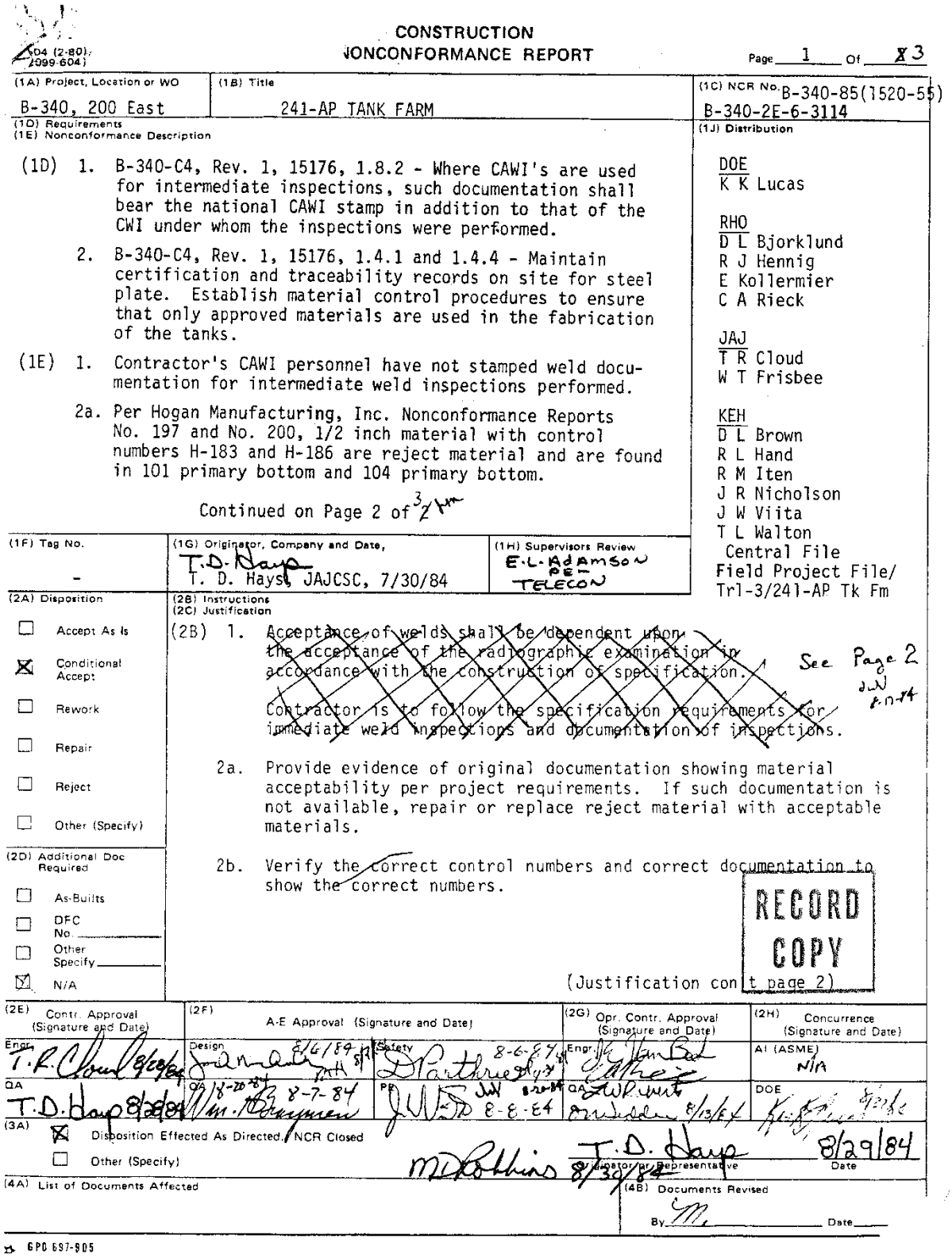
TANK 108, CASTABLE REFRACTORY 2ND LIFT, QUADRANTS #2 & #4
7:30 AM 2-29-84

TANK 108, CASTABLE REFRACTORY, 2ND LIFT QUADS #2 & #4 2-29-84

TANK 108 CASTABLE REFRACTORY 2nd LIFT, QUADRANTS #2 & #4
7:30 AM 2-29-84

TANK 108, CASTABLE REFRACTORY 2ND LIFT, QUADRANTS #2 & #4
7:30 AM 2-29-84

App. Figure B-17. Nonconformance Report B-340-85



CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of X3

(1A) Project, Location or WO: B-340, 200 East
(1B) Title: 241-AP TANK FARM
(1C) NCR No. B-340-85(1520-55)
B-340-2E-6-3114

(1D) Requirements
(1E) Nonconformance Description

(1D) 1. B-340-C4, Rev. 1, 15176, 1.8.2 - Where CAWI's are used for intermediate inspections, such documentation shall bear the national CAWI stamp in addition to that of the CWI under whom the inspections were performed.

2. B-340-C4, Rev. 1, 15176, 1.4.1 and 1.4.4 - Maintain certification and traceability records on site for steel plate. Establish material control procedures to ensure that only approved materials are used in the fabrication of the tanks.

(1E) 1. Contractor's CAWI personnel have not stamped weld documentation for intermediate weld inspections performed.

2a. Per Hogan Manufacturing, Inc. Nonconformance Reports No. 197 and No. 200, 1/2 inch material with control numbers H-183 and H-186 are reject material and are found in 101 primary bottom and 104 primary bottom.

Continued on Page 2 of 3

(1J) Distribution

DOE
K K Lucas

RHO
D L Bjorklund
R J Hennig
E Kollermier
C A Rieck

JAJ
T R Cloud
W T Frisbee

KEH
D L Brown
R L Hand
R M Iten
J R Nicholson
J W Viita
T L Walton
Central File
Field Project File/
Trl-3/241-AP Tk Fm

(1F) Tag No. -

(1G) Originator, Company and Date, T. D. Hays, JAJCSC, 7/30/84

(1H) Supervisors Review E.L. Adamson PER TELECON

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) 1. Acceptance of welds shall be dependent upon the acceptance of the radiographic examination in accordance with the construction of specification.

Contractor is to follow the specification requirements for immediate weld inspections and documentation of inspections.

See Page 2

2a. Provide evidence of original documentation showing material acceptability per project requirements. If such documentation is not available, repair or replace reject material with acceptable materials.

2b. Verify the correct control numbers and correct documentation to show the correct numbers.

(Justification cont page 2)

RECORD COPY

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. T.R. Cloud 8/6/84	Design 8/6/84	Safety 8-6-84	Engr. 8/13/84	AI (ASME) N/A
QA T.D. Hays 8/30/84	QA 8-20-84 / 8-7-84	PE 8-8-84	QA 8/13/84	DOE 8/29/84

(3A)
- ☒ Disposition Effected As Directed, NCR Closed
- ☐ Other (Specify)

M.D. Robbins 8/30/84

Originator or Representative T. D. Hays Date 8/29/84

(4A) List of Documents Affected

(4B) Documents Revised By _____ Date _____

GPO 697-805

NCR No. B-340-2E-6-3114
Page 2 of 3

(1E) NONCONFORMANCE DESCRIPTION (cont.)

2b. Reference Hogan Manufacturing, Inc. Nonconformance Report No. 345. Based on control number verification, the following piece marks have incorrect control numbers indicated on material: 102-B0-11-1G (102 secondary bottom), 201-B0-2B (102 primary bottom), 302-M4-12E (108 primary shell), 503-M1-23A (104 secondary shell), and 503-M1-20G (104 secondary shell).

(2C) JUSTIFICATION

1. The visual inspection requirements have been imposed to minimize the number of rejections and repairs identified by radiographic examination. The radiographic examination will provide the evidence of the weld integrity. See Page 3 JW 7-17-94

2a. Material must meet specification requirements.

2b. Proper documentation is necessary to provide traceability.

2B) REVISED ITEM 1 - INSTRUCTIONS

1. Acceptance of welds shall be dependent upon the acceptance of the radiographic examination in accordance with the construction ~~of~~ specification.

On dome seam welds, contractor is to provide backup documentation (inspection reports or inspection logs for example) on intermediate weld inspections. If documentation cannot be provided, spot radiography shall be performed. Acceptance criteria shall be in accordance with Section VIII, Division 2, ASME Code. Not less than 2% of seam welds shall be examined. The welds to be examined shall be selected to ensure that each individual welder doing the production welding is included. The size of the spot shall be equivalent to the minimum film size allowed in accordance with the C4 specification.

When a spot, radiographed as required, has been examined and the radiograph discloses welding which does not comply with the minimum quality requirements of Section VIII, Div. 2, two additional spots shall be radiographically examined in the same weld unit at locations away from the original spot. The locations of these additional shall be determined by the Government Representative.

If either of the two additional spots examined shows welding which does not comply with the Code requirements, the entire unit of weld represented shall be rejected or, at the Contractor's option, the entire unit of weld represented shall be completely radiographed and defective welding only need be corrected.

(2B) REVISED ITEM 1 (continued)

Contractor is to follow the specification requirements for intermediate weld inspections and documentation of inspections.

(2C) JUSTIFICATION

1. The visual inspection requirements have been imposed to minimize the number of rejections and repairs identified by radiographic examination. The radiographic examination will provide the evidence of the weld integrity.

   On dome seam welds, visual examination is the only examination method required by specification. Visual examination is required on all intermediate weld passes and if the welds are not examined at this point and the weld joint completed, a volumetric type examination (radiography) is required to determine the integrity of the weld joint (particularly the intermediate weld passes).

App. Figure B-18. Letter from Hogan Manufacturing to American Bridge - Plate Laminations

HOGAN MFG., INC.
P. O. BOX 398
ESCALON, CA 95320
Phone (209) 838-7323

IN REFERENCE TO:

AIRMAIL ☐ FIRST CLASS MAIL ☒ INTER-OFFICE ☐

FOR Phil Brooks
American Bridge
P.O. Box 1407
Richland, WA 99352

HOW TO USE THIS BAT/TIMES Time-Saver LETTER TO SAVE TIME.
Type or write your reply in the space below. Then mail the white copy to us and keep the pink copy for your files. You'll save time and effort, and we'll have your answer much faster! Thank you.

MESSAGE

Ref: HMI Job #83-544
AP 241 Tank Farm, HMI Hold Tag 197 & 200

DATE: July 30, 1984

Further review of the subject plates indicated that what was perceived to be laminations were in fact scabs. These scabs were repaired by minor grinding by Hogan Mfg. in lieu of returning to vendor, Kaiser Steel. Pits were acceptable in existing condition.

This was done in an effort to reduce overall costs and shop requirements of subject material. This determination was made after the NCR had been returned from the Project Manager to the Q.C. Department.

BY Phil Tilbury, Sr. Project Manager

REPLY

B-340-85
Item # 22

App. Figure B-19. Nonconformance Report B-340-89

RL-604 (2-80)
(54-2035-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 3

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE IV)

(1C) NCR No.: B-340-89 (1520-58)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Section 15176, Paragraph 3.2.2.3:

The tank dome shall form a smooth convex curve without visible flat spots or reverse curvatures.

NONCONFORMANCE DESCRIPTION

Tank 107: The dome plates at and around risers #5 at 180° and 270° dropped up to 5 inches. (See Attachments #1 and #2)

NOTE: KEH survey was used to plot area around risers.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Kollermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*M D Robbins
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: (1) M.D. ROBBINS 8-9-84 KEH FIELD ENGINEERING MDR

(1H) Supervisors Review

(2A) Disposition
- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [X] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

~~2B) Accept as is~~

~~2C) The two 42" risers and dome plates where the sag has been noted will not affect the structural or functional aspects of the tank.~~

2B) Add additional anchor studs as shown on attached Sketch ES-640-H51-1

2C) The repair will provide an additional margin of safety for reduction of stresses in the weld between the riser and the tank dome plate.

(2D) Additional Doc Required
- [X] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)			(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 8/13/84	Safety 8-14-84		Engr. 9/12/84	AI (ASME)
QA 8-10-84 8-15-84	QA	PE 9-11-84 8-15-84		QA 9/17/84 9/17/84	DOE 9/18/84

(3A)
- [X] Disposition Effected As Directed, NCR Closed
- [ ] Other (Specify)

M D Robbins — Originator or Representative — 9/18/84 Date

(4A) List of Documents Affected: H-2-90534

(4B) Documents Revised By ____ Date ____

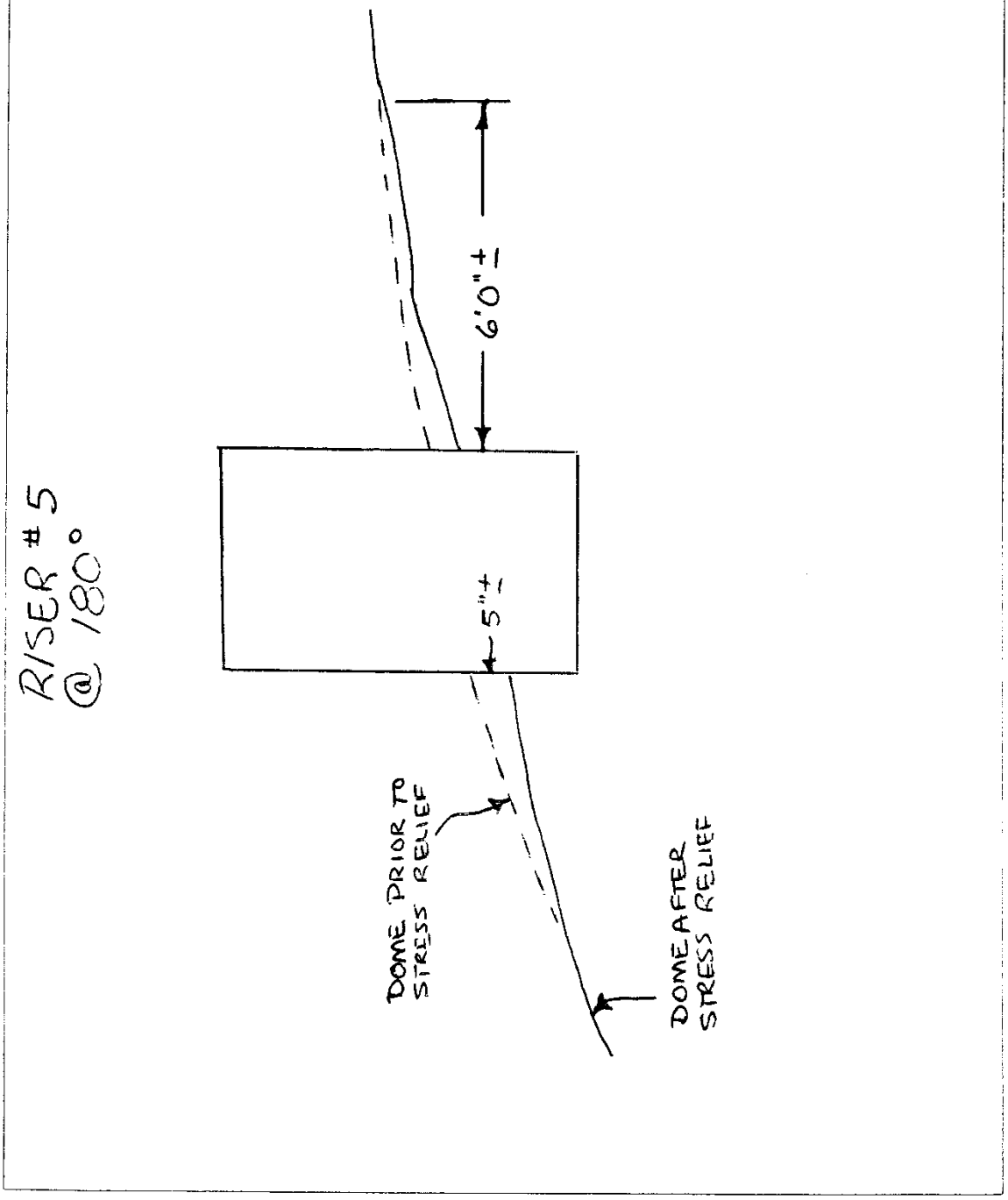
GPO 697-905

KAISER ENGINEERS
HANFORD

FIELD SKETCH

Attachment To Or Description:
ATTACHMENT #1 NCR B-340-89

Sheet: 1 of 1



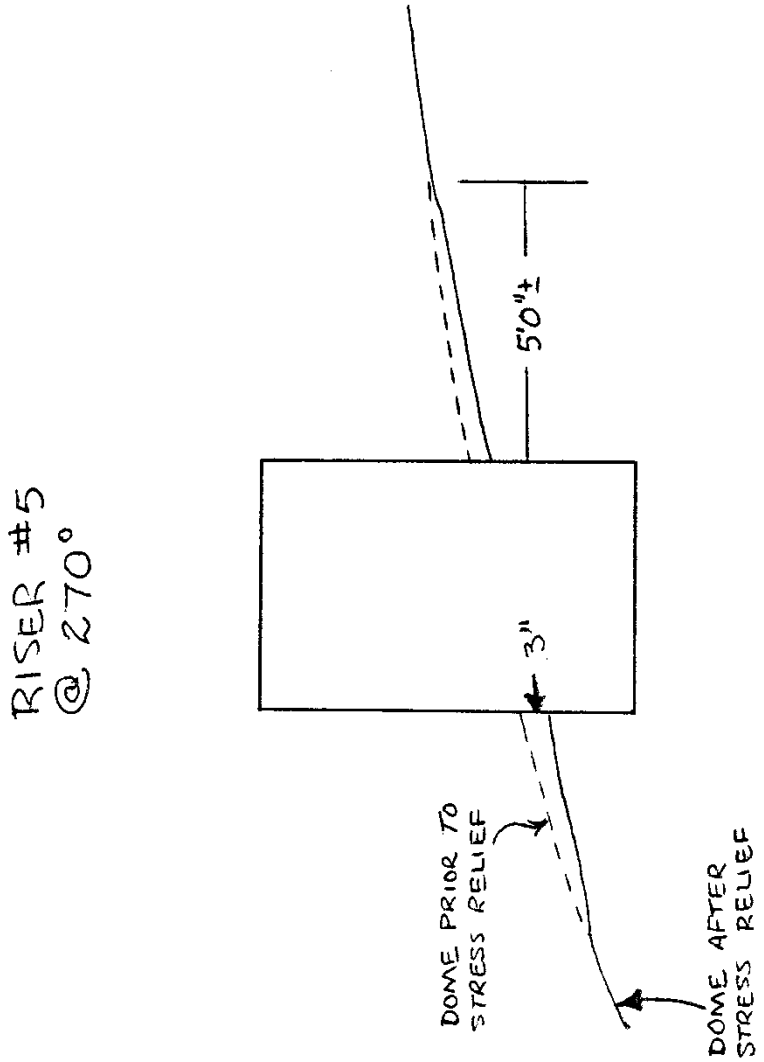
KEH-159.2 (4-82)

KAISER ENGINEERS
HANFORD

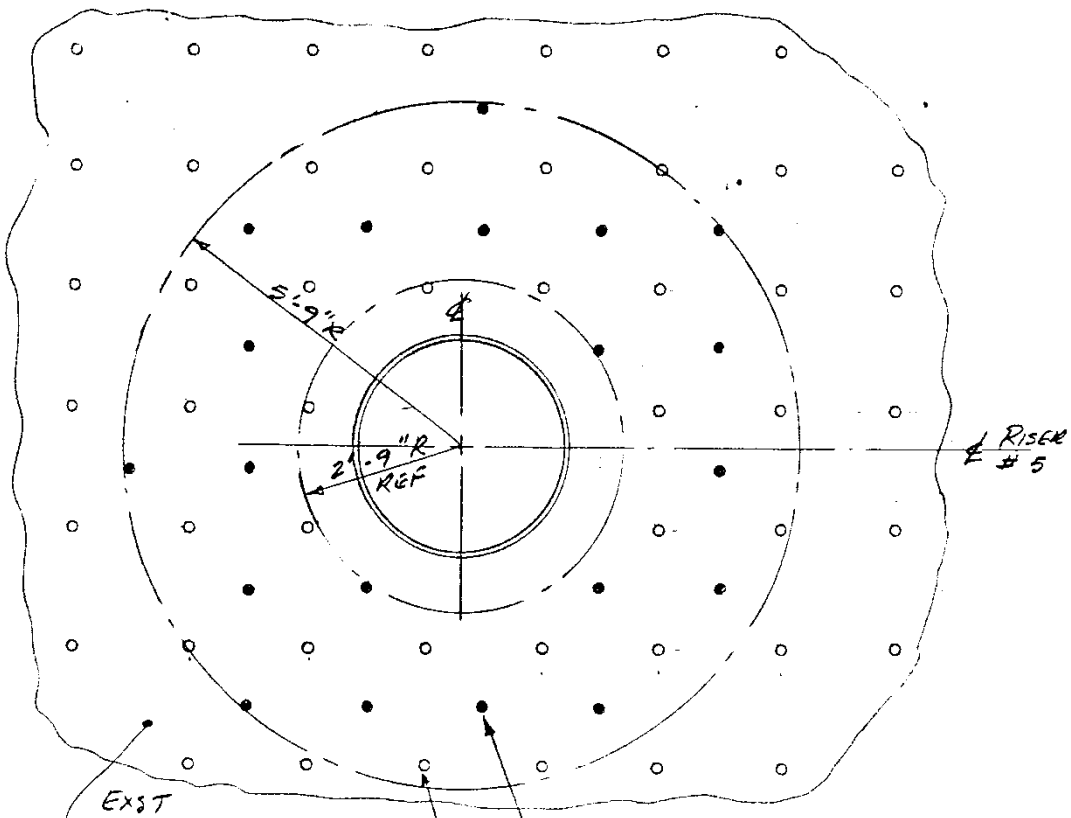
FIELD SKETCH

Attachment To Or Description:
ATTACHMENT #2 NCR B-340-89

Sheet 1 of 1



KEH-159.2 (4-82)



PLAN

NEW ANCHOR STUDS @ 2'-0 o.c.
per Detail (B / H-2-90534)
ALTERNATE:
1/2" x 6" NELSON H4L
Concrete Anchor

EXST ANCHOR STUDS @ 2'-0 o.c.
Ref. Detail (B / H-2-90534)

ES-640-H51-1
NCR-B-340-E9

App. Figure B-20. Nonconformance Report B-340-98

RL-604 (2-80)
34-099-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-98 (1520-64)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Section 15176, Paragraph 3.2.2.3: "The tank dome shall form a smooth convex curve without visible flat spots or reverse curvatures.

NONCONFORMANCE DESCRIPTION

Tank 104: The dome plates at and around Riser #5 at 0° dropped approximately 4 inches in a 4 foot radius; around Riser #5 at 90° they dropped approximately 3 inches in a 4 foot radius; and Risers #12 & #27 at 270° dropped approximately 2 inches in a 3 foot diameter.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Koellermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
~~Central File~~
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	E.L. BACKER 9-20-84 KEH FIELD ENGINEERING	MD Robbins

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Add additional anchor studs at riser #5 as shown on the attached sketch ES-640-H51-3.

Add additional anchor studs at riser #12 and #27 as shown on the attached sketch ES-640-H52-1.

2C) This repair will provide an additional margin of safety for reduction of stresses in the weld between the riser and the tank dome plate.

(2D) Additional Doc Required

- ☒ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☐ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: Jack R. Winslow	Safety: D Parthree 9-24-84	Engr. 9/27/84	AI (ASME) -NA-
QA	QA: Wm. H Baynham 9-24-84	PE: 9-24-84	QA 10/1/84	DOE 10/1/84

(3A)

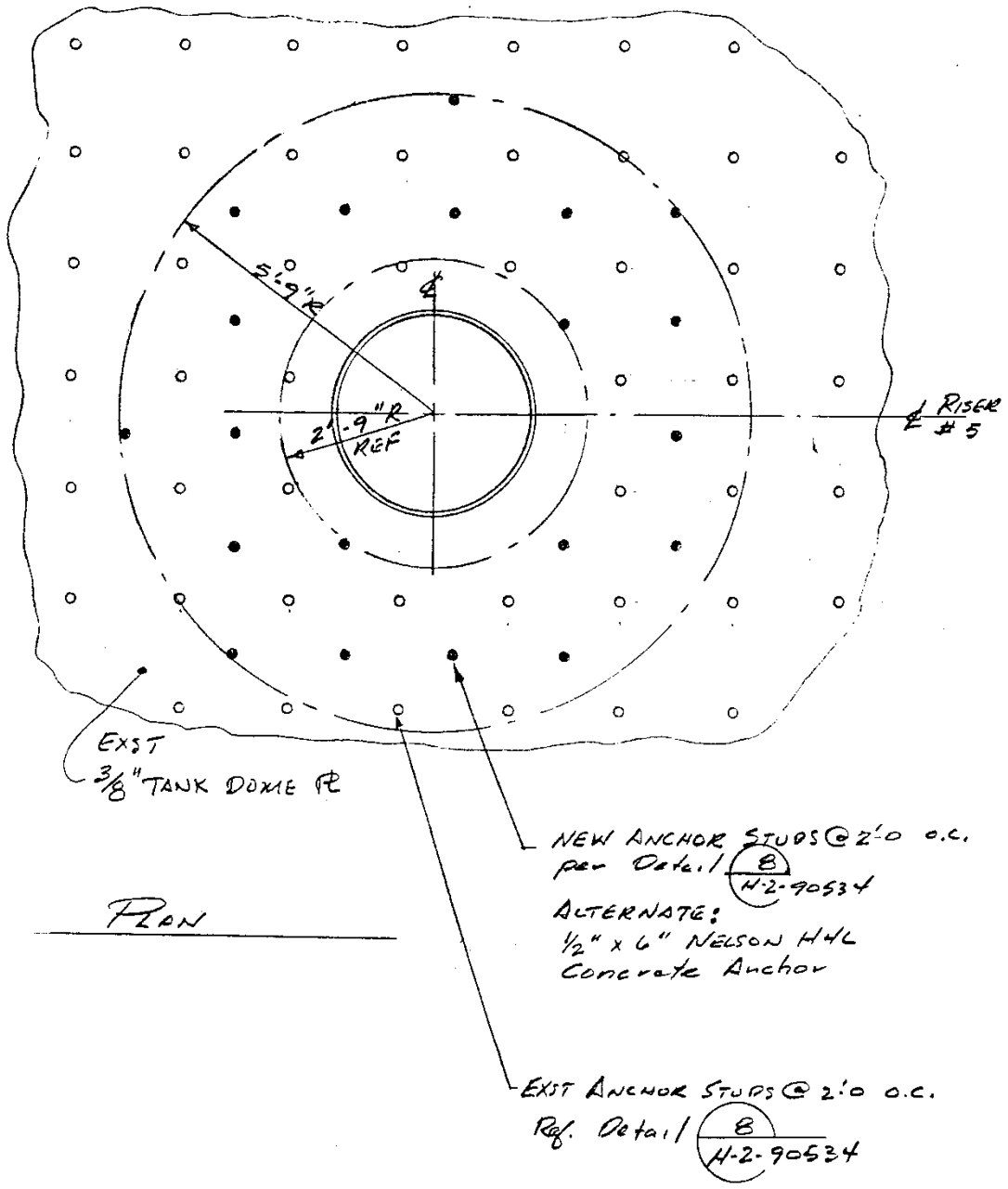
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

C. L. Backer — Originator or Representative — 10/26/84 — Date

(4A) List of Documents Affected

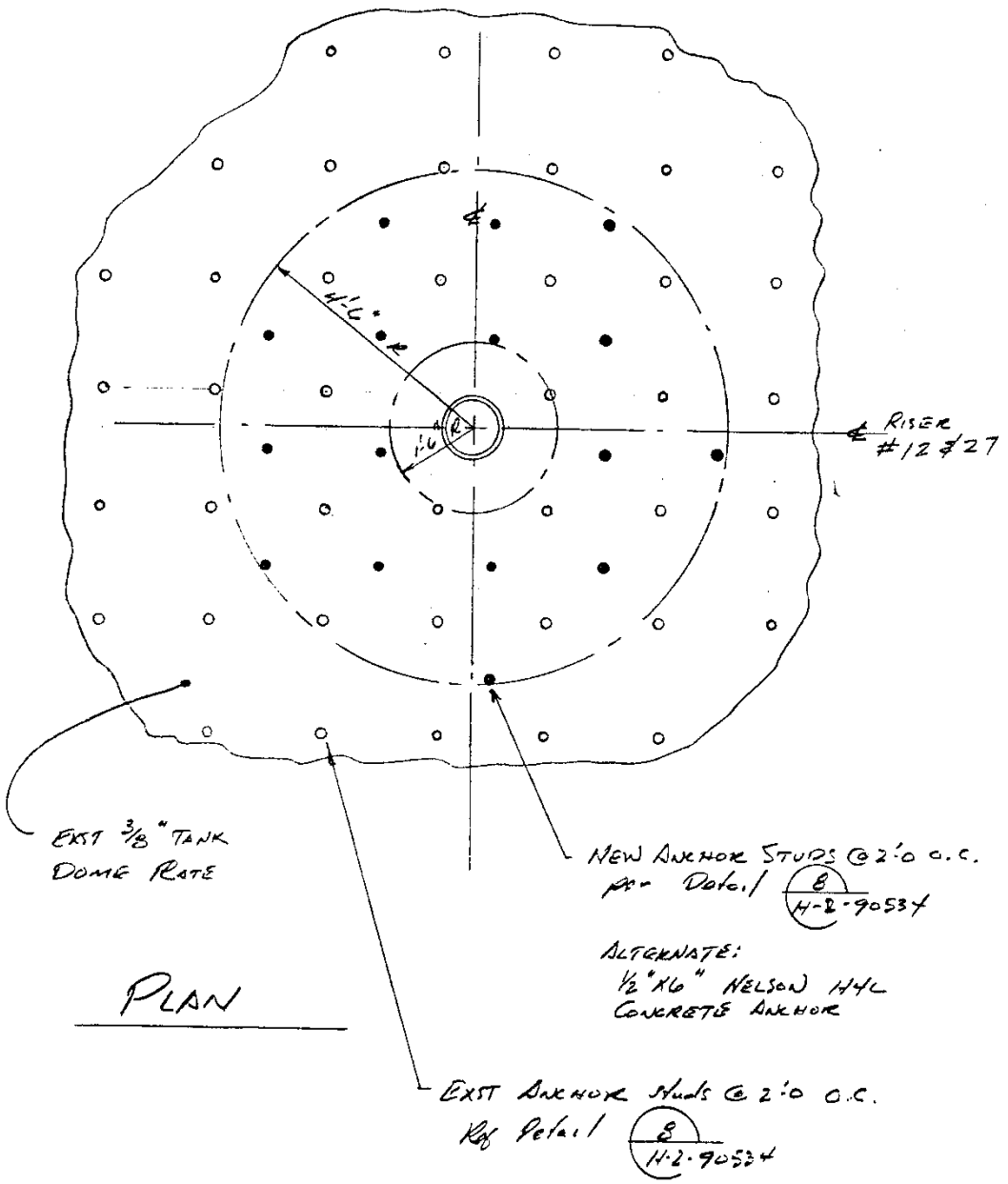
(4B) Documents Revised By ____ Date ____

GPO 697-905



PLAN

ES-640-H51-3



PLAN

ES-640-H52-1

App. Figure B-21. Nonconformance Report B-340-102

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE IV)	B-340-102 (1520-68)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Section 15176, Paragraph 3.2.2.3: The tank dome shall form a smooth convex curve without visible flat spots or reverse curvatures.

NONCONFORMANCE DESCRIPTION

Tank 103: The dome plates at and around Riser #5 at 0° dropped approximately 3" in a 4 foot radius and, at and around Riser #5 at 270° dropped approximately 2" in a 3 foot radius.

(1J) Distribution
DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Koellermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	E.L. BACKER 10-1-84 (1) CELB KEH FIELD ENGINEERING	MDRobbins

(2A) Disposition
- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Add additional anchor studs at riser #5 as shown on the attached sketch ES-640-H51-4

2B) The repair will provide an additional margin of safety for reduction of stresses in the weld between the riser and the tank dome plate.

(2D) Additional Doc Required
- ☒ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☐ N/A

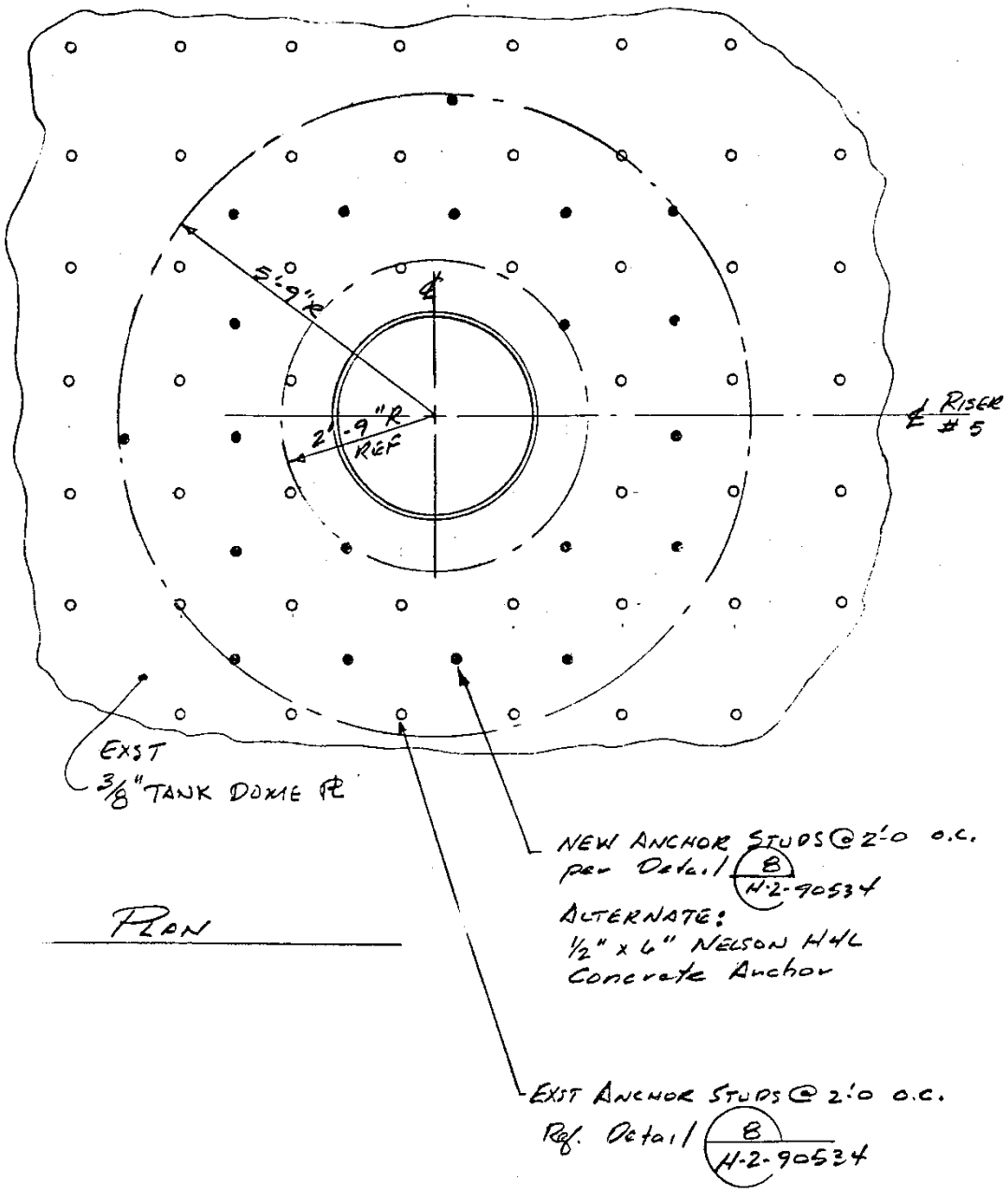
(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 10/2/84	Safety 10-3-84	Engr. 10/9/84	AI (ASME) N/A
QA	10-3-84	PE 10-4-84	QA 10/15/84	DOE 10/16/84

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative — Date 11-12-84

(4A) List of Documents Affected	(4B) Documents Revised
H-2-90534 C.ELB, MDR, TRC, FPF	By ____ Date ____

BPO 697-905



PLAN

ES-640-H51-4
NCR-B-340-102

App. Figure B-22. Nonconformance Report B-340-105

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT 97604

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM. (PHASE IV)	B-340-105 (1520-69)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C4, Rev. 1, Section 15176, Paragraph 3.2.2.3: The tank dome shall form a smooth convex curve without visible flat spots or reverse curvatures.

NONCONFORMANCE DESCRIPTION

Tank 105: The dome plates at and around Riser #5 at 180° and #5 at 270° dropped approximately 3" in a 6 foot radius.

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Koellermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	E.L. BACKER 10-10-84 KEH FIELD ENGINEERING CXB ①	MDRobbins

(2A) Disposition
- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Add additional anchor studs at riser #5 as shown on the attached Sketch ES-640-H51-5.

2C) The repair will provide an additional margin of safety for reduction of stresses in the weld between the riser and the tank dome plate.

(2D) Additional Doc Required
- ☒ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☐ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 10/12/84	Safety 10/12/84	Engr. 10/16/84	AI (ASME) — NA —
QA	PE 10-12-84		QA 10/17/84	DOE 10/18/84

(3A)
- ☒ Disposition Effected As Directed / NCR Closed
- ☐ Other (Specify)

Originator or Representative 10-31-84 Date

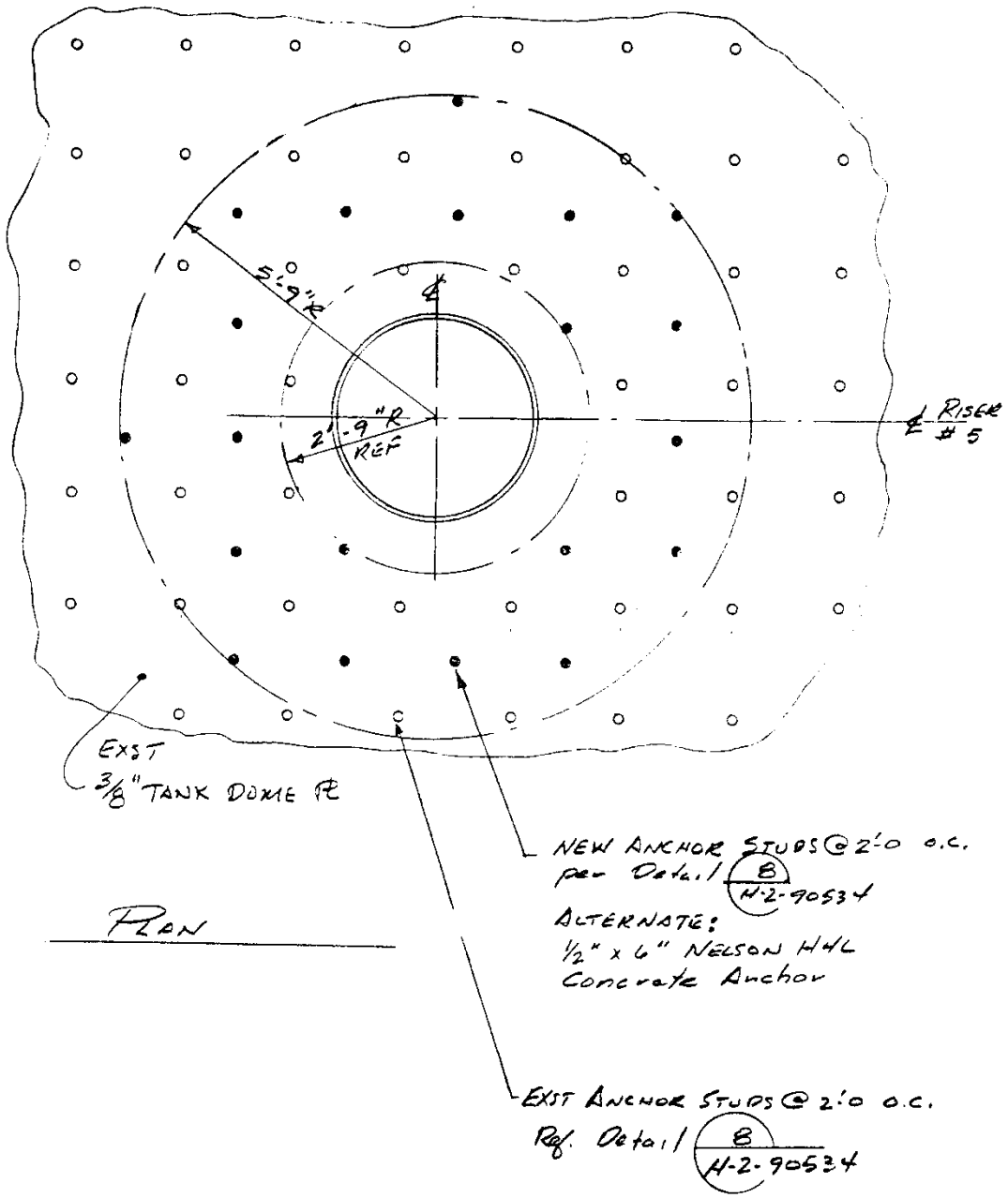
(4A) List of Documents Affected

H-2-90534

(4B) Documents Revised

By _____ Date _____

☼ GPO 697-805



PLAN

ES-640-H51-5
NCR-B-340-105

App. Figure B-23. Nonconformance Report B-340-13

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE III)	B-340-13 (1520-3)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.1.1 - "Install formwork in accordance with ACI-301, Section 4.2."

ACI-301-72 (Revised 1975) Section 4.2 - The formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in Chapter 1, Design, of "Recommended Practice for Concrete Formwork" ACI-347.

NONCONFORMANCE DESCRIPTION

Perimeter formwork installed for Tank Foundation "D" (102) did not withstand the lateral loading. Inadequate form braces gave way during concrete placement. See Attachment #1 for location.

(1J) Distribution

DOE
*G S Rokkan

RHO
*J D Galbraith
*R J Hennig

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
R M Iten
*J Morgan
*J W Viita
*T L Walton
Central File
*Official File/
Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date	(1H) Supervisors Review
N/A	J.D. CUMMINGS 8-10-83 KEH FIELD ENGINEERING	

(2A) Disposition

- [X] Accept As is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

(2B) The contractor shall outline how he plans to correct the formwork failure problem and specify his plan for adhering to the contract specifications as referenced above and attached prior to placement of the next foundation.

(2C) Slippage of forms did not effect the structural integrity of the slab.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. _____
- [ ] Other Specify _____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design DJ Lien 8/14/83	Safety K.H. Dennis	Engr.	AI (ASME) NA
QA	QA Wm. Brayman 8-17-83	PE J.W. Viita 8-18-83	QA	DOE G.S. Rokkan 8/19/83

(3A)

- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

J.D. Cummings 8/22/83
Originator or Representative — Date

(4A) List of Documents Affected

(4B) Documents Revised

By _____ Date _____

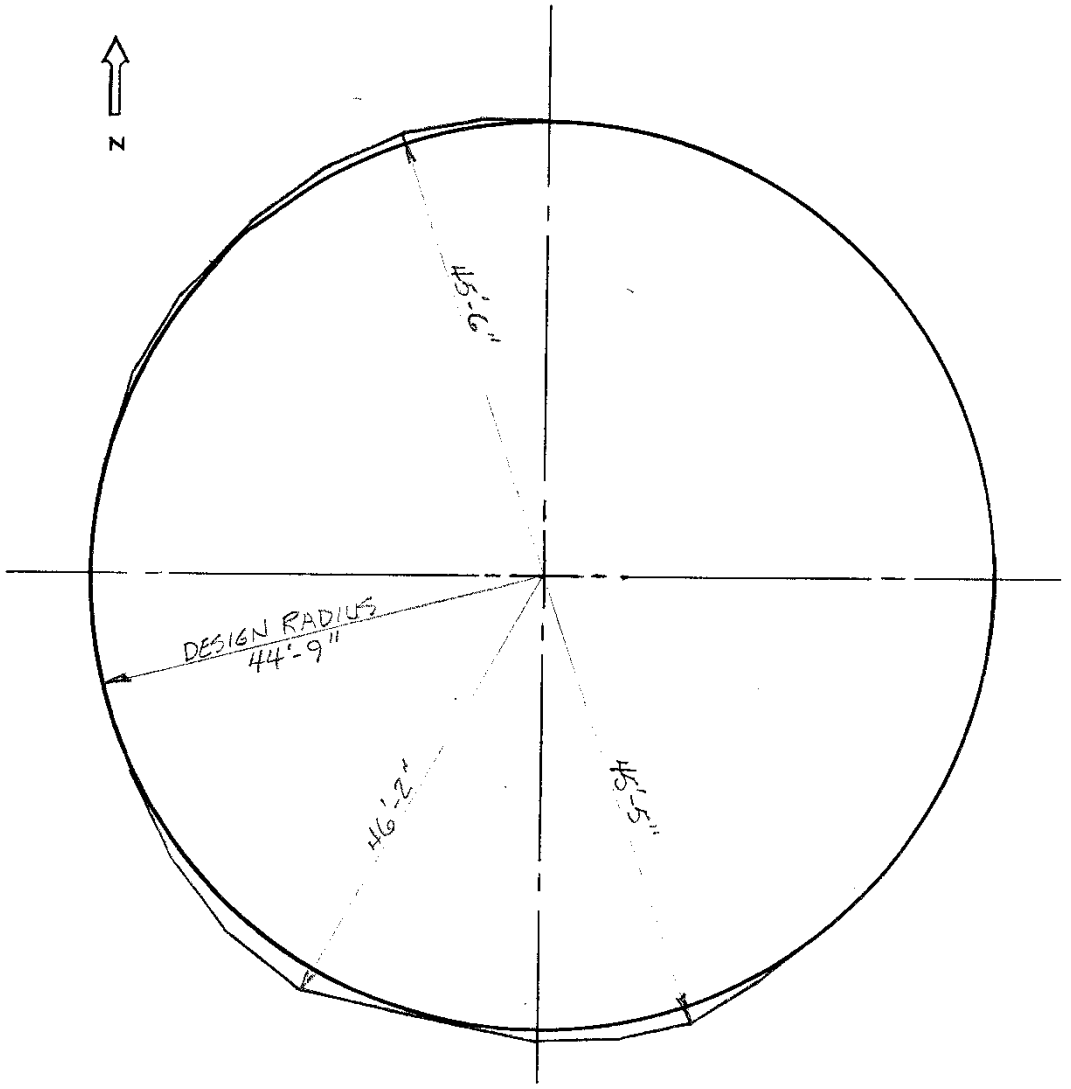
H GPO 697-905

KAISER ENGINEERS HANFORD

FIELD SKETCH

Attachment To Or Description:
NCR B-340-13 ATTACHMENT #1

Sheet ____ of ____



TANK 102 FOUNDATION
N.T.S.

KEH-159.2 (4-82)

TABLE 3.8.5.1b—MINIMUM CEMENT REQUIREMENTS FOR CONCRETE USED IN FLOORS

Maximum size of aggregate, in.	Cement, lb per cu yd
1½	470
1	520
3/4	540
1/2	590
3/8	610

to be capable of being finished to the satisfaction of the architect/engineer at a slump not exceeding that given in Table 3.8.5.1a.

Notes

In the sections of Chapter 3 listed below, specific approval is required:

3.6 To waive limitations on maximum aggregate size.

3.7.2 Of protective measures which will permit waiving the limitation on chloride ion content.

3.8.2.2 For mixture proportions.

CHAPTER 4—FORMWORK

4.1—General*

4.1.1—Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall have sufficient rigidity to maintain specified tolerances.

4.1.2—Additional formwork requirements for concrete are described in Chapter 10, Finishing of Formed Surfaces; Chapter 11, Slabs; Chapter 13, Architectural Concrete; and Chapter 15, Prestressed Concrete.

4.1.3—Earth cuts shall not be used as forms for vertical surfaces unless required or permitted.

4.1.4—Shop drawings for formwork including the location of shoring and reshoring shall be submitted for approval as required by the contract documents.

4.2—Design and installation of formwork

4.2.1—The design and engineering of the formwork, as well as its construction, shall be the responsibility of the contractor.

4.2.2—The formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in Chapter 1, Design, of "Recommended Practice for Concrete Formwork" (ACI 347) and for design considerations, wind loads, allowable stresses, and other applicable requirements of the controlling local building code.

* Detailed recommendations are given in "Recommended Practice for Concrete Formwork" (ACI 347).

4.2.3—Requirements for facing materials are given in Chapter 10, Finishing of Formed Surfaces. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

4.2.4—Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfer strips shall be placed in the corners of forms to produce beveled edges on permanently exposed surfaces. Interior corners on such surfaces and the edges of formed joints will not require beveling unless required by the contract documents.

4.2.5—To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete.

4.2.6—Positive means of adjustment (wedges or jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Forms shall be securely braced against lateral deflections.

4.2.7—Temporary openings shall be provided at the base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.

4.2.8—Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a commercially manufactured type. Nonfabricated wire shall not be used.

Form ties shall be constructed so that the ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete.

After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 diameters or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view except that in no case shall this distance be less than ¾ in. When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.

4.2.9—At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1 in. The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.

4.2.10—Wood forms for wall openings shall be constructed to facilitate loosening, if necessary, to counteract swelling of the forms.

4.2.11—Wedges used for final adjustment of the forms prior to concrete placement shall be fastened in position after the final check.

4.2.12—Formwork shall be so anchored to shores or other supporting surfaces or members that

TABLE 4.3.1—TOLERANCES FOR FORMED SURFACES

1. Variation from plumb:	
A. In the lines and surfaces of columns, piers, walls, and in arrises:	
In any 10 ft of length	1/4 in.
Maximum for the entire length	1 in.
B. For exposed corner columns, control-joint grooves, and other conspicuous lines:	
In any 20 ft length	1/4 in.
Maximum for the entire length	1/2 in.
2. Variation from the level or from the grades specified in the contract documents:	
A. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores	
In any 10 ft of length	1/4 in.
In any bay or in any 20 ft length	3/8 in.
Maximum for the entire length	3/4 in.
B. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:	
In any bay or in 20 ft length	1/4 in.
Maximum for the entire length	1/2 in.
3. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:	
In any bay	1/2 in.
In any 20 ft of length	1/2 in.
Maximum for the entire length	1 in.
4. Variation in the sizes and location of sleeves, floor openings, and wall openings	±1/4 in.
5. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:	
Minus	1/4 in.
Plus	1/2 in.
6. Footings*	
A. Variations in dimensions in plan:	
Minus	1/2 in.
Plus	2 in.
B. Misplacement or eccentricity:	
2 percent of the footing width in the direction of misplacement but not more than	2 in.
C. Thickness:	
Decrease in specified thickness	5 percent
Increase in specified thickness	No limit
7. Variation in steps:	
A. In a flight of stairs:	
Rise	±1/8 in
Tread	±1/4 in.
B. In consecutive steps:	
Rise	±1/16 in.
Tread	±1/8 in.

* Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

upward or lateral movement of any part of the formwork system during concrete placement will be prevented.

4.2.13—Runways for moving equipment shall be provided with struts or legs and shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

4.3—Tolerances

4.3.1—Unless otherwise specified by the architect/engineer, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in Table 4.3.1.

4.3.2—The contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project sufficient control points and bench marks to be used for reference purposes to check tolerances.

4.3.3—Regardless of the tolerances listed in Table 4.3.1, no portion of the building shall extend beyond the legal boundary of the project.

4.3.4—Permissible variations from plumb and designated building lines for portions of buildings more than 100 ft above the ground shall be as specified in the contract documents.

4.4—Preparation of form surfaces

4.4.1—All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed in them.

4.4.2—Unless otherwise specified or approved, surfaces of forms shall be treated as follows:

4.4.2.1 Before placing of either the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an approved coating material that will effectively prevent absorption of moisture and prevent bond with the concrete, and will not stain the concrete surfaces. A field

measurement after initial set and before decentering

(g) Special requirements for post-tensioned concrete members. The effect of load transfer during tensioning of post-tensioned members may be critical, and the contractor should be advised of any special provisions that must be made in the formwork for this condition

(h) If camber is desired for slab soffits or structural members to compensate for elastic deflection and/or deflection due to creep of the concrete, the contract drawings must so indicate and state the amounts. Measurement of camber attained should be made after initial set and before removal of formwork supports

(i) Where chamfers are required on beam soffits or column corners, they should be specified

(j) The contract documents of the engineer/architect must cover in detail any requirements for inserts, waterstops, built-in frames for openings, holes through concrete, and similar requirements were work of other trades will be attached to, supported by, or passed through formwork

(k) Where architectural features, embedded items, or the work of other trades could change the location of structural members such as joists in one-way or two-way joist systems such changes or conditions should be coordinated by the engineer/architect

(l) The ACI Building Code (ACI 318) requirement that structural drawings show the live load used in the design.

CHAPTER 2—DESIGN

2.1—General

2.1.1 *Planning*—Any form regardless of size should be planned in every particular prior to its construction. The amount of planning required will depend on the size, complexity, and importance (considering reuses) of the form. A design analysis should be made for all formwork. Stability and buckling should be investigated in all cases.

2.1.2 *Formwork drawings*—Before constructing forms, the contractor, if required, will submit detailed drawings and/or design calculations of proposed formwork for review and/or approval by the engineer/architect or approving agency. If such drawings are not in conformity with contract documents as determined by the engineer/architect or approving agency, the contractor will make such changes as may be required prior to start of work.

The review and/or approval of the formwork drawings in no way relieves the contractor of his responsibility for adequately constructing and maintaining the forms so that they will function properly. Such review and/or approval indicates that the assumed design loadings in combination with design stresses shown; proposed construction methods; placement rates, equipment, and sequences; the proposed form materials; and the overall scheme of formwork are deemed capable of producing the desired concrete in an acceptable manner. All major design values and loading conditions should be shown on formwork drawings. These include assumed values of live load; rate of placement, temperature, height and drop of [illegible] which may be operated on formwork; foundation pressure; design stresses; camber diagrams; and other pertinent information, if applicable.

In addition to specifying types of materials, sizes, lengths, and connection details, formwork drawings should provide for applicable details such as:

(a) Procedures, sequence, and timing for removal of forms, shores, and reshores, if this is critical

(b) Design allowance for construction loads on new slabs should be shown when such allowance will affect the development of shoring and/or reshoring schemes (see Sections 2.5.3 and 3.7 for shoring and reshoring of multistory structures)

(c) Anchors, form ties, shores, and braces

(d) Field adjustment of form during placing of concrete

(e) Waterstops, keyways, and inserts

(f) Working scaffolds and runways

(g) Weepholes or vibrator holes where required

(h) Screeds and grade strips

(i) Crush plates or wrecking plates where stripping may damage concrete

(j) Removal of spreaders or temporary blocking

(k) Cleanout holes and inspection openings

(l) Construction joints, control joints, and expansion joints to conform to design drawings [ACI Building Code (ACI 318)]

(m) Sequence of concrete placement and minimum elapsed time between adjacent placement

(n) Chamfer strips or grade strips for exposed corners and construction joints

(o) Camber (see Sections 2.5.1 and 2.5.2)

(p) Mudsills or other foundation provisions for formwork

(q) Special provisions such as safety, fire, drainage, and protection from ice and debris at water crossings

(r) Formwork coatings

(s) Notes to formwork erector for conduits and pipes embedded in concrete according to ACI Building Code (ACI 318)

(t) Temporary openings or attachments for climbing crane or other material handling equipment

2.1.3 *Design and erection*—Formwork should be designed so that concrete slabs, walls, and other members will be of correct dimensions, shape, alignment, elevation, and position. Formwork should also be designed, erected, supported, braced, and maintained so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Vertical and lateral loads must be carried to the ground by the formwork system or by the in-place construction that has adequate strength for that purpose.

2.2—Loads

2.2.1 *Vertical loads*—Vertical loads consist of dead load and live load. The weight of formwork plus the weight of freshly placed concrete is dead load. The live load includes the weight of workmen, equipment, material storage, runways, and impact.

Vertical loads assumed for shoring and reshoring design for multistory construction must include all loads transmitted from the floors above as dictated by the proposed construction schedule. Refer to Section 2.5, Shores.

Vertical supports and horizontal framing should be designed for a minimum live load of 50 psf of horizontal projection. When motorized carts are used the minimum live load should be 75 psf.

The minimum design load for combined dead and live loads should be 100 psf, or 125 psf if motorized carts are used.

2.2.2 *Lateral pressure of concrete*—For concrete made with Type I cement weighing 150 lb per cu ft, containing no pozzolans or admixtures, having slump 4 in. or less, and normal internal vibration, formwork should be designed for a lateral pressure of fresh concrete as follows, where

p = lateral pressure, psf
R = rate of placement, ft per hr
T = temperature of concrete in the forms, deg F
h = height of fresh concrete above point considered, ft

(a) For columns:

$$p = 150 + 9000\,R/T$$

(maximum of 3000 psf or 150h, whichever is least)

(b) For walls, rate of placement not exceeding 7 ft per hr

$$p = 150 + 9000R/T$$

(maximum of 2000 psf or 150h, whichever is least)

(c) For walls, rate of placement 7 to 10 ft per hr

$$p = 150 + 43{,}400/T + 2800\,R/T$$

(maximum of 2000 psf or 150h, whichever is least)

(d) For walls, rate of placement greater than 10 ft per hr

$$p = 150h$$

(e) Where retarding admixtures are employed, an effective value of temperature less than that of the concrete in the forms should be used in the above formulas. Refer to specific admixture manufacturer's recommendations.

(f) Appropriate adjustment for lateral pressures should be made when using concretes weighing other than 150 lb per cu ft; containing pozzolans, admixtures, or cements other than Type I; or external vibration of forms.[1-3]

(g) For slipform lateral pressures, see Section 6.3.2.3.

2.2.3 *Horizontal loads*—Braces and shores should be designed to resist all foreseeable horizontal loads such as wind, cable tensions, inclined supports, dumping of concrete, and starting and stopping of equipment. Wind loads on enclosures or other wind breaks attached to the formwork should be considered in addition to those loads mentioned above.

2.2.3.1 For building construction, in no case should the assumed value of horizontal load due to wind, dumping of concrete, and equipment acting in any direction at each floor line be less than 100 lb per lineal ft of floor edge or 2 percent of total dead load on the form distributed as a uniform load per lineal foot of slab edge, whichever is greater.

2.2.3.2 Wall forms should be designed to meet wind load requirements of the local building code. The minimum wind design load should be 15 psf, unless local codes specifically permit less. Bracing for wall forms should be designed for a horizontal load of at least 100 lb per lineal ft of wall, applied at the top.

2.2.3.3 Wall forms of unusual height or exposure should be given special consideration.

2.2.4 *Special loads*—The formwork should be designed for any special conditions of construction likely to occur, such as unsymmetrical placement of concrete, impact of machine-

delivered concrete, uplift, concentrated loads of reinforcement, and storage of construction materials. Form designers should be alert to provide for special loading conditions, such as walls constructed over spans of slabs or beams which exert a different loading pattern before hardening of concrete than that for which the supporting structure is designed.

Imposition of any construction loads on the partially completed structure should not be allowed except with the approval of the engineer or architect. See Section 3.8 for special conditions pertaining to multistory work.

2.3—Unit stresses

Unit stresses for use in the design of formwork, exclusive of accessories, are given in the applicable codes or specifications listed in Chapter 4. When fabricated formwork, shoring, or scaffolding units are used, manufacturer's recommendations for allowable loads may be followed if supported by test reports or successful experience records; for formwork materials which will experience substantial reuse, reduced values may be required. For formwork materials with limited reuse, allowable stresses specified in the appropriate design codes or specifications for temporary structures or for temporary loads on permanent structures may be used. Where there will be a considerable number of formwork reuses or where formwork is fabricated from materials such as steel, aluminum, or magnesium, it is recommended that the formwork be designed as a permanent structure carrying permanent loads.

2.4—Safety factors for accessories

Table 2.4 shows recommended minimum factors of safety for formwork accessories such as form ties, form anchors, and form hangers. In selecting these accessories the formwork designer should be certain that materials furnished for the job meet these minimum ultimate strength safety requirements.

2.5—Shores

2.5.1 *General*—Shores are defined as vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above. When patented shores, patented splices in shoring, or patented methods of shoring are used, manufacturer's recommendations as to load-carrying capacities may be followed but only if supported by test reports of a qualified and recognized testing agency. The formwork designer must carefully follow the manufacturer's recommendations as to bracing and working loads for unsupported shore lengths.

2.5.2 *Splices*—Field-constructed butt or lap

TABLE 2.4—MINIMUM SAFETY FACTORS OF FORMWORK ACCESSORIES*

Accessory	Safety factor	Type of construction
Form tie	1.5	Light formwork, 8 ft or less in height with no hazard to life
	2.0	All formwork over 8 ft in height or hazardous to life. Formwork for architectural concrete
Form anchor	2.0	Formwork supporting form weight and concrete pressures only
	3.0	Formwork supporting weight of forms, concrete, construction live loads, and impact
Form hangers	2.0	All applications
Anchoring inserts used as form ties	2.0	Precast concrete panels when used as formwork

*Safety factors are based on ultimate strength of accessory.

unless they are made using fabricated hardware devices of demonstrated strength and stability. If plywood or lumber splices are made for timber shoring, they should be designed against buckling and bending as for any other structural compression member.

2.5.3 *Multistory structures*—Shores should be designed to carry the full weight of the concrete and formwork and construction loads of all floors above them prior to the removal of the first story of shores supported by the ground. No shoring should be removed until the concrete has gained sufficient strength to support the loads which will be transferred to the structure upon removal of such shoring.

Once the first floor of shores supported by the ground has been removed, shores and reshores must be designed to carry all loads transmitted from the slabs above. Shores in no case should be designed to carry less than one and one-half times the weight of a given floor of concrete, formwork and construction loads.[2-1,2-2] In determining the number of floors to be shored or reshored, the factors to be considered should include but not necessarily be limited to the following:

1. Design load capacity of the slab or member including live load, partition loads, and other loads for which the engineer designed the slab. Where the engineer included allowances for construction loads, such values should be shown on the structural drawings
2. Dead load weight of the concrete and formwork
3. Construction live loads, such as placing crews

App. Figure B-24. Nonconformance Report B-340-14

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE III)	B-340-14 (1520-4)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.3.3 - "Place concrete in accordance with ACI-301, Sections 8.1, 8.2 and 8.3".

ACI-301-72 (Revised 1975) Section 8.3 - Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section . . . Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic.

NONCONFORMANCE DESCRIPTION

A layer of concrete placed in the North side of Tank "D" (102) foundation hardened to the point it was not plastic prior to placing the subsequent layer. See Attachment #1 for approximate location.

(1J) Distribution

DOE
*G S Rokkan

RHO
*J D Galbraith
*R J Hennig

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
R M Iten
*J Morgan
*J W Viita
*T L Walton
Central File
*Official File/
Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date, &	(1H) Supervisors Review
N/A	J.D. CUMMINGS 8-10-83 KEH FIELD ENGINEERING	

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☒ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) Core drill slab with 4"Ø bit to a depth of 16" for 2'-0 thick slab and 24" for 2'-8" thick slab at locations determined in field and referenced on attachment #1 (but not limited to number of cores shown).

(2C) 1. To determine:
   a. If cold joint exists
   b. Extent of cold joint
   c. depth of cold joint
2. Evaluation of cores will determine disposition of this NCR.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. _____
- ☒ Other Specify NCR B-340-24
- ☐ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 8/17/83 D D Luen	Safety 8/17/83 R. H. Dennis	Engr. 8/17/83	AI (ASME) NA
QA	QA 8-17-83 Wm. Braymen	PE 8-18-83	QA 8-18-83	DOE 8/19/83

(3A)

- ☐ Disposition Effected As Directed, NCR Closed
- ☒ Other (Specify) REF. NCR B-340-24

Originator or Representative 9/7/83 Date

(4A) List of Documents Affected

(4B) Documents Revised

By _____ Date _____

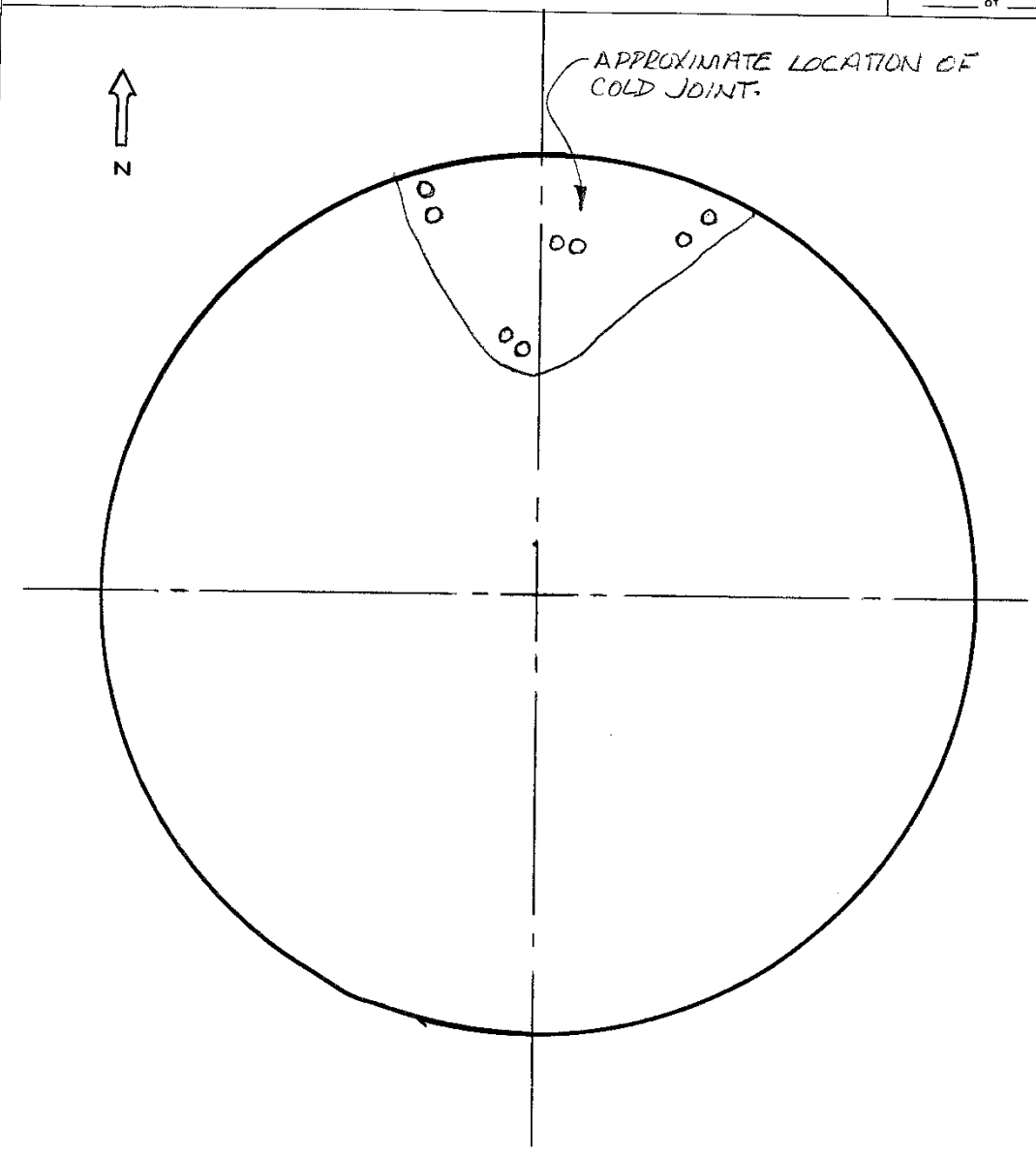
GPO 697-905

KAISER ENGINEERS HANFORD

FIELD SKETCH

Attachment To Or Description: NCR B-340-14 ATTACHMENT #1

Sheet ____ of ____



TANK 102 FOUNDATION
N.T.S.

KEH-159.2 (4-82)

App. Figure B-25. Nonconformance Report B-340-15

RL-604 (2-79)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-15 (1520-5)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.3.3 - "Place concrete in accordance with ACI-301, Sections 8.1, 8.2 & 8.3."

ACI-301-72 (Revised 1975) Section 8.3:

8.3.3 Segregation - Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.

8.3.4 Consolidation - All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall be operated by competent workmen. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 in. apart. At each insertion,

(Continued on Page 2 of 2)

(1J) Distribution

DOE K K Lucas
~~*G S Rokkan~~

RHO D L Bjorklund
~~*J D Galbraith~~
*R J Hennig
E Kollermeier
E A Rieck
JAJ
*T R Cloud
*W T Frisbee

KEH J R Nicholson
*J D Cummings
R L Hand
R M Iten
~~*J Morgan~~ D L Brown
*J W Viita
*T L Walton
Central File
*Official File/
Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.D. CUMMINGS 8-10-83 KEH FIELD ENGINEERING

(1H) Supervisors Review

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2A) Disposition - Repair

(2B) 1. Repair defect areas to contract specification requirements.
2. Contractor shall take appropriate action to insure that concrete placement and finishing is performed according to contract specificatio
3. Method of patching to be approved by the Govt Rep prior to patching.

(2C) Repair is required to meet contract specifications.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 8/17/83 DG Lien	Safety 8/17/83 R.H. Dennis	Engr.	AI (ASME)
QA	QA 8-17-83 Wm. Brayman	PE J.W. Viita 8-10-83	QA	DOE 8/24/83

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative: Michael D. Rahm Date: 8/14/84

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905

(1D) REQUIREMENTS (continued)

the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 sec.

ACI-301-72 (Revised 1975) Section 11.7.2 - Floated Finish - After the concrete has been placed, consolidated, struck off and leveled, float to a uniform sandy texture.

(1E) NONCONFORMANCE DESCRIPTION

Concrete pour of Tank Foundation "D" (102) on 8-9-83.

1. Internal vibrators were operated by inexperienced workmen. At several locations, concrete was deposited in large quantities in one area, and vibrators were used to transport concrete within the forms. Some concrete received excessive vibration and others not enough.

   Inadequate vibration was performed around embeds and forms causing air voids, and stone pockets. The embedded angles installed along the leak detection drain have voids under the angle at several locations.

2. The floated finish required for Tank Foundation 102 does not have a uniform sandy texture. At various locations, the surface is irregular and has air voids and visible surface aggregate.

   NOTE: The contractor was repeatedly notified about problems associated with improper placement and consolidation.

App. Figure B-26. Nonconformance Report B-340-17

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE III)	B-340-17 (1520-6)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. Construction Specification B-340-C3, Section 03300, Paragraph 3.3.3 - "Place concrete in accordance with ACI-301, Sections 8.1, 8.2 & 8.3."

   ACI-301-72 (Revised 1975) Section 8.3 - "Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section . . . Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic."

(Continued on Page 2 of 2)

(1J) Distribution

DOE
*G S Rokkan

RHO
*J D Galbraith
*R J Hennig

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J Morgan
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	J.W. MIDDLETON 8-19-83 KEH FIELD ENGINEERING	

(2A) Disposition

- [X] Accept As is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

(2B) Instruction
The contractor should take precautions to prevent the formation of cold joints by maintaining adequate rate of concrete placement.

(2C) Justification
Revibration is acceptable as long as the running vibrator will sink of its own weight into the concrete and liquidify it momentarily.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 8/29/83	Safety 8/29/83	Engr. 9/6/83	AI (ASME) NA
QA	QA 8/24/83	PE 8-30-83	QA 9/6/83	DOE 9/6/83

(3A)
- [X] Disposition Effected As Directed/ NCR Closed
- [ ] Other (Specify)

Originator or Representative Date 9-12-83

(4A) List of Documents Affected

(4B) Documents Revised

By ____ Date ____

GPD 697-905

NCR B-340-17 (1520-6)

NONCONFORMANCE DESCRIPTION

1. At several large areas within the slab, the rate of concrete placement was not such that the concrete to be integrated with fresh concrete was still plastic.

   Excessive over-vibration was used to re-establish plasticity of the hardening concrete prior to placement and integration with the subsequent layer of concrete.

   Second and even third time re-vibration was employed to maintain plasticity of the concrete after the establishment of initial set.

   See Attachment #1 for approximate locations.

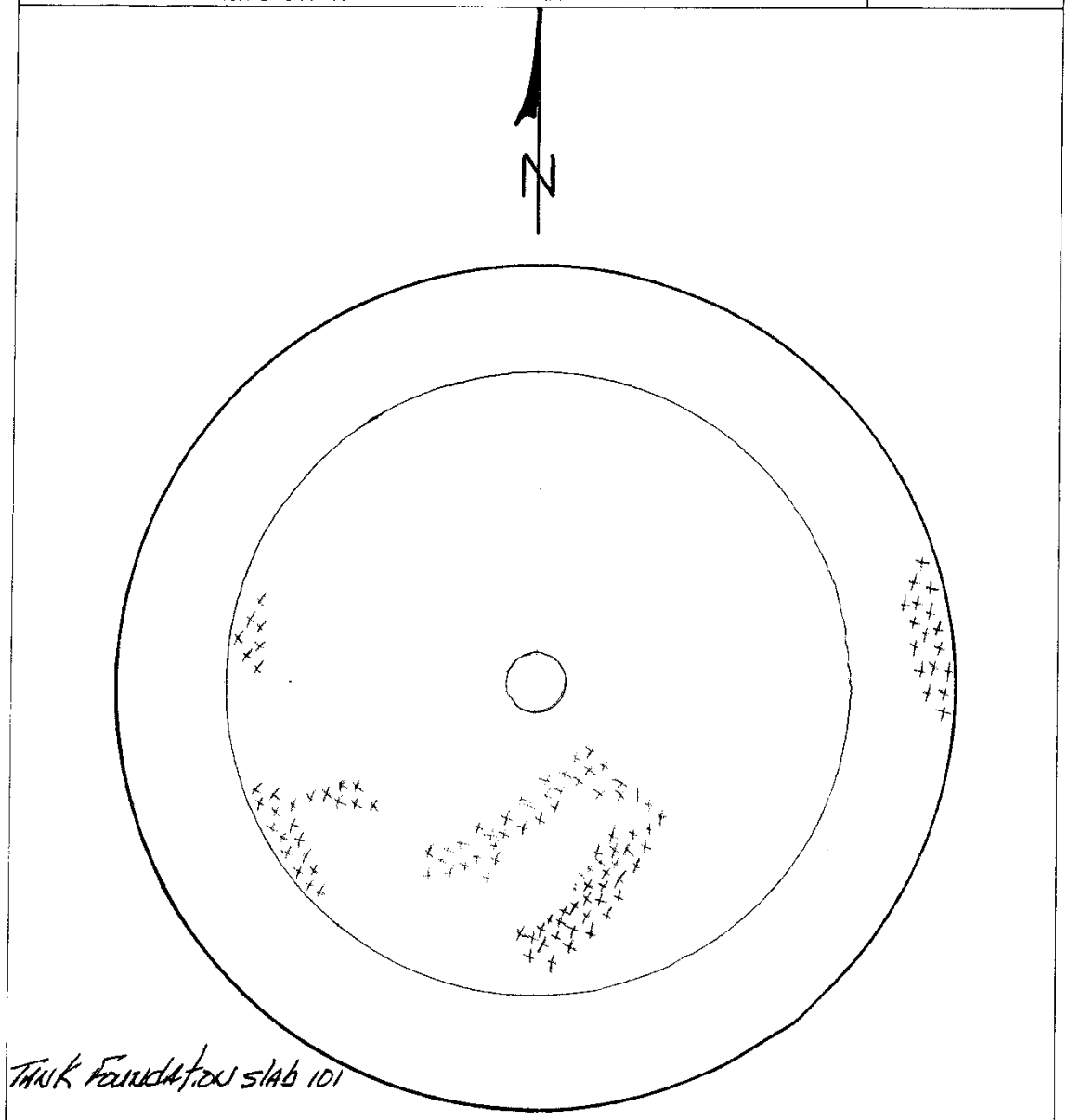
KAISER ENGINEERS HANFORD

FIELD SKETCH

Attachment To Or Description:

NCR B-340-17 ATTACHMENT #1

Sheet _____ of _____



TANK Foundation SLAB 101

Approximate locations of NON CONFORMANCE AS described in REQUIREMENT # 1

KEH-159.2 (4-82)

App. Figure B-27. Nonconformance Report B-340-21

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-21 (1520-9)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.5.2.1 - "Finish uniformed surface in accordance with ACI-301, Section 11.7.2."

ACI-301-72 (Revised 1975) Section 11.7.2 - Floated Finish - After the concrete has been placed, consolidated struck off and leveled, float to a uniform sandy texture.

NONCONFORMANCE DESCRIPTION

The floated finish required for Tank Foundation "C" (108) does not have a uniform sandy texture. At various locations, the surface is irregular and has air voids and visible surface aggregate.

NOTE: The contractor was repeatedly notified about the condition of the finish in sufficient time to correct the problem.

Ref. RWD #25, Tank 101 inadequate float finish and NCR B-340-15 for inadequate float finish, Tank 102.

(1J) Distribution

DOE
*G S Rokkan

RHO
*DL Bjorklund
*J D Galbraith
*R J Hennig
*S Joncus

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.W. MIDDLETON 8-30-83
KEH FIELD ENGINEERING

(1H) Supervisors Review: L. Rippey

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) 1. Repair defect areas to contract specification requirements.

2. Contractor shall take appropriate action to insure that concrete placement and finishing is performed according to contract specification.

3. Method of patching to be approved by the Govt Rep prior to patching.

(2C) Repair is required to meet contract specifications.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. NA	Design 9/2/83	Safety 9.2.83	Engr. 9/6/83	AI (ASME) NA
QA NA	9-2-83	PE 9-6-83	QA 9/6-83	DOE

(3A)
☒ Disposition Effected As Directed, NCR Closed
☐ Other (Specify)

Originator or Representative

Date 7/25/84

4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-905

App. Figure B-28. Nonconformance Report B-340-23

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE III)	B-340-23 (1520-11)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.3.3 - "Place concrete in accordance with ACI-301, Sections 8.1, 8.2 & 8.3."

ACI-301-72 (Revised 1975) Section 8.3:

8.3.3 - Segregation - Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.

8.3.4 - Consolidation - Use of vibrators to transport concrete within forms shall not be allowed.

NONCONFORMANCE DESCRIPTION

Concrete pour of Tank Foundation "C" (108) on 8-30-83

At several locations, concrete was deposited in large quantities in one area and vibrators were used to transport concrete within the forms. In several instances this resulted in excessive vibration and segregation.

(1J) Distribution

DOE
* G S Rokkan

RHO
*D L Bjorklund
~~*J D Galbraith~~ SR Briggs
*R J Hennig
*S Joncus

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
N/A	J.W. MIDDLETON 8-30-83 KEH FIELD ENGINEERING	

(2A) Disposition

- [x] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [x] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

(2B) 1. Contractor shall provide means of placing concrete at its final location. Concrete shall be moved by vibration no further than 2 to 3 ft. to prevent segregation of aggregate.

2. Repair any defects caused by segregation to contract specification requirements. Repair requirements to be determined by visual inspection of finished slab.

(2C) Repair is required to meet contract specifications.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [x] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 9/6/83	Safety 9-6-83	Engr. 9/13/83	AI (ASME) NA
QA	QA 9-6-83	PE 9-7-83	QC 9-13-83	DOE 9/9/83

(3A)

- [x] Disposition Effected As Directed/NCR Closed
- [ ] Other (Specify)

Originator or Representative 9-21-83 Date

(4A) List of Documents Affected

(4B) Documents Revised

By ____ Date ____

GPO 697-905

App. Figure B-29. Nonconformance Report B-340-24

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-24 (1520-12)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Core drill foundation of Tank 102 as instructed by NCR B-340-14 (attached) to determine if a cold joint exists, the extent of the cold joint and depth.

NONCONFORMANCE DESCRIPTION

Upon evaluation of concrete cores taken from Tank "D" (102) foundation, a cold joint was indicated at Core #3, 11-1/2" from the surface and Core #9, 12-1/2" from the surface (see attachment).

(1J) Distribution

DOE
*~~G S Rokkan~~ K K Lucas

RHO
*D L Bjorklund
*~~J D Galbraith~~ CA Rieck
*R J Hennig
*S Joncus

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
R M Iten
*~~J E Morgan~~ D M Brown
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date, (1) 2pl c: J.D. CUMMINGS 9-7-83, KEH FIELD ENGINEERING

(1H) Supervisory Review: D. Kippy

(2A) Disposition
- ☐ Accept As is
- ☐ Conditional Accept
- ☒ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) Instructions

a. Provide a permanent record of:
   - Locate all cores with angle and distance from center of tank.
   - Identify rebar cut when coring, radial or circumferential for each core hole.

b. Repair all core holes by filling with nonshrink grout, nonmetallic type; "Five Star Grout" by US Grout Corp; "Por-Rok "Anchoring Cement by Hallemite; or "Masterflow 713" by Master Builders.

c. Remove cold joint in the area around cores #3 and #9. The method of rework shall be submitted by the contractor for approval prior to the start of rework. The extent of the cold joint will be determined by the Government Representative during rework.

(2C) Justification

Rework is required to meet contract specifications. Based on the inspection of cores removed, the only rework is in the area of the cold joint.

Cont on Page #2

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. NA	Design [signature] 9/13/83	Safety S S Lotson 9-12-83	Engr. [signature] 9/13/83	AI (ASME) NA
QA NA	QA [signature] 9-13-83	PE [signature] 9-13-83	QA [signature] 9-15-83	DOE [signature] 9/22/83

(3A)
- ☒ Disposition Effected As Directed, NCR Closed
- ☐ Other (Specify)

[signature] 3-2-84
Originator or Representative — Date

(4A) List of Documents Affected

(4B) Documents Revised
By _____ Date _____

GPO 697-905

CONSTRUCTION NONCONFORMANCE REPORT B-340-24

(2C) Justification Cont.

CORES TAKEN OUTSIDE THE COLD-JOINT AREA WAS, 5-13-83

There is no evidence of rock pockets. A few large (1/2" dia max.) air bubbles were seen, but not of a frequency to effect the structural integrity of the concrete tank foundation.

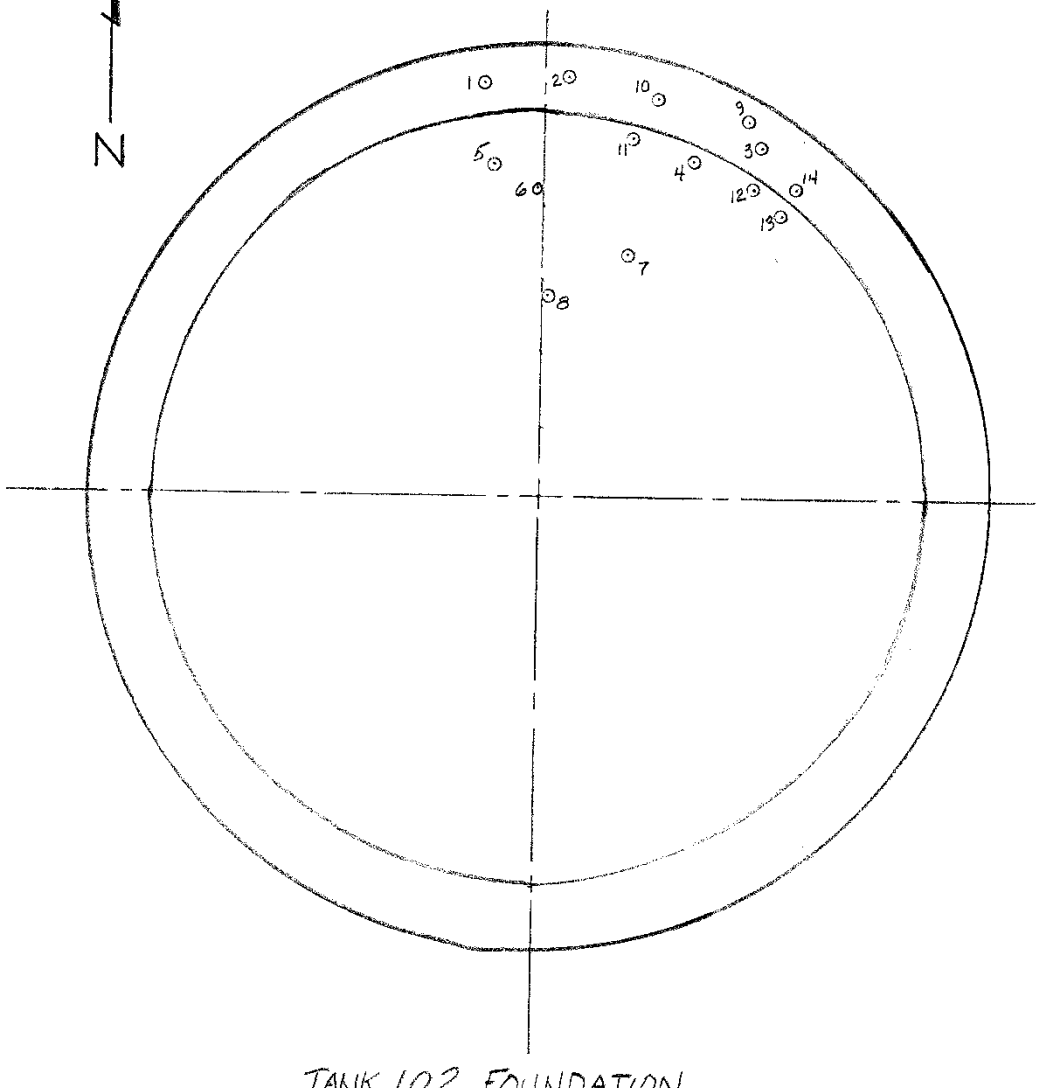
KAISER ENGINEERS HANFORD

FIELD SKETCH

Attachment To Or Description: NCR B-340-24 ATTACHMENT #1

Sheet ____ of ____

CORE DRILL IDENTIFICATION



TANK 102 FOUNDATION
NTS

KEH-159.2 (4-82)

NUR B-340-2.4
INSTRUCTION (2.5) a.

TANK FOUNDATION 102
Core Drilling

CORE #1
Location: N 8° 13' 15" W 42.44' from centerline
Reinforcing Steel Cut: (1) #6 circumferential bar and part of (1) #7 radial bar

CORE #2
Location: N 5° 23' 40" E 43.09' from centerline
Reinforcing Steel Cut: (1) #6 circumferential bar

CORE #3
Location: N 31° 32' 00" 41.62' from centerline
Reinforcing Steel Cut: (1) #7 radial bar

CORE #4
Location: N 20° 09' 18" E 36.45' from centerline
Reinforcing Steel Cut: (1) #7 radial bar and (1) #6 circumferential bar at splice

CORE #5
Location: N 8° 49' 05" W 34.67' from centerline
Reinforcing Steel Cut: (1) #5 circumferential bar

CORE #6
Location: N 1° 30' 22" W 32.48' from centerline
Reinforcing Steel Cut: Part of (1) #7 radial bar

CORE #7
Location: N 16° 46' 18" E 26.75' from centerline
Reinforcing Steel Cut: (1) #5 circumferential bar; (1) #6 and part of (1) #7 radial bars at splice

CORE #8
Location: N 0° 10' 00" E 21.34' from centerline
Reinforcing Steel Cut: None

CORE #9
Location: N 31° 15' 55" E 43.24' from centerline
Reinforcing Steel Cut: (1) #6 circumferential bar

CORE #10
Location: N 15° 30' 42" E 43.80' from centerline
Reinforcing Steel Cut: (1) #6 circumferential bar

CORE #11

Location: N 14° 26' 43" E 38.75' from centerline

Reinforcing Steel Cut: (1) #6 circumferential bar and (1) #7 radial bar

CORE #12

Location: N 32° 57' 22" E 38.00' from centerline

Reinforcing Steel Cut: (1) #7 radial bar

CORE #13

Location: N 39° 21' 00" E 38.11' from centerline

Reinforcing Steel Cut: None

CORE #14

Location: N 38° 08' 52" E 41.69' from centerline

Reinforcing Steel Cut: (1) #6 circumferential bar

CORE #15

Location: N 25° 58' 30" E 42.33' from centerline

Reinforcing Steel Cut: (1) #6 circumferential bar

App. Figure B-30. Nonconformance Report B-340-29

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-29 (1520-15)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Rev. 0, Paragraph 3.5.3.2 - Fill all low spots which are out of tolerance with bonding grout in accordance with manufacturers instructions. The manufacturer of Daraweld-C Bonding Agent states, "The surface to which Daraweld-C grout or topping is applied, must be clean and sound."

NONCONFORMANCE DESCRIPTION "B"(103) "C"(108)

While performing repair at Tank Base, Daraweld-C Bonding Grout was placed over curing compound.

NOTE: 1) In telephone conversations with the manufacturer of Daraweld-C and A C Horn, the manufacturer of the curing compound, it was stressed that the curing compound must be removed prior to patching to obtain the desired bond.
2) Ref. Inspection Report by J.D. Cummings dated 9-28-83. Contractor has previously been informed of the correct procedure.

(1J) Distribution

DOE
*G S Rokkan

RHO
*D L Bjorklund
*S R Briggs
*R J Hennig
*S Joncus

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.D. CUMMINGS 10-6-83, KEH FIELD ENGINEERING (1)

(1H) Supervisors Review: L. Rippy

(2A) Disposition

- ☐ Accept As Is
- ☐ Conditional Accept
- ☒ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) Instructions
Remove all patches applied over curing compound. Prior to applying new patches, remove all traces of curing compound in accordance with the manufacturer's instructions.

(2C) Justification
The patch and concrete base must bond together to produce an acceptable patch. A curing compound produces a bond breaker and prevents bond between the base and patch.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 10/11/83	Safety 10-11-83	Engr. 10/14/83	AI (ASME)
QA	QA 10-11-83	PE 10-12-83	QA	DOE

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative — Date 1-24-84

(4A) List of Documents Affected

(4B) Documents Revised

By ____ Date ____

GPO 697-905

KAISER ENGINEERS HANFORD

INSPECTION REPORT

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B-340	PHASE III	9/27/83	9/28/83	MH	

DISCIPLINE		JOB SITE ACTIVITY	YES	NO
Civil/Structural	☑	Site visited	☑	☐
Mechanical	☐	Construction in progress (personal observation)	☑	☐
HVAC	☐			
Electrical	☐			
Instrumentation	☐			

WEATHER EFFECT INFORMATION	YES	NO
Construction hindered by weather	☐	☑
Work rejected due to weather	☐	☑

Conditions/Comment _____

INSPECTION

Item	Acc	Rej	Other Documentation
CONCRETE PATCHING & REPAIR TK BASE 103 (IN PROGRESS)	✓		SEE COMMENTS

OTHER ACTIVITIES / GENERAL COMMENTS

OBSERVED CONCRETE REPAIR & PATCHING AT TK BASE 103 SURFACE. NOTICED THAT THE CURING COMPOUND PREVIOUSLY APPLIED WAS NOT BEING COMPLETELY REMOVED AND THAT THE ACID ETCHING MATERIAL BEING PLACED WAS NOT BEING LEFT ON THE CONCRETE LONG ENOUGH (APPROX 10-15 SEC.). I INFORMED JAI-BM & CONTRACTOR THAT THE CURING COMPOUND MUST BE ENTIRELY REMOVED FROM THE REPAIR AREA AND THAT THE ACID ETCH MATERIAL SHOULD BE LEFT ON THE SURFACE FROM 3-5 MIN. CONTRACTOR ACKNOWLEDGED AND COMPLIED.

Report continued on reverse side ☐

Signature

KEH-377 (2-83)

REVISED SURVEY REQUEST TIME ON TK BASE 106 FOR PRE-POUR CHECKOUT FROM FRIDAY MORNING TO FRIDAY AFTERNOON OR SATURDAY (10/1/83).

REQUESTED SURVEY TO MAKE FINAL ELEV. CHECK ON CONCRETE SURFACE OF TK BASE 103 ON 9/30/83 AM

J. R. Cummings
B-340-III
9/28/83

App. Figure B-31. Nonconformance Report B-340-30

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-30 (1520-16)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Field Submittal dated 9-9-83 - Concrete Repair Procedure, including the manufacturers data for Daraweld-C Bonding Agent for Concrete: "Daraweld-C is used for bonding, patching or resurfacing concrete floors, . . . with strengths exceeding the strength of the concrete being repaired or surfaced." (See attachment)

NONCONFORMANCE DESCRIPTION

Repair patching performed on the surface of Tank Bases 101, 103, 104 and 108 have areas that are soft and indicate lack of strength. Areas at Tank Base 108 have excessive cracking in the repair patch.

(1J) Distribution

DOE
~~*G S Rokkan~~
*K K Lucas
RHO
*D L Bjorklund
~~*S R Briggs~~
*R J Hennig
*S Joncus
CARleck
JAJ
*T R Cloud
*W T Frisbee
KEH
*J D Cummings
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.D. CUMMINGS 10-7-83 KEH FIELD ENGINEERING

(1H) Supervisors Review

(2A) Disposition
- ☐ Accept As Is
- ☐ Conditional Accept
- ☒ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

(2B) INSTRUCTIONS

- Determine the cause of the low strength patching material and excessive cracking. Verify through manufacturer of the bonding agent that materials used and method of application will not be determental to the development of bond and compressive strength, or develop cracking of the patch.
- Remove all unsound material, etch and clean surface to be repaired and apply patching material: all in accordance with the manufacturers instructions.

(2C) JUSTIFICATIONS

The repair material must be thoroughly bonded to, and develop equivalent compressive strength of the existing sound concrete.

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 10/13/83	Safety 10/13/83	Engr. 10/17/83	AI (ASME)
QA	QA 10-13-83	PE 10-14-83	QA 10-17-83	DOE

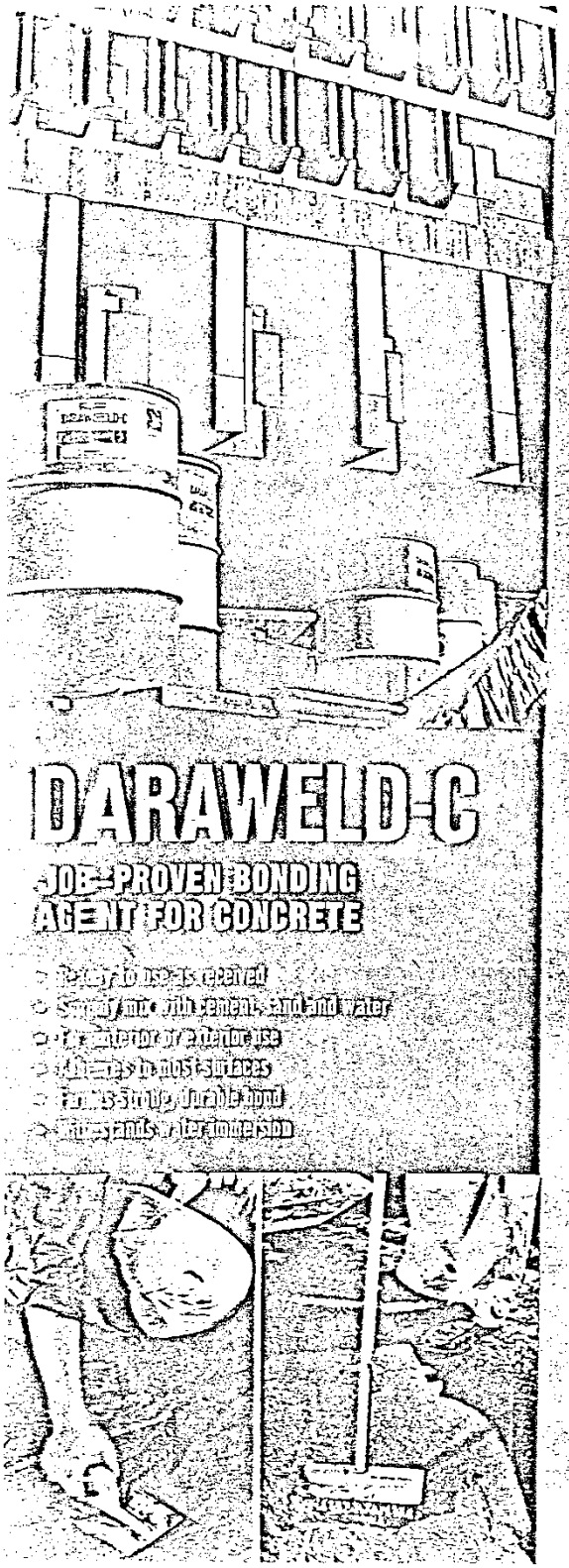
(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative 2-9-84 Date

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905



DESCRIPTION

Daraweld-C is a nding agent for concrete. When used as directed L weld-C will form a bond between new to old, new to new, or old to old concrete stronger than the concrete being bonded. Daraweld-C is a dispersion of internally plasticized, high polymer resin in water. It is a ready-to-use, non-settling, milk white liquid with a viscosity only slightly greater than that of water and a weight of 9.0 pounds per gallon.

Mixed with cement and sand, Daraweld-C forms a strong, highly adhesive bonding grout which will adhere to most substrates. Daraweld-C is not re-emulsifiable and consequently the grout, when cured, will withstand intermittent or continued exposure to water.

USES

Daraweld-C is primarily intended for bonding new to old, or old to old portland cement concrete in exterior or interior applications. It is used for bonding, patching or resurfacing concrete floors, walls, beams, columns, or other structural members with strengths exceeding the strength of the concrete being repaired or resurfaced. Daraweld-C will substantially improve the adhesion of pneumatically applied mortar or concrete. Because Daraweld-C grouts and mortars will adhere to most substrates, it has been used in a wide variety of miscellaneous applications. These include repair of masonry structures, bonding construction joints, prevention of cold joints in multiple pours, leveling of floors prior to secondary surfacing, skidproofing existing floors, finishing concrete block walls, patching of stuccoed walls, striping or bonding to asphalt surfaces. Daraweld-C grout is used to replace rubbing of concrete surfaces with a resulting waterproof, weatherproof, uniform, and attractive finish at substantially lower cost.

SURFACE PREPARATION

The surface to which Daraweld-C grout or topping is applied must be clean and sound. Remove oil, grease and similar substances with Grease and Stain Remover, as required, used according to W. R. Grace & Co.'s recommendations. Remove unsound concrete, loose material and foreign matter by scarifying or other mechanical means. All concrete whether new or old, when cleaned, must be etched with a 1:1 muriatic acid solution (approximately 14%) and thoroughly rinsed with water to remove all traces of acid. A properly prepared surface will be clean and sound, readily and uniformly wettable with water.

MIXING AND PLACING

Bonding Grout:

For all applications as a bonding agent Daraweld-C is mixed to the following proportions by weight or by volume:

1 part Daraweld-C
5 parts portland cement
2.5 parts fine sand

plus sufficient water to yield the desired consistency. A suitable sand will generally conform to the requirements of ASTM C 144.

In normal mixing the portland cement and sand are dry blended together, water and Daraweld-C are mixed together, added to the cement-sand blend and the whole thoroughly mixed by mechanical means. Up to 1 part of water may be required depending upon the water

App. Figure B-32. Nonconformance Report B-340-40

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page _____ Of _____

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-40 (1520-24)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.4.2 - "Cure concrete repairs the same as new concrete" and Paragraph 3.6.2 - "Protect concrete during cold weather in accordance with ACI 306R and ACI 301, Section 1.2.3."

ACI 301, Section 12.3.1 - "When the mean daily outdoor temperature is less than 40°F, the temperature of the concrete shall be maintained between 50° and 70°F for the required curing period.

ACI 306, Section 1.3 - "All unformed concrete surfaces should be protected from freezing for at least the first 24 hours after it is placed."

NONCONFORMANCE DESCRIPTION

Repair patches placed in the drain slots of Tank Base "B" (105) on 11-29-83 were not protected from freezing temperature. Temperatures as low as 26°F were recorded at approximately 7:30 a.m., 11-30-83.

(1J) Distribution

DOE
*G S Rokkan

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.W. MIDDLETON 11-30-83 (1) KEH FIELD ENGINEERING

(1H) Supervisors Review: 11-30-83

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

INSTRUCTIONS

Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350° F days. Reevaluate all patched areas prior to placement of secondary tank bottom. Areas of low strength or poor bond shall be reworked.

JUSTIFICATION

Future loose material in the drain slots is not acceptable. Evaluation of the patches prior to placement of secondary tank bottom will provide assurance that patch is sound. The mfg of the bonding agent recommends a min. curing temperature of 40° F during the curing period.

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. NA	Design 12/8/83	Safety 12-8-83	Engr. 12/12/83	AI (ASME) NA
QA NA	QA 12-8-83	PE 12-9-83	QA 12-14-83	DOE 12/14/83

(3A)
- ☐ Disposition Effected As Directed. NCR Closed
- ☒ Other (Specify) REF NCR B-340-47

Originator or Representative: 1-12-84 Date

(4A) List of Documents Affected

(4B) Documents Revised By _____ Date _____

GPO 697-905

App. Figure B-33. Nonconformance Report B-340-42

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP Tank Farm (Phase III)

(1C) NCR No.: B-340-42 (1520-26)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.4.2 "Cure concrete repairs the same as new concrete", and Paragraph 3.6.2 "Protect concrete during cold weather in accordance with ACI 306R, and ACI 301, Section 12.3".

ACI-301-72 (Revised 1975) Section 12.3 "Cold weather - when the mean daily outdoor temperature is less than 40° F, the temperature of the concrete shall be maintained between 50° and 70° F for the required curing period".

Field Submittal dated 9/9/83 - Concrete repair procedure, including the manufacturer's data for Darweld-C bonding agent for concrete.
Note: The minimum acceptable curing temperature recommended for patches utilizing Darweld-C is 40° F per telephone conversation on 12/6/83 with Herman G. Protze, III.

(Continued on Page 2)

(1J) Distribution

DOE
~~*G S Rokkan~~
R K Lucas
RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck
JAJ
*T R Cloud
*W T Frisbee
KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicolson
*J W Viita
*T L Walton
Central File
*Field Project File 2910E (3)

*Preliminary Copies

(1F) Tag No.: No

(1G) Originator, Company and Date: J. W. Middleton KEH Field Engineering 12/8/83

(1H) Supervisors Review: 12/8/83

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

INSTRUCTIONS

Provide 40° F min temperature of the environment for 350° F days required by the bonding grout mfg.

Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350° F days.

Reevaluate all patched areas prior to placement of secondary tank bottom. Area of low strength or bond should be reworked.

The contractor shall provide evidence of the jobsite to the satisfaction of the government's representative that he can provide an environment capable of maintianing a minimum temperature of 40° F before and after placement of any patching, prior to patching continuing. The foundation shall be heated for a time interval adequate to maintian a minimum temperature of 40° F during placement of the patching material. After placement of the patching material, the environment shall be maintained at 40° F min until the patching has cured the 350° F days.

(con't)

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr. N/A	Design 12/9/83	Safety 12-12-83	Engr. 12/14/83	AI (ASME) NA
QA N/A	PE 12-12-83	QA 12-14-83	QA	DOE 12/16/83

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative 2-9-84 Date

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905

Page 2 of 2
NCR #B-340-42
241-AP Tank Farm (Phase III)

NONCONFORMANCE DESCRIPTION

Repair patches placed on tankbase 101, 104 and 102, have not been adequately protected from cold weather.

Repair patches on tankbase 101 placed on 11/29/83 and 12/2/83 had recorded overnight and morning temperatures ranging from 31° F to 36° F on five (5) consecutive days after placement.

Repair patches on tankbase 104 placed on 12/2/83 ranged from 33° F to 36° F for 3 consecutive days after placement.

Repair patches placed on tankbase 102 on 12/7/83 ranged from 36° F to 37° F the first morning after placement.

JUSTIFICATION

Future loose material from the patching is not acceptable. Evaluation of the patches prior to placement of secondary tank bottom will provide assurance that patch is sound. Acceptance of the patching requires the contractor to comply with the manufacturers instructions for the use and application of the bonding grout.

App. Figure B-34. Nonconformance Report B-340-43

RL-6004 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-43 (1520-27)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.4.2 - "Cure concrete repairs the same as new concrete", and Paragraph 3.6.2 "Protect concrete during cold weather in accordance with ACI 306R, and ACI 301, Section 12.3".

ACI-301-72 (Revised 1975) Section 12.3 "Cold weather - when the mean daily outdoor temperature is less than 40°F, the temperature of the concrete shall be maintained between 50° and 70°F for the required curing period".

Field Submittal dated 9-9-83 - Concrete repair procedure, including the manufacturer's data for Daraweld-C bonding agent for concrete.
NOTE: The minimum acceptable curing temperature recommended for patches utilizing Daraweld-C is 40°F per telephone conversation on 12-6-83 with Herman G. Protze, III.

(Continued on Page 2 of 2)

(1J) Distribution
DOE
*G S Rokkan

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: NO

(1G) Originator, Company and Date: J.W. MIDDLETON 12-22-83 KEH FIELD ENGINEERING

(1H) Supervisors Review: 12/23/83

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

INSTRUCTIONS

Provide 40° F min temperature of the environment for 350° F days required by the bonding grout mfg.

Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350° F days.

Reevaluate all patched areas prior to placement of secondary tank bottom. Area of low strength or bond should be reworked.

The contractor shall provide evidence of the jobsite to the satisfaction of the government's representative that he can provide an environment capable of maintaining a minimum temperature of 40° F before and after placement of any patching, prior to patching continuing. The foundation shall be heated for a time interval adequate to maintain a minimum temperature of 40° F during placement of the patching material. After placement of the patching material, the environment shall be maintained at 40° F min until the patching has cured the 350° F days.

(continued)

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design DB Lien 12/28/83	Safety SB Letson 12-28-83	Engr. [illegible] 1/16/84	AI (ASME) N/A
QA	QA [illegible] 12-28-83	PE JW 12-28-83	QA Onwedde 1-17-84	DOE Kay K Flynn 1/26/84

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative: J W Middleton Date: 2-3-84

(4A) List of Documents Affected

(4B) Documents Revised By _____ Date _____

GPO 697-905

B-340-43 (1520-27)

NONCONFORMANCE DESCRIPTION

Repair patches placed on 12-19-83 at Tank Base "A" (102) have not been adequately protected from cold weather.

Morning temperatures on 12-22-83 revealed patch temperatures ranging from 28°F to 34°F. Ice formations were apparent on several patches. The ambient overnight low within the heated shelter was 25°F.

2c. JUSTIFICATION

Future loose material from the patching is not acceptable. Evaluation of the patches prior to placement of secondary tank bottom will provide assurance that patch is sound. Acceptance of the patching requires the contractor to comply with the manufacturers instructions for the use and application of the bonding grout.

App. Figure B-35. Nonconformance Report B-340-46

85218

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE III)	B-340-46 (1520-29)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. Construction Specification B-340-C3, Rev. 0, Section 03300 - Cast-In-Place Concrete - Paragraph 3.5.2.2:

   "Place the tank foundation concrete with a maximum variation in finished surface of + 1/2 inch from the elevation shown on the drawings." (Drawing H-2-90439, Section 1, shows top of concrete to be at elevation 623.26'.)

2. Construction Specification B-340-C3, Rev. 0, Section 03300 - Cast-In-Place Concrete:

   a. Paragraph 3.5.2.3: "Finish the top surface of the tank foundation concrete to a true horizontal plane within 1/8 inch in 2 feet as determined by a 2 foot straight edge placed anywhere on the slab in any direction."

(Continued on Page 2 of 2)

(1J) Distribution

DOE
*G S Rokkan

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date	(1H) Supervisors Review
N/A	J.W. MIDDLETON 1-11-84 KEH FIELD ENGINEERING	

(2A) Disposition

- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ~~☒~~ Other (Specify)

(2B) Instructions
(2C) Justification

1) (2A) ~~Accept as is~~ Conditional Accept
   (2B) Take corrective measures to assure primary tank bottom will be at specified elevation within specified tolerances.
   (2C) The slight deviation from specified elevation will not impact the design requirements for the tank.

2) (2A) Repair
   (2B) Grind surface or patch per approved repair procedures to meet required flatness tolerances.
   (2C) Flatness requirements for the tank bottoms must be maintained.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 1/19/84	Safety 1-19-84	Engr 1/25/84	AI (ASME) N/A
QA	QA 1-24-84	PE 1-24-84	QA 1/25/84	DOE 1/26/84

(3A)

- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative 2-1-84 Date

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905

NCR B-340-46

Page 2 of 2

REQUIREMENTS (Continued)

2. Construction Specification B-340-C3, Rev. 0, Section 03300 - Cast-In-Place Concrete:

   b. Paragraph 3.5.2.4: "Finish the top of tank foundation concrete to a true horizontal plane within 1/4 inch in 10 feet as determined by a 10 foot straight edge placed anywhere on the slab in any direction."

NONCONFORMANCE DESCRIPTION

1. At Tank Foundation 101 there are 11 locations on the top of the concrete foundation that are out of tolerance by 0.01 of a foot (1/8 inch). (See attached survey data report)

2. At Tank Foundation 101 there are 20 areas that do not meet the required flatness tolerances. These areas exceed either or both the 1/4 inch in 10 foot or 1/8 inch in 2 foot flatness tolerance. (See attached flatness check report.)

KAISER ENGINEERS HANFORD

SURVEY DATA REPORT

1. Project/W.O. No.	2. KEH Job No.	3. Project Title	4. Date
B340	R295C3	A.P. TANK FARM	12-13-83

5. Requested By	6. Field Contact	7. Representing
JOHN CUMMINGS	#5	K.E.H.

8. Location Of Work (Area/Bldg.): 200E / 241-AP

9. Approved References (Dwgs, Sketches, Letters, etc.):

10. Description Of Work Requested: RE-CHECK TANK BASE 101-AP.

11. Distribution
- Survey File ☑
- FE Project File ☑
- J. CUMMINGS ☑
- T. CLOUD ☑
- ☐
- ☐
- ☐

12. Request Accepted/Confirmed: L.J. Compton

13. Computer File: -0-

	ITEMS	PERFORMED BY	CHECKED BY
HORIZONTAL	14. Appropriate Controls	N/A	N/A
	15. Layout Computations	↓	↓
	16. Survey Closed		
	17. Field Data Reduced		
VERTICAL	18. Control	Fay L. Davis	Grant T. Braziel
	19. Level Circuit Closed	Fay Davis	Grant T. Braziel
	20. Level Notes Reduced	Fay Davis	L.J. Compton

21. Items Surveyed Within Plan Tolerance: Yes ☐ No ☒ NA ☐ TBD by Requestor ☐

22. No. Of Attachments: 1

23. Survey Results And Comments

SEE ATTACHMENT

24. Survey Party Chief	25. Approved By	26. Survey File No.
F. L. Davis 12/13/83	L.J. Compton	834-299-2EAP-007

App. Figure B-36. Nonconformance Report B-340-47

85218

304 (2-80) 2099-604

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-47 (1520-30)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.4.2: "Cure concrete repairs the same as new concrete", and Paragraph 3.6.2: "Protect concrete during cold weather in accordance with ACI 306R and ACI 301, Section 1.2.3."

ACI 301, Section 12.3.1: "When the mean daily outdoor temperature is less than 40°F, the temperature of the concrete shall be maintained between 50° and 70°F for the required curing period.

ACI 306, Section 1.3: "All uniformed concrete surfaces should be protected from freezing for at least the first 24 hours after it is placed."

NONCONFORMANCE DESCRIPTION

Reference NCR B-340-40. Repair patches placed in the drain slots of Tank Base (105) on 11-29-83 were not protected from freezing temperature. Temperatures as low as 26°F were recorded at approximately 7:30 a.m., 11-30-83. Reevaluation of patches was performed on 1-9-84 and 1-11-84. At (2) locations, the patches are soft and lack strength. (See attached photographs of each patch and sketch for location)

(1J) Distribution

DOE
*G S Rokkan

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.D. CUMMINGS 1-11-84 KEH FIELD ENGINEERING

(1H) Supervisors Review: [signature]

(2A) Disposition
☐ Accept As Is
☐ Conditional Accept
☐ Rework
☐ Repair
☐ Reject
☒ Other (Specify)

(2D) Additional Doc Required
☐ As-Builts
☐ DFC No.
☐ Other Specify
☒ N/A

(2B) Instructions
(2C) Justification

Patch No 1 (see photo) 2A) Rework

2B) Replace patch No 1, shown in photo prior to placement of the secondary tank bottom. Use approved procedure and materials, cure for 350 F° days, or until patch reaches 500 psi compressive strength as verified by breaking of sample cubes. As as alternate to the above instructions, the repair may be placed with an approved non-shrink grout material installed per the manufacturers instructions.
Protection and curing shall conform to the manufacturers instructions and a minimum strength of 500 psi shall be attained.

2C) To reduce a high stress concentration area between the hole and trench edge and prevent the edge of concrete from spalling into the trench, the hole must be filled with a load bearing grout material.

Patch No 2
2A) Accept as is
2B) Accept as is

(con't page 2)

(2E) Contr. Approval (Signature and Date)
Engr.
QA

(2F) A-E Approval (Signature and Date)
Design: [signature] 1/13/84 Safety: [signature] 1/13/84
QA: [signature] 1-13-84 PE: [signature] 1-13-84

(2G) Opr. Contr. Approval (Signature and Date)
Engr.: [signature] 1/17/84
QA: [signature]

(2H) Concurrence (Signature and Date)
At (ASME): N/A
DOE: [signature] 1/13/84

(3A) ☒ Disposition Effected As Directed. NCR Closed
☐ Other (Specify)

Originator or Representative: [signature] Date: 1/13/84

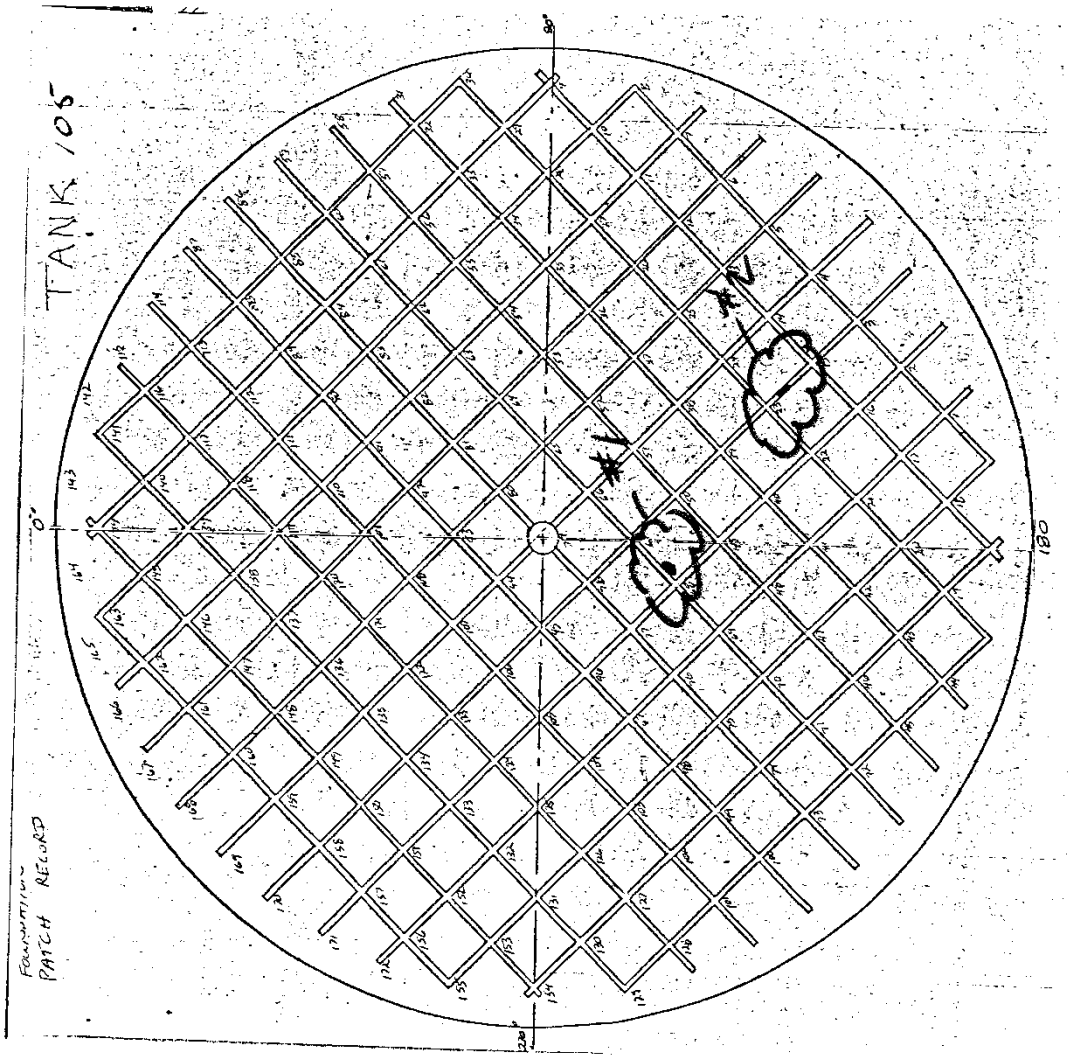
(4A) List of Documents Affected

(4B) Documents Revised
By___ Date___

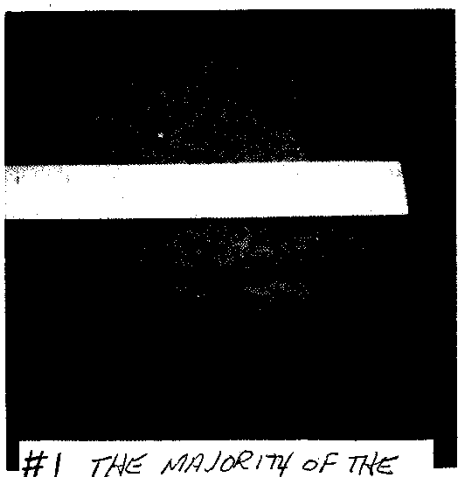
GPO 897-905

2C) The patch in the immediate area occupies about 35% of the surface area. This would not block the trench if it became detached.

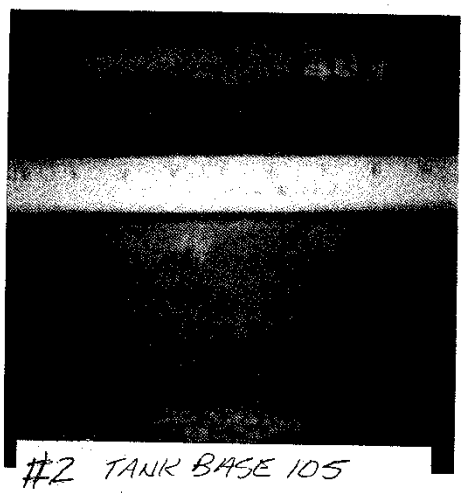
NCR B-340-47
ATTACHMENT



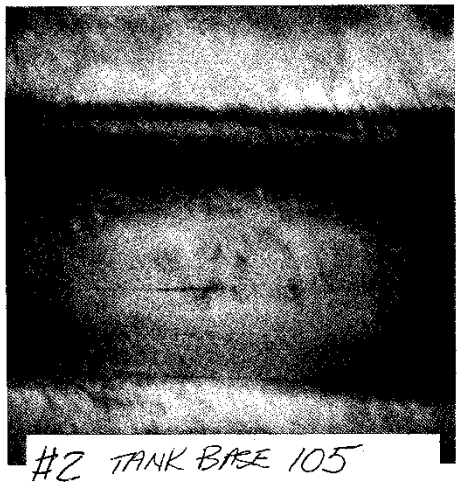
NCR B340-47
ATTACHMENT



#1 THE MAJORITY OF THE PATCH MATERIAL HAS BEEN REMOVED. STANDING WATER IN PATCH AREA, ± 1/2" DEEP
TANK BASE 105



#2 TANK BASE 105
PATCH IN BOTTOM OF SLOT.



#2 TANK BASE 105
PATCH IN BOTTOM OF SLOT.

App. Figure B-37. Nonconformance Report B-340-49

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-49 (1520-32)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 3.4.2: "Cure concrete repairs the same as new concrete", and Paragraph 3.6.2: "Protect concrete during cold weather in accordance with ACI 306R, and ACI 301, Section 12.3".

ACI-301-72 (Revised 1975), Section 12.3: "Cold weather - when the mean daily outdoor temperature is less than 40°F, the temperature of the concrete shall be maintained between 50° and 70°F for the required curing period."

Field Submittal dated 9-9-83: Concrete repair procedure, including the manufacturer's data for Daraweld-C bonding agent for concrete.
NOTE: The minimum acceptable curing temperature recommended for patches utilizing Daraweld-C is 40°F per telephone conversation on 12-6-83 with Herman G. Protze, III.

(Continued on Page 2 of 2)

(1J) Distribution

DOE
~~*G S Rokkan~~
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.W. MIDDLETON 1-19-84 KEH FIELD ENGINEERING

(1H) Supervisors Review

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete base after 350°F days. Reevaluate all patched areas prior to placement of secondary tank bottom. Areas of low strength or poor bond shall be reworked.

2C) Future loose material from the patching is not acceptable. Evaluation of the patches prior to placement of secondary tank bottom will provide assurance that patch is sound. Acceptance of the patching requires the contractor to comply with the manufacturers instructions for the use and application of the bonding grout.

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: 1/23/84	Safety: 1-23-84	Engr. 1/25/84	AI (ASME): N/A
QA	QA: 1-23-84	PE: 1-23-84	QA: 1/25/84	DOE: 1/26/84

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

Originator or Representative — Date: 2-6-84

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905

NCR B-340-49

Page 2 of 2

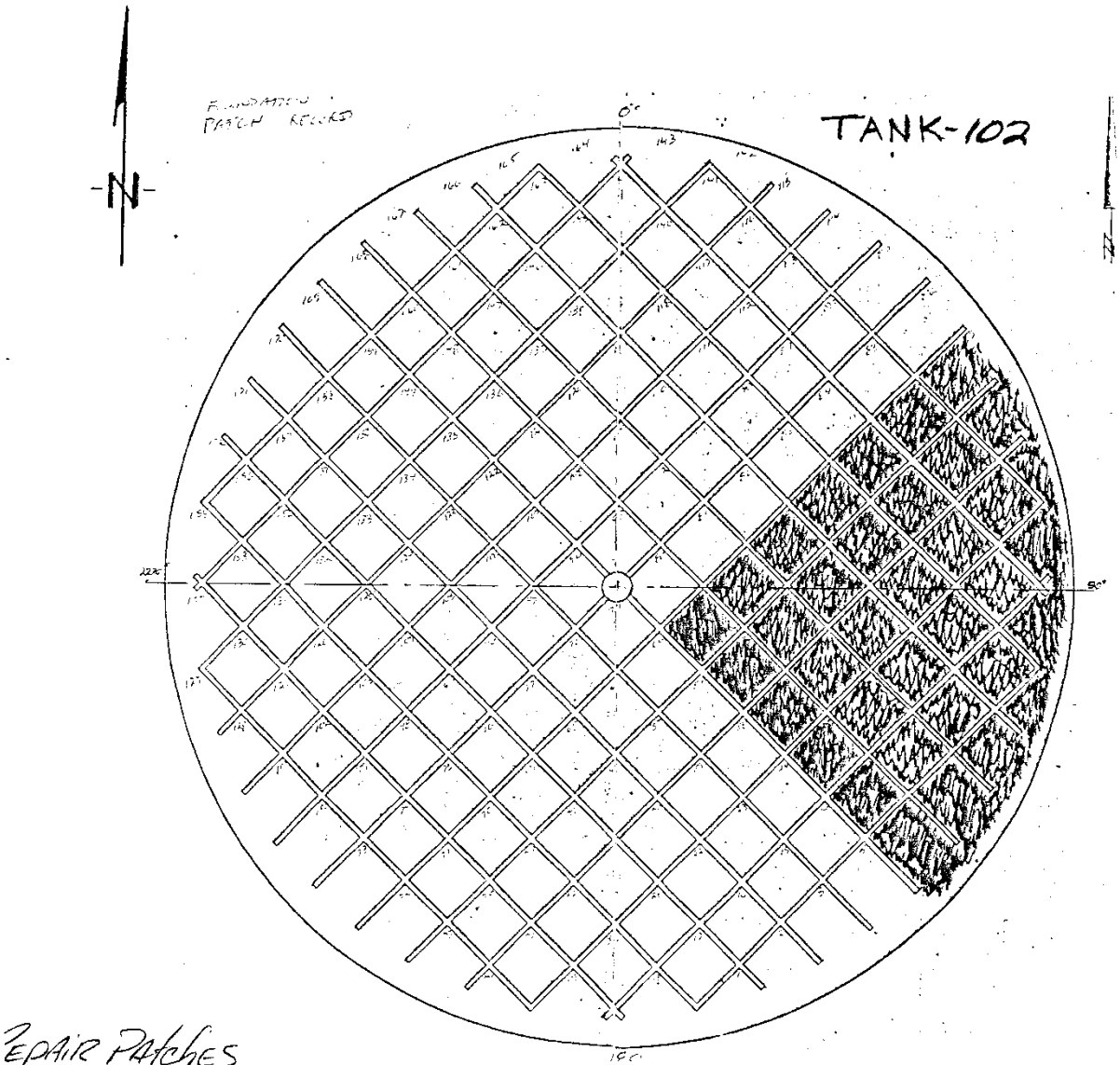
NONCONFORMANCE DESCRIPTION

Repair patches placed on Tank Base "D" (102) on 1-13-84, 1-16-84 and 1-17-84 have not been adequately protected from cold weather.

On 1-19-84, at approximately 9:30 a.m., recorded patch temperatures ranged from 33°F to 39°F.

See attached sketch for patch locations.

NOTE: Morning temperatures were again below 40°F for these repaired areas on 1/20/84 per JD Cummings.



REPAIR PATCHES
PLACED 1-13-84, 1-16-84, AND 1-17-84
ADEQUATELY PROTECTED FROM COLD
WEATHER.

App. Figure B-38. Nonconformance Report B-340-51

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-51 (1520-34)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Rev. 0, Section 03300 - Cast-In-Place Concrete - Paragraph 3.5.2.2: "Place the tank foundation concrete with a maximum variation in finished surface of ± 1/2 inch from the elevation shown on the drawing."

Drawing H-2-90439, Zone G-6 shows the drain slot to be 2-1/2 inches minimum and 2-5/8 inches maximum in depth. Considering the allowable tolerances, the elevation of the bottom of the drain slots should be between 623.00 and 623.09.

NONCONFORMANCE DESCRIPTION

At Tank Foundation "D" (102), the elevation of the finished drain slots vary from the allowable tolerance. See attached sketch for location and elevation.

(1J) Distribution

DOE
~~*G S Rokkan~~
*KK Lucas

RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J D Cummings
R L Hand
R M Iten
*J E Morgan
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: J.D. CUMMINGS 1-31-84 KEH FIELD ENGINEERING

(1H) Supervisors Review: MD Cobbins

(2A) Disposition
- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is

2C) All slots have adequate cross sectional area and alternate directions of flow to provide adequate leak detection drainage in event of leakage.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: EA Gahey 2/2/84	Safety: SB Letson 2-2-84	Engr: Accepted 2/10/84	A! (ASME): N/A
QA	QA: Wm. Engmann 2-2-84	PE: JW Viita 2-2-84	QA: 2/10/84	DOE: Ray K Lucas 2/10/84

(3A)
- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Originator or Representative: J.D. Cummings Date: 2/15/84

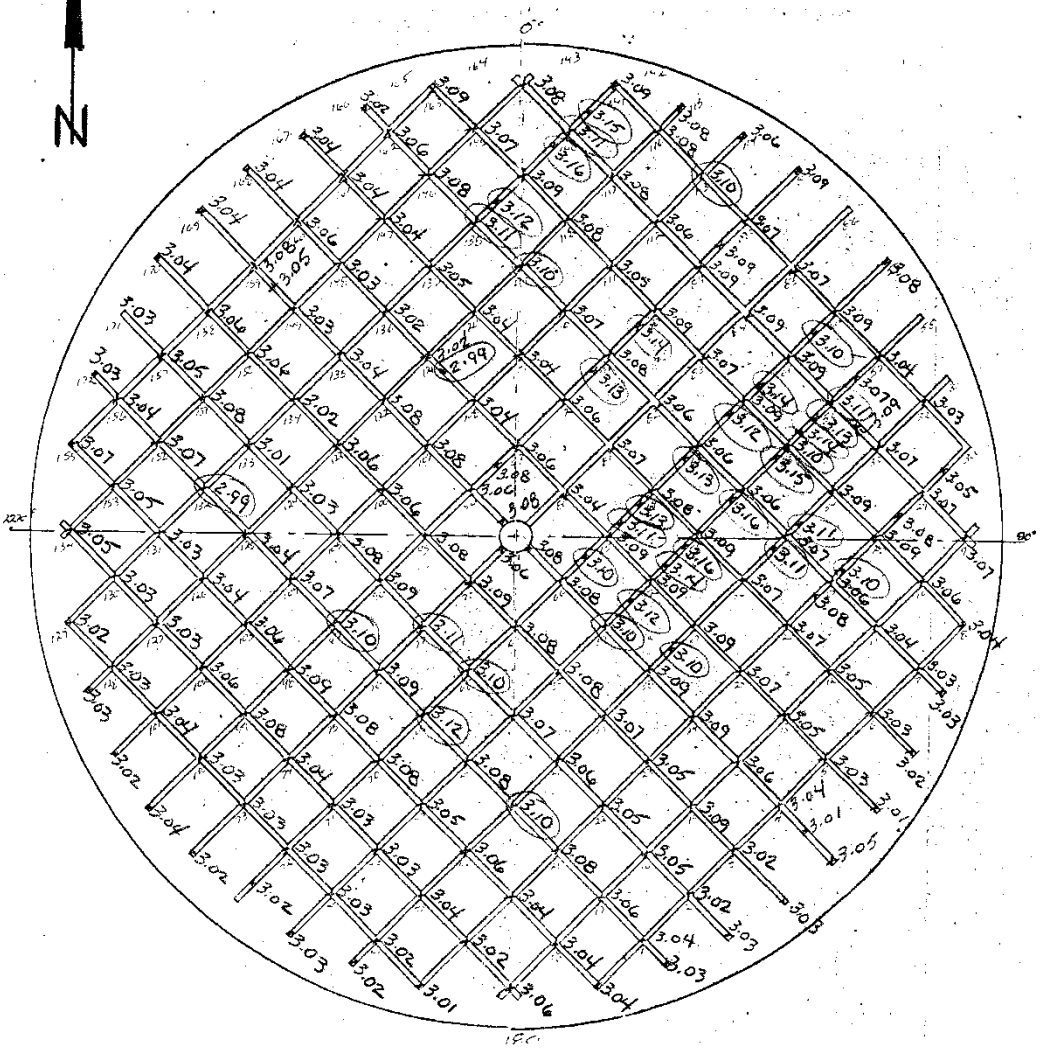
(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905

ATTACHMENT TO NCR B-340-51

TANK FOUNDATION 102
DRAIN SLOT ELEVATIONS



NOTE: #1. Add 620.00 to all readings shown.

#2. Out of tolerance elevations are circled.

#3. Elevation data is taken from Survey Data Reports of 1-10-84, 1-11-84 and 1-27-84.

App. Figure B-39. Nonconformance Report B-340-53

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE III)

(1C) NCR No.: B-340-53 (1520-36)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C3, Section 03300, Paragraph 2.1.4.2:

Slump: 4 inch maximum in accordance with ACI 301, Section 3.5.

NONCONFORMANCE DESCRIPTION

Concrete placed on 2-1-84 for pour back of cold joint on Tank Base (102) was a 6" slump. (Reference NCR #24) Approximately one cubic yard of concrete was placed.

(1J) Distribution

DOE
~~*G S Rokkan~~
*KK Lucas
RHO
*D L Bjorklund
*R J Hennig
*S Joncus
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*J W Middleton
R L Hand
R M Iten
~~*J E Morgan~~ DH BROWN
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date, J.W. MIDDLETON 2-1-84 KEH FIELD ENGINEERING

(1H) Supervisory Review

(2A) Disposition
- [X] Accept As Is
- [X] ~~Conditional Accept~~
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Conditional accept. Acceptance shall be based on break strength of cylinders at 28 days.

2C) The concrete strength shall meet the requirements of the specification.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 2/3/84	Safety 2-3-84	Engr.	AI (ASME) N/A
IA	QA 2-6-84	PE 2-6-84	QA 2-6-84	DOE 4/9/84

(3A)
- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

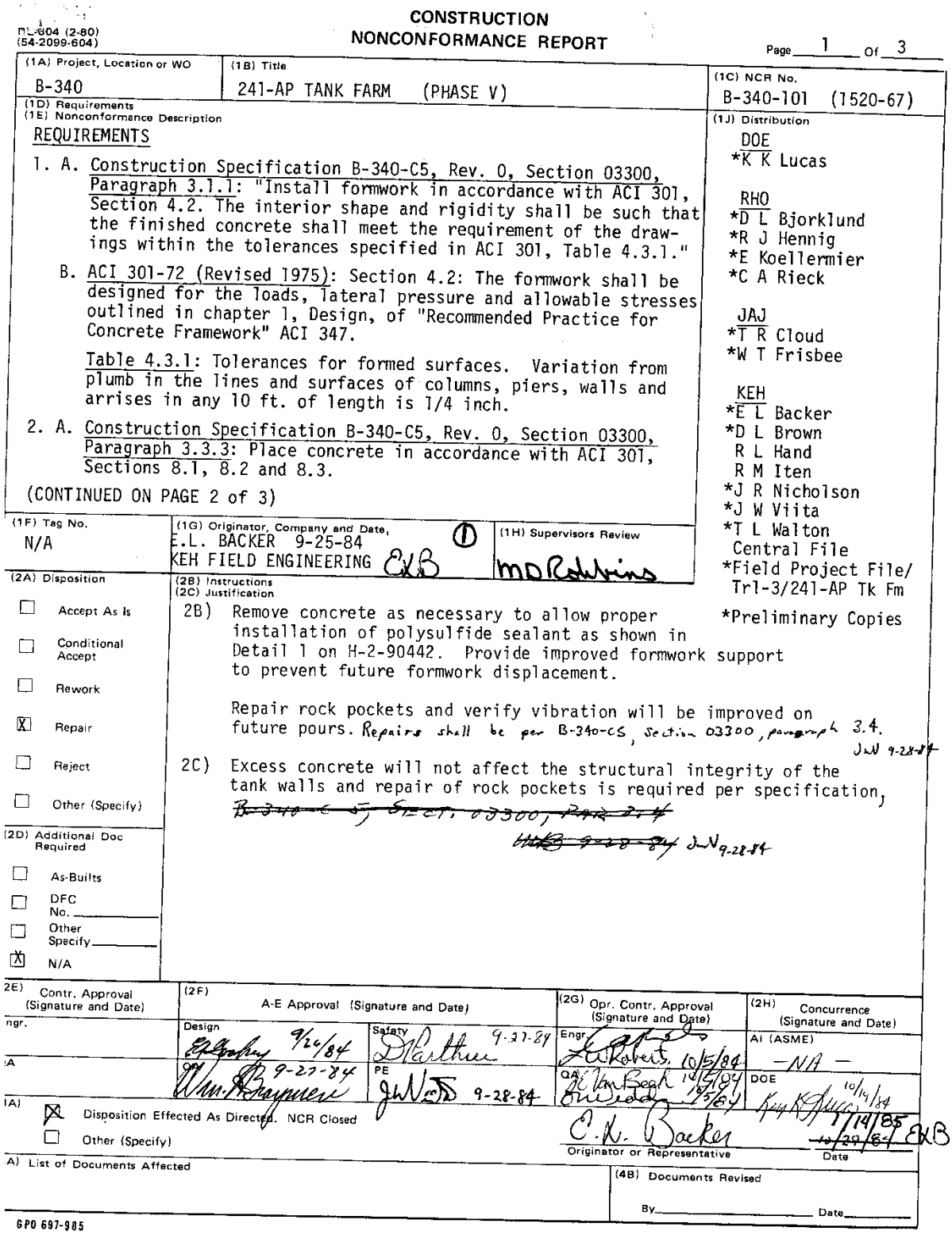
Originator or Representative — Date 3-2-84

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-905

App. Figure B-40. Nonconformance Report B-340-101



CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 3

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No.: B-340-101 (1520-67)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Construction Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.1.1: "Install formwork in accordance with ACI 301, Section 4.2. The interior shape and rigidity shall be such that the finished concrete shall meet the requirement of the drawings within the tolerances specified in ACI 301, Table 4.3.1."

   B. ACI 301-72 (Revised 1975): Section 4.2: The formwork shall be designed for the loads, lateral pressure and allowable stresses outlined in chapter 1, Design, of "Recommended Practice for Concrete Framework" ACI 347.

   Table 4.3.1: Tolerances for formed surfaces. Variation from plumb in the lines and surfaces of columns, piers, walls and arrises in any 10 ft. of length is 1/4 inch.

2. A. Construction Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.3.3: Place concrete in accordance with ACI 301, Sections 8.1, 8.2 and 8.3.

(CONTINUED ON PAGE 2 of 3)

(1J) Distribution

DOE
*K K Lucas

RHO
*D L Bjorklund
*R J Hennig
*E Koellermier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: E.L. BACKER 9-25-84 KEH FIELD ENGINEERING E.L.B. ①

(1H) Supervisors Review: M D Robbins

(2A) Disposition
- ☐ Accept As Is
- ☐ Conditional Accept
- ☐ Rework
- ☒ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Remove concrete as necessary to allow proper installation of polysulfide sealant as shown in Detail 1 on H-2-90442. Provide improved formwork support to prevent future formwork displacement.

Repair rock pockets and verify vibration will be improved on future pours. Repairs shall be per B-340-C5, Section 03300, paragraph 3.4. JWN 9-28-84

2C) Excess concrete will not affect the structural integrity of the tank walls and repair of rock pockets is required per specification, ~~B-340-C5, Sect. 03300, Par. 3.4~~ ~~E.L.B. 9-28-84~~ JWN 9-28-84

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
ngr.	Design: E.P. Graham 9/26/84	Safety: D Barthuer 9-27-84	Engr: L Roberts 10/5/84	AI (ASME): -NA-
A	W.R. Baumann 9-27-84	PE: JWN 9-28-84	QA: W.M. Beagh 10/5/84	DOE: Kay K Lucas 10/14/84

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

C.N. Backer — Originator or Representative — Date: ~~10/29/84~~ 7/14/85 E.L.B.

(4A) List of Documents Affected

(4B) Documents Revised By ____ Date ____

GPO 697-985

NCR B-340-101 (1520-67)

REQUIREMENTS (Continued)

2. B. ACI 301-72 (Revised 1975): Section 8.3.4 - Consolidation: All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting or planes of weakness.

NONCONFORMANCE DESCRIPTION

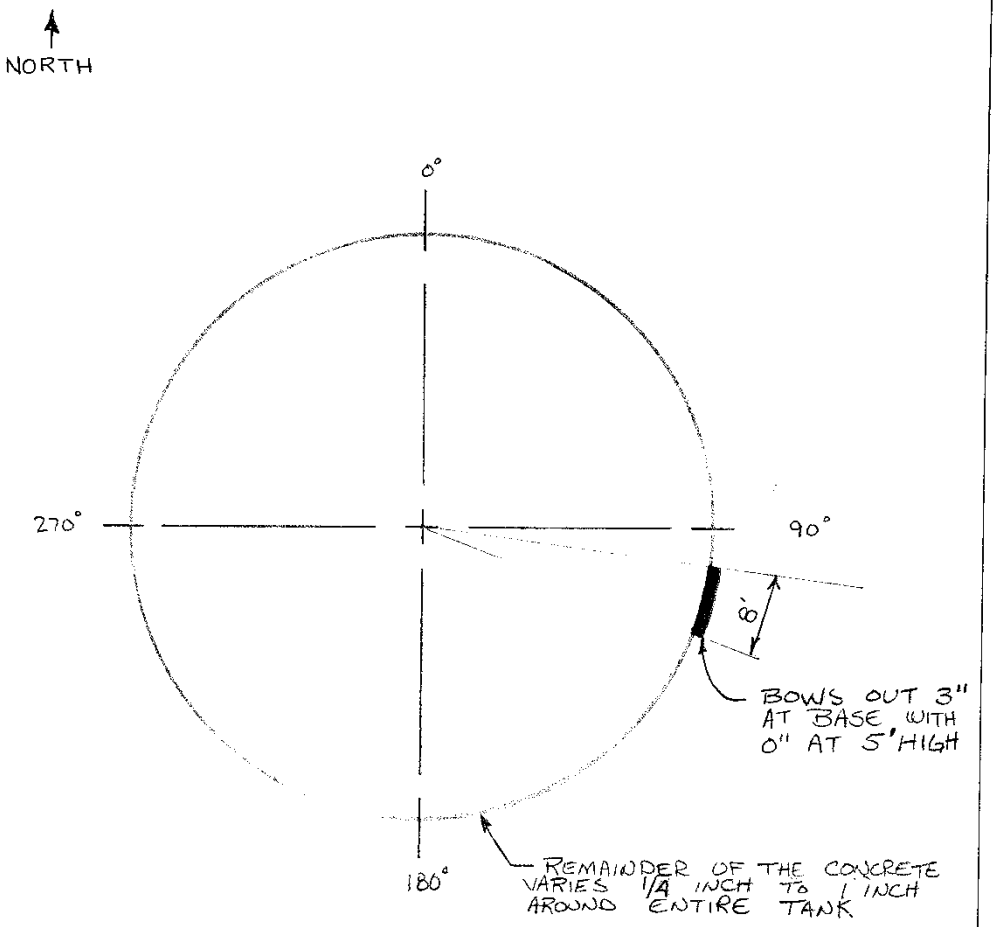
Tank 108: During placement of concrete, forms gave way (see Attached Sketch #1). Also, vibration was not performed adequately, causing some rock pockets on the surface approximately 4 inches deep.

KAISER ENGINEERS HANFORD

FIELD SKETCH 9/25/84

Attachment To Or Description:
NCR B-340-101 (1520-67)

Sheet 1 of 1



SKETCH NO. 1
TANK 108

KEH-159.2 (4-82)

App. Figure B-41. Nonconformance Report B-340-107

RL (54-80)
(54-04)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No.: B-340-107 (1520-70)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C-5 Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8 and ACI 318, Section 4.8.3.

   B. Specification B-340-C5 Rev 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4 Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K. K. Lucas

ROCKWELL
*D. L. Bjorklund
*R. J. Hennig
*E. Koellermeier
*C. A. Rieck

JAJ
*T. R. Cloud
*W. T. Frisbee

KEH
*E. L. Backer
*D. L. Brown
R. L. Hand
R. M. Iten
*J. R. Nicholson
*J. W. Viita
*T. L. Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.: N/A

(1G) Originator, Company and Date: E. L. BACKER 10/31/84 KEH FIELD ENGINEERING

(1H) Supervisors Review: MD Robbins

(2A) Disposition
- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is - Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: 11/2/84	Safety: 11/2/84	Engr. 11/14/84	AI (ASME): —NA—
QA	QA: 10-2-84	PE: 11-5-84	QA 11/14/84	DOE: 11/15/84

(3A)
- [X] Disposition Effected As Directed. NCR Closed. CURE WAS IMPROVED
- [ ] Other (Specify)

MD Robbins — Originator or Representative — Date 11/16/84

(4A) List of Documents Affected: NONE

(4B) Documents Revised: By ____ Date ____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-107 (1520-70)
Page 2 of 2

NONCONFORMANCE
DESCRIPTION

Tank 107 lower shell concrete breaks at 28 days: Field cured cylinders failed to make 5000 psi or 85% of lab cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1	3178-3	5980	0.85(5980) = 5083
	3178-4	5940	0.85(5940) = 5049
	3178-5 (FC)	4920	
	3178-6 (FC)	4830	
2	3178-9	5910	
	3178-10	5960	
	3178-11 (FC)	4600	0.85(5910) = 5024
	3178-12 (FC)	4650	0.85(5960) = 5066
3	3178-15	6230	0.85(6230) = 5296
	3178-16	6170	0.85(6170) = 5245
	3178-17 (FC)	4850	
	3178-18 (FC)	4780	

ELB/lv

App. Figure B-42. Nonconformance Report B-340-108

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM PHASE V

(1C) NCR No.: B-340-108 (1520-71)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6 and 16.3.8 and ACI 318, Section 4.8.3

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4 Procedures for protecting and curing concrete shall be improved when strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K. K. Lucas

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*D. L. Bjorklund
*R. J. Hennig
*E. Koellermeier
*C. A. Rieck

JAJ
*T. R. Cloud
*W. T. Frisbee

KEH
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*J. R. Nicholson
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*T. L. Walton
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*Field Project File/ Trl-3/241-AP Tk Fm

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(1F) Tag No.: N/A

(1G) Originator, Company and Date: E. L. BACKER 10/31/84 KEH FIELD ENGINEERING

(1H) Supervisors Review: MDRobbins

(2A) Disposition
- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is - Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: E L Backer 11/2/84	Safety: Jay Wells 11/2/84	Engr: C Wolaver 11/14/84	AI (ASME): -NA-
QA	QA: Wm Chapman 11-2-84	PE: J W Viita 11-5-84	QA: Van Beek 11/15/84	DOE: K K Lucas 11/15/84

(3A)
- [X] Disposition Effected As Directed. NCR Closed CURE WAS improved
- [ ] Other (Specify)

MDRobbins 11/16/84
Originator or Representative Date

(4A) List of Documents Affected: NINE

(4B) Documents Revised By ____ Date ____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-108 (1520-71)
Page 2 of 2

NONCONFORMANCE
DESCRIPTION

Tank 108 upper shell concrete breaks at 28 days: Field cured cylinders failed to make 5000 psi or 85% of lab cured cylinders.

Test No.	Cylinder No.	PSI @ 28 days	
1	3179-3	5780	.85(5780) = 4913
	3179-4	5870	.85(5870) = 4990
	3179-5 (FC)	4930	
	3179-6 (FC)	4860	
2	3179-9	5960	.85(5960) = 5066
	3179-10	5930	.85(5930) = 5041
	3179-11 (FC)	4700	
	3179-12 (FC)	4700	
3	3179-15	5860	.85(5860) = 4981
	3179-16	5730	.85(5730) = 4871
	3179-17 (FC)	4900	
	3179-18 (FC)	4900	

ELB/lv

App. Figure B-43. Nonconformance Report B-340-109

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE V)	B-340-109 (1520-72)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K. K. Lucas

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*E. Koellermeier
*C. A. Rieck

JAJ
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*Field Project File/ Trl-3/241-AP Tk Fm

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(1F) Tag No.

(1G) Originator, Company and Date: E. L. Backer 11/2/84 KEH Field Engineering

(1H) Supervisors Review: CAB MDRobbins

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is - Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: EL Backer 11/7/84	Safety: 11-7-84	Engr: 11/14/84	AI (ASME): -NA-
QA	QA: 11-7-84	PE: JWViita 11-8-84	PE: 11/14/84	DOE: 11/15/84

(3A)
- [X] Disposition Effected As Directed, NCR Closed — CURE WAS IMPROVED
- [ ] Other (Specify)

MDRobbins 11/16/84
Originator or Representative Date

(4A) List of Documents Affected: NONE

(4B) Documents Revised By ____ Date ____

☆ U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

B-340-109 (1520-72)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank 102 lower shell concrete breaks at 28 days: Field cured cylinders failed to make 5000 psi or 85% of lab cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1	3180-3 (FC)	4510	
	-4 (FC)	4550	
	-5	5850	0.85(5850) = 4973
	-6	6050	0.85(6050) = 5143
2	3180-9 (FC)	4490	
	-10 (FC)	4650	
	-11	5610	0.85(5610) = 4769
	-12	5770	0.85(5770) = 4905
3	3180-15 (FC)	4550	
	-16 (FC)	4690	
	-17	6630	0.85(6630) = 5636
	-18	6310	0.85(6310) = 5364

ELB/lv

App. Figure B-44. Nonconformance Report B-340-111

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (Phase V)	B-340-111 (1520-74)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 PSI at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K. K. Lucas

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*R. J. Hennig
*E. Koellermeier
*C. A. Rieck

JAJ
*T. R. Cloud
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*J. W. Viita
*T. L. Walton
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(1F) Tag No.	(1G) Originator, Company and Date	(1H) Supervisors Review
	E. L. Backer 11/7/84 (8) ELB KEH Field Engineering	MD Robbins

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is - Contractor shall improve precedures for protecting and curing concrete as required by ACI-318, Section 4.8.3. Future NCR's for low strength field cured cylinder results are not necessary unless they fall below 4250 psi.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design E. Backer 11/12/84	Safety D. Barthree 11/12/84	Engr. [illegible] 11/27/84	AI (ASME) -NA-
QA	QA Wm. Bergquam 11-12-84	PE J. W. Viita 11-13-84	QA M. Barbe 11/27/84	DOE K. K. Lucas 11/29/84

(3A)

- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

E. L. Backer 11/29/84
Originator or Representative — Date

(4A) List of Documents Affected	(4B) Documents Revised
None	By ____ Date ____

☆ U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-111 (1520-74)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank 107 upper shell concrete breaks at 28 days: field cured cylinders failed to make 5000 PSI or 85% of lab cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1	3181-3	5570	0.85(5570) = 4735
	-4	5660	0.85(5660) = 4811
	-5 (FC)	4320	
	-6 (FC)	4210	
2	3181-9	5590	0.85(5590) = 4752
	-10	5660	0.85(5660) = 4811
	-11 (FC)	4420	
	-12 (FC)	4320	
3	3189-15	5640	0.85(5640) = 4794
	-16	5570	0.85(5570) = 4735
	-17 (FC)	3960	
	-18 (FC)	3960	

ELB/lv

App. Figure B-45. Nonconformance Report B-340-114

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No. 1520-76
B-340-114

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K. K. Lucas

ROCKWELL
*D. L. Bjorklund
*R. J. Hennig
*E. Koellermeier
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JAJ
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*W. T. Frisbee

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*D. L. Brown
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R. M. Iten
*J. R. Nicholson
*J. W. Viita
T. L. Walton
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(1F) Tag No.

(1G) Originator, Company and Date,
H. H. GLASSEY 11/15/84 (8)
KEH FIELD ENGINEERING

(1H) Supervisors Review
MD Robbins

(2A) Disposition
- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is. Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

2B) continued
On future pours, Field Engineering should take additional laboratory and field cylinders for testing at a later date (i.e. 45 days) to determine the adequacy of field curing.

2C) continued
These additional cylinders may be discontinued when curing and protection procedures verify the adequacy of field curing.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 11-26-84	Safety 11-26-84	Engr. 11/30/84	AI (ASME) -NA-
QA	QA 11-26-84	PE 11-28-84	QA 11/30/84	DOE 12/4/84

(3A)
- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Originator or Representative — Date 12-5-84

(4A) List of Documents Affected
none

(4B) Documents Revised
By ____ Date ____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-114 (1520-76)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank 101 upper shell concrete breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI at 28 Days	
1.	3184-3	5700	0.85(5700) = 4845
	3184-4	5840	0.85(5840) = 4964
	3184-5 (FC)	4180	
	3184-6 (FC)	4270	
2.	3184-9	5890	0.85(5890) = 5007
	3184-10	5820	0.85(5820) = 4947
	3184-11 (FC)	4160	
	3184-12 (FC)	4120	
3.	3184-15	6050	0.85(6050) = 5143
	3184-16	5900	0.85(5900) = 5015
	3184-17 (FC)	4070	
	3184-18 (FC)	4240	

HHG/lv

App. Figure B-46. Nonconformance Report B-340-116

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No. 1520-78
B340-116

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K. K. Lucas

ROCKWELL
*D. L. Bjorklund
*R. J. Hennig
*E. Koellermeier
*C. A. Rieck

JAJ
*T. R. Cloud
*W. T. Frisbee

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(1F) Tag No.

(1G) Originator, Company and Date, E. L. Backer 11/15/84 KEH Field Engineering

(1H) Supervisors Review: MD Robbins

(2A) Disposition

- [X] Accept As is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is. Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

2B) continued
On future pours, Field Engineering should take additional laboratory and field cylinders for testing at a later date (i.e. 45 days) to determine the adequacy of field curing.

2C) continued
These additional cylinders may be discontinued when curing and protection procedures verify the adequacy of field curing.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 11/21/84	Safety 11-26-84	Engr. 11/24/84	AI (ASME) – NA –
QA	QA 11-26-84 11-28-84	PE 11-28-84	QA 11/28/84	DOE 12/4/84

(3A)

- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Originator or Representative: E. L. Backer Date: 12/5/84

(4A) List of Documents Affected: None

(4B) Documents Revised By ____ Date ____

GPO 697-805

NCR B-340-116 (1520-78)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank 102 upper shell concrete breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days
1.	3183-3	5940 0.85(5940) = 5049
	-4	5990 0.85(5990) = 5092
	-5 (FC)	3800
	-6 (FC)	3820
2.	3183-9	6730 0.85(6730) = 5720
	-10	6840 0.85(6840) = 5814
	-11 (FC)	4190
	-12 (FC)	4190
3.	Field cured cylinders acceptable	

ELB/lv

App. Figure B-47. Nonconformance Report B-340-117

RL-604 (2-80)
(54-2099-504)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No. (1520-79)
B-340	241-AP TANK FARM (PHASE V)	B-340-117

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*KK Lucas

ROCKWELL
*DL Bjorklund
*RJ Hennig
*E Koellermeier
*CA Rieck

JAJ
*TR Cloud
*WT Frisbee

KEH
*HH Glassey
*DL Brown
RL Hand
RM Iten
*JR Nicholson
*JW Viita
TL Walton
Central File
*Field Project File/
Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
	H. H. Glassey KEH Field Engineering 11/16/84	MD Collins

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is. Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements.

2B) continued
On future pours, Field Engineering should take additional laboratory and field cylinders for testing at a later date (i.e. 45 days) to determine the adequacy of field curing.

2C) continued
These additional cylinders may be discontinued when curing and protection procedures verify the adequacy of field curing.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 11/21/84	Safety 11-28-84	Engr. 11/26/84	AI (ASME) -NA-
QA	QA 11-28-84	PE 11-28-84	QA Donna Turner 11/26/84	DOE 12/4/84

(3A)

- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Originator or Representative 12-5-84 Date

(4A) List of Documents Affected

None

(4B) Documents Revised

By ____ Date ____

GPO 697-905

NCR B-340-117 (1520-79)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank #106 lower shell concrete breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI at 28 Days
1.	3185-3 (FC)	4010
	3185-4 (FC)	4330
	3185-5	6140 0.85(6140) = 5219
	3185-6	6010 0.85(6010) = 5109
2.	3185-9 (FC)	3730
	3185-10 (FC)	4040
	3185-11	5680 0.85(5680) = 4828
	3185-12	5750 0.85(5750) = 4888

HHG/lv

App. Figure B-48. Nonconformance Report B-340-118

97609

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 Of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM - PHASE IV	1520-80 B-340-118

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS:

1. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.3.4. Temper concrete only as permitted in ACI 301, Section 7.5.

2. ACI 301-72 (Revised 1975), Paragraph 7.5 Tempering and control of mixing water.

DESCRIPTION:

During concrete placement on Tank 102 Dome, water inside the tank came out of the filler holes and entered the concrete. The amount of water is not known. The tank was full of water treated with 3500 pounds of Sodium Bicarbonate.

(1J) Distribution

DOE
* K K Lucas

ROCKWELL
* D L Bjorklund
* R J Hennig
* E Koellermeier
* C A Rieck

JAJ
* T R Cloud
* W T Frisbee

KEH
* M D Robbins
* D L Brown
R L Hand
R M Iten
* J R Nicholson
* J W Viita
T L Walton
Central File
* Field Project File/ Trl-3/241-AP Tk Fm

* Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
	M. D. ROBBINS KEH FIELD ENGINEERING 11/21/84 MDR	

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is. Per telephone conversation with field engineering, the water washed over the surface of a completed area of the pour washing away sand and cement and exposing some aggregate. This damaged surface area will be repaired in accordance with Section 03300, paragraph 3.4 of Specification B-340-C5.

2C) The concentration of sodium bicarbonate in the tank water is less than 350 parts per million. Concentrations greater than 1000 ppm in the mixing water may cause a reduction in setting time and 28 day concrete strength. Ref PCA Engineering Bulletin, EB 001.11T, "Design & Concrete Mixtures". The tank water was not used for mixing water and was not allowed to mix in the fresh concrete, Thereby causing no chemical damage to the fresh concrete. The physical damage will be corrected during repair of the concrete surface.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. _____
- [ ] Other Specify _____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 12/3/84	Safety 12-4-84	Engr. 12/10/84	AI (ASME) — NA —
QA	QA 12-4-84	PE 12-4-84	QA 12/10/84	DOE 12/11/84

(3A)

- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Michael D Robbins 12-12-84
Originator or Representative Date

(4A) List of Documents Affected	(4B) Documents Revised
None	By _____ Date _____

RPP 607-QNR

App. Figure B-49. Nonconformance Report B-340-120

RL-204 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No. (1520-81) B-340-120

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318,Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
T L Walton
Central File
*Field Project File/ 241-AP Tk Fm/Trl-3

(1F) Tag No.

(1G) Originator, Company and Date, E. L. BACKER 11/26/84, KEH FIELD ENGINEERING

(1H) Supervisors Review: M D Robbins

(2A) Disposition

- [X] Accept As Is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Accept as is. Contractor shall improve procedures for protecting and curing concrete as required by ACI-318, Section 4.8.3. On future pours, Field Engineering should take additional laboratory and field cylinders for testing at a later date, (i.e. 45 days), to determine the adequacy of field curing.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance is based on lab cured cylinders which meet specified requirements. These additional cylinders may be discontinued when curing and protection procedures verify the adequacy of field curing.

(2D) Additional Doc Required

- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design W L Gahey 12/3/84	Safety D Parthree 12-4-84	Engr [illegible] 12/11-84 / 12/16/84	AI (ASME) N/A
QA	QA [illegible] 12-4-84	PE [illegible] 12-4-84	QA [illegible] 12/11/84	DOE [illegible] 12/13/84

(3A)
- [X] Disposition Effected As Directed, NCR Closed
- [ ] Other (Specify)

E. L. Backer 12/17/84
Originator or Representative Date

(4A) List of Documents Affected: None

(4B) Documents Revised By ____ Date ____

GPO 697-905

NCR B-340-120 (1520-81)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank 106 Upper Shell concrete breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1.	3186-3 (FC)	4050	
	-4 (FC)	4210	
	-5	6460	0.85(6460) = 5491
	-6	6370	0.85(6370) = 5415
3.	3186-15 (FC)	4130	
	-16 (FC)	4130	
	-17	6360	0.85(6360) = 5406
	-18	6410	0.85(6410) = 5449

ELB/lv

App. Figure B-50. Nonconformance Report B-340-121

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 3

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM, PHASE V

(1C) NCR No. 1520-82
B-340-121

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.6.2. Protect concrete during ..., and during cold weather in accordance with ACI 306R.

ACI 306R-78, Table 1.4.1

Recommended concrete temperatures minimum concrete temperature as placed and maintained for 12-36 in.section 50°F.

DESCRIPTION

Temperature of concrete placed on dome of Tank 106 dropped below 50° to a low of 43° in one location. (For locations of thermocouples and for a chart of hourly temperatures, see attachments 1 and 2.)

(1J) Distribution

DOE
*K. K. Lucas

ROCKWELL
*D. L. Bjorklund
*R. J. Hennig
*E. Koellermeier
*C. A. Rieck

JAJ
*T. R. Cloud
*W. T. Frisbee

KEH
*J. D. Young
*D. L. Brown
R. L. Hand
R. M. Iten
*J. R. Nicholson
*J. W. Viita
T. L. Walton
Central File
*Field Project File/ Trl-3/241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date: J. D. Young 12/6/84 KEH Field Engineering (1)

(1H) Supervisors Review: MD Rollins

(2A) Disposition

- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Conditional Accept - Provide additional protection time to develop compressive strength comparable to those areas better protected. Acceptance will be based on results of field cured cylinders. **

2C) The concrete temperature did not reach freezing and thus the ability to develop full compressive strength was not impaired.

**The seven day field strength tests averaged 4005 psi and seven day lab strength tests averaged 4530 psi, indicating no damage to concrete due to low initial curing temperature. Additional protection requirements will not be necessary. 1/2/85

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 12/10/84	Safety 12-12-84	Engr. 11/3/85 1/9/85	AI (ASME) —
QA	QA 12-10-84 1-2-85	PE 1-2-85 12-10-84	QA 1-3 85	DOE 1/17/85

(3A)
- ☑ Disposition Effected As Directed, NCR Closed
- ☐ Other (Specify)

J. D. Young — Originator or Representative — 1-21-85 Date

(4A) List of Documents Affected: None

(4B) Documents Revised By ____ Date ____

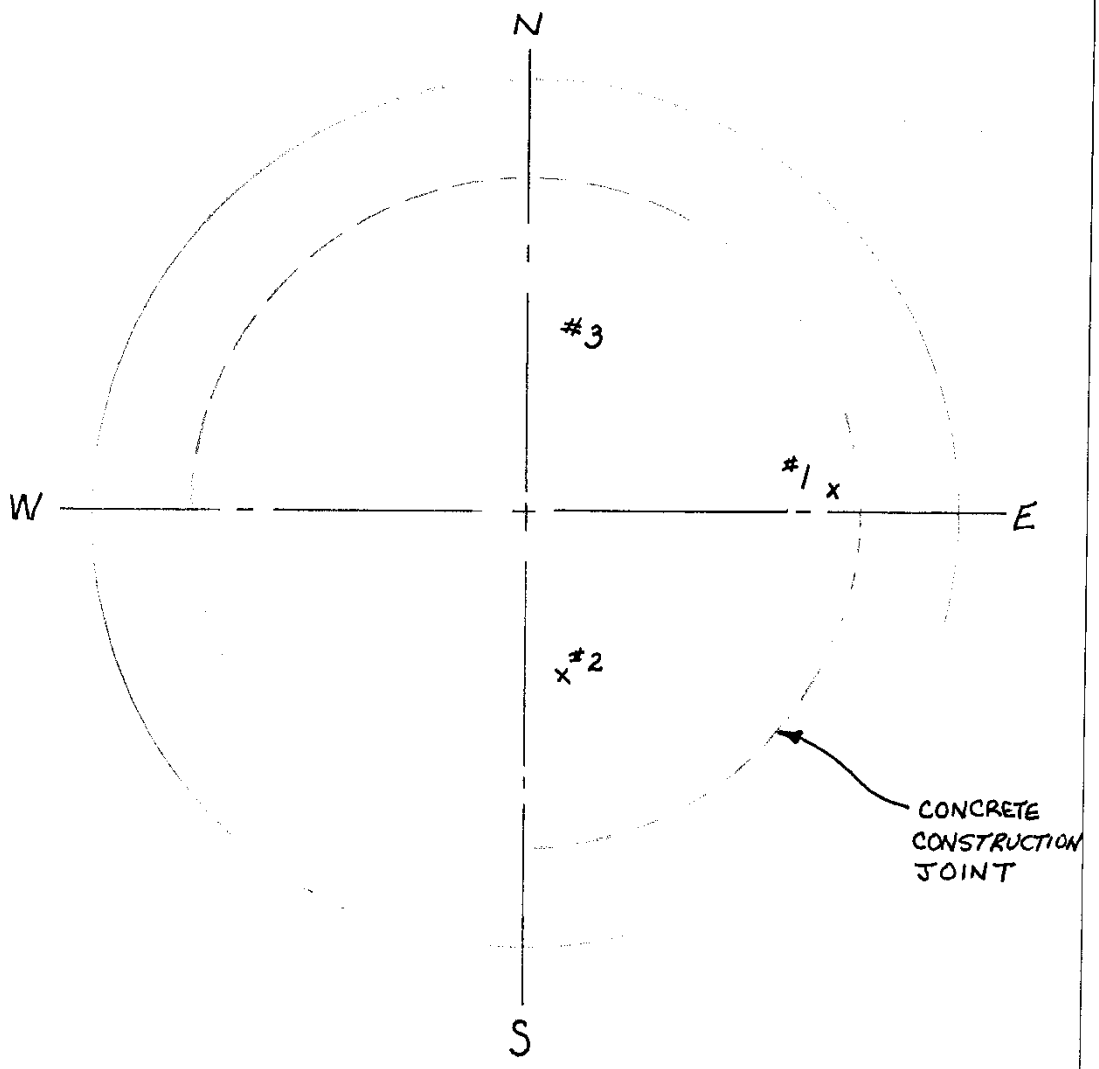
GPO 697-805

KAISER ENGINEERS HANFORD

FIELD SKETCH

Attachment To Or Description:
NCR B-340-121 (1520-82)

Sheet 2 of 3



THERMOCOUPLE LOCATIONS TK 106 DOME

KEH-159.2 (4-82)

NCR B-340-121 (1520-82)
Page 3 of 3

		#1	#2	#3	Amb.
1:00	p.m.	47	62	56	--
2:00	"	47	61	55	--
3:00	"	47	60	54	35
4:00	"	46	59	53	32
5:00	"	45	58	52	30
6:00	"	45	57	52	27
7:00	"	45	56	50	26
8:00	"	44	55	49	24
9:00	"	44	55	49	23
10:00	" * NOTE	43	54	48	23
11:00	"	43	53	49	22
12:00	a.m. 12/5/84	43	53	50	22
1:00	"	44	53	51	22
2:00	"	45	54	53	21
3:00	"	45	54	54	21
4:00	"	46	55	56	21
5:00	"	47	56	58	20
6:00	"	47	57	59	20
7:00	"	48	58	61	19
8:00	"	48	59	62	19
9:00	"	49	59	63	21
10:00	"	50	60	64	22
11:00	"	50	60	65	23
12:00	p.m.	51	61	65	24
1:00	"	52	62	67	25
2:00	"	53	63	67	26
3:00	"	54	63	68	27
4:00	"	54	64	68	25
5:00	"	55	64	68	24
6:00	"	55	65	68	23
7:00	"	55	65	68	22
8:00	"	55	65	69	22
9:00	"	55	66	68	21
10:00	"	55	66	68	22
11:00	"	55	66	68	21
12:00	a.m. 12/6/84	55	66	68	20
1:00	"	55	66	68	20
2:00	"	55	66	68	20
3:00	"	55	66	68	20
4:00	"	55	66	68	18
5:00	"	55	66	68	19
6:00	"	54	66	68	22
7:00	"	54	66	67	23

*NOTE- Cure blankets applied at this time.

App. Figure B-51. Nonconformance Report B-340-124

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No. 1520-84
B-340-124

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File
241-AP/Tk Fm/Trl-3

*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date, E. L. Backer 12/13/84 KEH Field Engineering

(1H) Supervisors Review

(2A) Disposition
- [X] Accept As Is
- [X] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance of concrete strength requirements is based on lab cured cylinders which meet specified requirements.

2B Rev 1 and 2C Rev 1, see page 2 of 2

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No.
- [ ] Other Specify
- [X] N/A

Rev 1 Signatures/Rev 2 Reinitial

Design	Safety	Engr	AI (ASME)
1/15/85	11/5/85	1/17/85	
QA	**PE**	**QA**	**DOE**
1-15-85	1-16-85	1/29/85	1/28/85

(2E) Contr. Approval (Signature and Date)

(2F) A-E Approval (Signature and Date)

(2G) Opr. Contr. Approval (Signature and Date)

(2H) Concurrence (Signature and Date)

Engr.	Design	Safety	Engr	AI (ASME)
	12/27/84	12/27/84	1/2/85	
QA	**QA**	**PE**	**QA**	**DOE**
	12/27/84	12-27-84	1-3-85	1/3/85

(3A)
- [X] Disposition Effected As Directed/NCR Closed
- [ ] Other (Specify)

Originator or Representative — Date 3-28-85

(4A) List of Documents Affected

(4B) Documents Revised By _____ Date _____

☆ U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-124 (1520-84)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Tank 107 Dome - Concrete cylinder breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days
1	3193-3 (FC)	3240
	-4 (FC)	3340
	-5	6080 0.85(6080) = 5168
	-6	6030 0.85(6030) = 5126
2	3193-10 (FC)	3610
	-11 (FC)	3640
	-12	6400 0.85(6400) = 5440
	-13	6330 0.85(6330) = 5381

2B) Instructions Rev 1

Acceptance of curing and protection of the concrete pour shall be based on the results of tests on 45 day field cylinders taken for the dome and/or haunch pours on tanks 103, 104, 105 and 106.

2C) Justification Rev 1

Additional cylinders for 45 day strength tests are not available on this tank for testing. The results of tests on field cured cylinders from other tanks with the same concrete mix, protected by the same methods and exposed to similar weather extremes will verify the concrete will develop the specified strength.

2B) Instructions Rev 2

Accept as is

2C) Justification Rev 2

See attached letter dated 3/20/85 by EA Goakey and JW Viita.

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution

DATE March 20, 1985

FROM E. A. Goakey
J. W. Viita

COPIES TO

JOB NO.

SUBJECT Project B-340, NCR's B-340 - 124, 127, 129 and 134

These NCR's were written because the field cured cylinder breaks did not meet the ACI guideline of being within 85% of the laboratory cured breaks. Acceptance of the concrete mix is based on the laboratory breaks where the field breaks indicate the acceptability of the curing procedures in place and the effect the weather may have on the in-place concrete.

Acceptance of NCR #134 per the original disposition was to be based on 45 day cylinder breaks for that pour. Acceptance of the other 3 NCR's was to be based on 45 day breaks for those pours for which spare cylinders were available since all curing blankets and heat were removed from all pours after the first week.

The results of the 28 day and 45 day field cured cylinder breaks are summarized as follows:

	Pour Slip #	28 day F.C.	45 day F.C.
Tank 103 Dome	3207	4308 psi	4198 psi
104 Dome	3204	4710	4905
105 Dome	3208	4720	4408
106 Dome	3202	4960	4832
106 Haunch	3200	5342	5660
104 Haunch	3203	4278	4725
103 Haunch	3205	4560	5042
105 Haunch	3206	5090	5110
	Average	4746 psi	4860 psi

The average 28 day Field Cured cylinder breaks for the pours with the open NCR's is:

	NCR #	28 day F.C.
107 Dome	124	3458 psi
102 Dome	127	4020
101 Dome	129	4205
103 Dome	134	4308
	Average	3998 psi

The specified concrete strength is 5000 psi for laboratory cured cylinders at 28 days. Using 85% for field cured cylinders would give us a value of 4250 psi for field cured cylinders. The average strength gain demonstrated by the 45 day cylinder breaks was lower than expected and does not give a firm indication that the field strength would meet the 4250 psi figure but does show that the concrete is continuing to gain strength despite the prolonged period of cold weather.

DOE Richland, WA

Interoffice Memorandum
March 20, 1985

There are some notable inconsistancies in the test data such as the decrease in strength from 28 day field cure to 45 day field cure for 3 of the 8 pours for which 45 day field breaks are available. Due to these inconsistancies, it was decided to perform some tests on the in-place concrete with the Windsor Probe.

The Windsor Probe is approved for use by ASTM in comparing the relative strengths of concrete but not in determining the actual strength. To obtain a comparison to concrete which is known to be acceptable, testing was done on the Tank 108 dome in addition to the 4 domes with open NCR's. The Tank 108 dome had an average 28 day field cure strength of 4890 psi and a laboratory cure strength of 6325 psi.

A predicted field cure strength of the concrete was obtained by comparing the Windsor Probe results for Tank 108 and the other domes with the field cure strength for Tank 108. The following formula was used:

$$\frac{\text{Probe results Tank "X"}}{\text{Probe results Tank 108}} \times 4890 \text{ psi} = \text{Predicted Field Cure Strength}$$

Windsor Probe results for Tank 108 indicated an average strength of 5150psi (8 tests) (concrete age of 113 days)

Tank	Windsor Probe Strength	Predicted Strength	Age of Concrete
107	5213 psi (8 tests)	4949 psi	101 days
102	4933 (6 tests)	4685	106
101	5040 (5 tests)	4787	98
103	4530 (6 tests)	4303	82

(Tank 103 was tested twice. There were problems with the roughness of the concrete surface possibly effecting the results of the test so the first test was discarded; the test locations were ground to an acceptable smoothness (allowed by ASTM) and new tests performed.)

The results indicate predicted field cure strength in excess of 4250 psi with an actual increase of essentially zero (0) (4303 versus 4308) for the Tank 103 dome to approximately 1500 psi for the Tank 107 dome when compared to the field cured cylinder results. These predicted strengths are considered somewhat conservative since the base results from Tank 108 have the longest cure time with Tank 103 having 31 days less cure time.

In summary, considering the Windsor Probe results on the in-place concrete along with the cylinder test results (both lab. cured and field cured) all encasement concrete will develop the required strength to properly perform as intended in the design. Some of the individual tests may indicate a problem but the overall results indicate that the contractor has supplied and placed the concrete as specified

JWV/ss

Distribution: Attachment to NCR B-340-124
Attachment to NCR B-340-127
Attachment to NCR B-340-129
Attachment to NCR B-340-134
EA Goakey
JW Viita File
Central File
LB

KAISER ENGINEERS HANFORD — **INSPECTION REPORT**

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B-340	PHASE V	2-23-85	2-26-85		

DISCIPLINE		JOB SITE ACTIVITY	YES	NO	WEATHER EFFECT INFORMATION	YES	NO
Civil/Structural	☒	Site visited	☒	☐	Construction hindered by weather	☐	☒
Mechanical	☐				Work rejected due to weather	☐	☒
HVAC	☐	Construction in progress (personal observation)	☐	☒	Conditions/Comment		
Electrical	☐						
Instrumentation	☐						

INSPECTION

Item	Acc	Rej	Other Documentation
No NCR this item. Pour Slip #2189 Tk 108 Dome. Cyl. tests were on comparison use as basis of -			

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING FOR COMPRESSIVE STRENGTH OF TANK 108 DOME. A TOTAL OF (9) TESTS WERE TAKEN EACH TEST CONSISTING OF THE AVE OF (3) PROBES. TEST # 1 IS NOT USED IN THE CALC. OF THE DATA DUE TO EXCESSIVE SPAWLING CAUSING INACCURATE MEASUREMENT.

SEE ATTACHED DATA SHEET FOR RESULTS OF TESTING.

Report continued on reverse side ☐

[signature]
Signature

KEH-377 (2-83)

Client: RHO	Address:	Phone No.
Project Name: B-340	Project Location: AP TANK FARM (TANK 108 DOME)	Job Phone No.
Job Number: PHASE II	Date: 2-26-85 Test Date: 2-26-85	By: J D CUMMINGS

AV. STR. 5150 psi
R.(E.V.) 1500 psi
STD. DEV. 526.8 psi
COeff. of V. = % 10.23%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good X	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Curr Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
~~1~~	108 DOME	NATURAL 3/4"	6	113	268609 268616	1.9375	~~4900~~
2					268622	2.050	5800
3					268609 268607	2.075	6000
4					268611	1.925	4800
5					268613	1.8875	4500
6					268615	1.9625	5100
7					268620	1.900	4600
8					268621	1.9625	5100
9					268623	1.9875	5300
TEST #1 RESULT ~~ARE~~ 5800 NOT USED DUE TO PROCESSING CONCRETE SPALLING. THE MOISTURE MOUNT WAS NOT APPROPRIATE.							

TABLE 3 - FACTORS FOR COMPUTING WITHIN-TEST STANDARD DEVIATION*

Number of Specimens		$1/d_2$
2		0.8865
3		0.5907
4		0.4857
5		0.4299
6		0.3946
7		0.3698
8		0.3512
9		0.3367
10		0.3249

* From Table B2, "Manual on Quality Control of Materials", ASTM Special Technical Publication No. 15-C.

USING TABLE 3 (Ex. 3 test report)

Assume Mob's #4 Aggregate

Exposed Probe Height

A	B	C
1.800 inch	1.750 inch	1.825 inch
psi conversion from Windsor column #4		
5100 psi	4750 psi	5275 psi

Range = 5275 (Hi) - 4750 (Low) = 525 psi

Std. Dev. = Range x 0.5907. (from Table 3)

Thus: 525 x .5907 = 310 (Std. Dev.)

Coeff. of Var. = Std. Dev. ÷ Av. psi x 100

or

310 ÷ 5041 (av.) = .614 x 100 = 6.14%

NOTE: Table may be used to report as many as ten tests.

AMERICAN CONCRETE INSTITUTE COPY STANDARD 214-65

TABLE 2 - STANDARDS OF CONCRETE CONTROL

Class of operation	Coefficient of variation for different control standards			
	Excellent	Good	Fair	Poor
Over-all variation: General construction	Below 10.0	10.0 to 15.0	15.0 to 20.0	Above 20.0
Laboratory Control	Below 5.0	5.0 to 7.0	7.0 to 10.0	Above 10.0
Within-test variations: Field control	Below 4.0	4.0 to 5.0	5.0 to 6.0	Above 6.0
Laboratory Control	Below 3.0	3.0 to 4.0	4.0 to 5.0	Above 5.0

Note: These standards represent the average for 28-day cylinders computed from a large number of tests. Different values for other than average concretes can be expected.

ICN-C 802-79

KAISER ENGINEERS HANFORD — **INSPECTION REPORT**

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B 340	DIKE II		2/23/85		

DISCIPLINE		JOB SITE ACTIVITY	YES	NO
Civil, Structural	☑	Site visited	☑	☐
Mechanical	☐	Construction in progress (personal observation)	☐	☑
HVAC	☐			
Electrical	☐			
Instrumentation	☐			

WEATHER EFFECT INFORMATION	YES	NO
Construction hindered by weather	☐	☑
Work rejected due to weather	☐	☑

Conditions/Comment _____

INSPECTION

Item	Acc.	Re.	Other Documentation

NCR-B-2340-124

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING ON TANK 107 CONCRETE DOME. A TOTAL OF (9) TESTS WERE TAKEN, EACH TEST CONSISTING OF THE AVERAGE OF (3) PROBES. TEST #4 IS NOT USED IN THE CALCULATION OF THE DATA SINCE (2) OF THE (3) PROBES DRIVEN WERE AT AN ANGLE SUCH THAT THE TRIANGULAR MEASURING PLATE WOULD NOT RECEIVE THE PROBE ENDS.

SEE ATTACHED TEST DATA SHEET FOR RESULTS OF TESTING.

A MOHS HARDNESS TEST WAS PERFORMED ON TWO DIFFERENT AGGREGATE SPECIMENS - BOTH INDICATED A #6 HARDNESS.

Report cont'd on reverse side ☐

Signature

KE-377 (2-83)

NCR-W-3403-124

Client:	Address:		Phone No.
Project Name: 3-340	Project Location: J.D. TOUR FARM (TK 107 DOME)		Job Phone No.
Job Number: PHASE II	Date: 2/25/85	Test Date: 4/23/85	By: J.D. CUMMINGS

AV. STR. 5213 psi

R.(E.V.) 2000 psi

STD. DEV. 314 psi

COeff. of V. = % 6.06%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent X	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Cage (Av. - 3 Probes)	Comp. Strength (psi)
1	10% SAND	3/4"	6	101	268618 (2) 268608 (1)	1.975	5200
2	"	"	6	101	268605	1.9125	4700
3	"	"	6	101	(2) 268614 (1) 268608	2.0125	5500
4*	"	"	6	101	268603	2.0643 QUEST 2.3625	5900
5	"	"	6	101	(2) 268604 (1) 268608	2.0125	5500
6	"	"	6	101	268617	1.9625	5100
7	"	"	6	101	268610	1.9875	5300
8	"	"	6	101	(2) 268602 (1) 268601	1.925	4800
9	10% SAND	3/4" WATER	6	101	(2) 268601 (1) 268607 (2) 268602	2.025	5600

* (2) OF THE THREE PROBES WERE ANGLED SUCH THAT PLATES COULD NOT FIT.

NCR-15340-137

Client:	Address:	Phone No.
Project Name: AP TANK FARM	Project Location: TANK 102 DOME	Job Phone No.
Job Number: B-2210 CHICAGO	Date: 3-5-85	Test Date: 3-5-85 By: J.D. CUMMINGS

AV. STR. 4833. psi

R.(E,W.) 600 psi

STD. DEV. 312.8 psi

Coeff. of V. = % 6.4%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Age.	Mach's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
1	102 DOME	NOTHING 3/4"	6	106	273332	1.950	5000
2	"	"	"	"	273333	1.9375	4900
3	"	"	"	"	273334	1.875	4400
4	"	"	"	"	273335	1.9375	4900
5	"	"	"	"	(2) 273336, (1) 273327	1.975	5200
6	"	"	"	"	273337	1.975	5200
	102 DOME POURED				11-19-84		

NEC-15-SW-129

Client:	Address:	Phone No.
Project Name: AP TANK FARM	Project Location: TANK 101 DOME	Job Phone No.
Job Number: B-3405 DETAIL	Date: 3-5-85 Test Date: 3-25-85	By: V.D. CUMMINGS

AV. STR. 5240 psi

R, (E.V.) 1400. psi

STD. DEV. 622.86 psi

Coeff. of V. = % 11.9%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
1	101 DOME	3/4"	6	99	269624	2.050	5800
2					(2) 269625 (1) 269626	2.025	5600
3					(1) 273326 (2) 273329	UNDER (WEIGHT - 1.975 OUT OF TOLERANCE)	* 5200
4					273329	1.925	4800
5					273330	1.875	4400
6					273331	1.900	4400

* DUE TO UNDER WEIGHT OF THE (3) PROBES TEST #3 IS OUT OF THE PRECISION TOLERANCE AS GIVEN IN ASTM C803

101 DOME POURED 11.27.84

NCR-B-340-134

Rotated

To purchase

Client:	Address:	Phone No.
Project Title: AP TANK FARM	Project Location: TANK 103 DOME	Job Phone No.
Job Number: B-340 DOME T.	Date: 3-5-85 Test Date: 12-5-85	By: J. D. CUMMINGS

AV. STR. 5600 psi

R.(S.V.) 5492 psi

STD. DEV. 1107.87 psi

Coeff. of V. = % 20.17%

SOIL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor X
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mch's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Sink (Av. - 3 Probes)	Comp. Strength (psi)
1	103 DOME	3/4"	6	76	273338	2.025	5600
2					273339	2.0175	5500
3					273340	1.775	3600
4					273341	1.7375	3300
5					(2) 273342 (1) 273342	1.725	3200
6					273344	1.9125	4700
7					273345	1.9375	4900

NOTE: TEST # 3, 4 & 5 WERE TAKEN ON THE SOUTH 1/2 OF THE TANK DOME.

103 DOME POURED 12-19-84

NCR: B-340-134

Client:	Address:		Phone No.
Project Name: B-340	Project Location: AP TANK FARM DOME 103		Job Phone No.
Job Number: B-340 DOME	Date: 3-11-85	Test Date: 3-11-85	By: J. D. CUMMINGS

AV. STR. 4650 psi

R.(H.V.) 2000 psi

STD. DEV. 722.2 psi

Coeff. of V. = % 17%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Arr.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
8	NEAR TEST #4 SW QUAD.		6		273346	1.8875	4500
9	NEAR TEST #5 SE QUAD.		1		(1) 273347 (2) 273348	1.950	5000
10	NEAR TEST #3 SW QUAD.				273349	1.8875	4500
11	NEAR TEST #1 NORTH E/C				273350	1.7875	3700
12	NEAR TEST #7 SE QUAD.				273677	1.8875	4500
13	NEAR TEST #2 NE QUAD.				(2) 273676 (1) 273676	2.0375	5700

NOTE: ALL TEST AREA SURFACES WERE GROUND TO OBTAIN A SOMEWHAT FLAT SURFACE.

App. Figure B-52. Nonconformance Report B-340-125

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE V)	B-340-125 1520-85

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6 and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution
DOE
*KK Lucas

ROCKWELL
*DL Bjorklund
*RJ Hennig
*LE Johnson
*E Koellermeier

JAJ
*TR Cloud
*WT Frisbee

KEH
*EL Backer
*DL Brown
*EA Goakey
RL Hand
Data Control
*JW Viita
*TL Walton
Central File
*Field Project File

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
	E. L. Backer 12/18/84 KEH Field Project Engineering	JWV for MDR Gibbins

(2A) Disposition
- [X] Accept As is
- [ ] Conditional Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification Rev 2

2B) Accept as is

2C) A total of three pairs of field cured and three pairs of lab cured cylinders were tested at 28 days with the following results:

Test No.	L. C. Strength	F. C. Strength
1	6885 psi	5490 psi
2	6765 psi	3660 psi
3	6590 psi	4855 psi
	average 6745 psi	

Test No. 2 F. C. cylinders were considerably below the average strength of test No. 1 and 3 F. C. cylinders (5490 + 4855) 1/2 = 5175 psi 5000 psi design strength of the concrete. The L. C. cylinders show a consistency in strength and therefore one must conclude that F. C. test cylinders No. 2 did not receive the same curing and protection as F. C. test cylinders No.'s 1 and 3. Therefore, based on engineering judgement, ignore the results of F. C. test No. 2.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design EA Goakey 2/5/85	Safety 3-15-85	Engr.	AI (ASME)
QA	QA 2-15-85	PE JWV 3-19-85	QA	DOE

(3A)
- [ ] Disposition Effected As Directed/ NCR Closed
- [ ] Other (Specify)

Originator or Representative ____ Date ____

(4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

GPO 697-905 c: EZB/MDR/TRC

NCR B-340-125
Page 2

NONCONFORMANCE DESCRIPTION

Tank 105 Lower Shell concrete breaks at 28 days: Field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days
2	3195- 9 3480 (FC)	
	-10 3840 (FC)	
	-11 6720	0.85 (6720) = 5712
	-12 6810	0.85 (6810) = 5789

App. Figure B-53. Nonconformance Report B-340-126

97604

RL-504 (2-80)
(54-2099-604)

CONSTRUCTION
NONCONFORMANCE REPORT

Page 1 of 1

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE V)	(1520-86) B-340-126

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

Construction Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.4.1.2.

Immediately after removal of forms, cut back all form ties and inspect surfaces for defects....

Paragraph 3.4.2

Repair of Surface Defects: repair surface defects in concrete in accordance with ACI 301, Sections 9.1, 9.2, and 9.3. Cure concrete repairs the same as new concrete.

NONCONFORMANCE DESCRIPTION

Form ties were not removed immediately after removal of concrete forms on Tanks 103, 104, 105, and 106. Form ties on Tank 106 (haunch pour area) were removed 12/18/84. Concrete was heated up prior to patching with grout mix. After patch was placed, no curing was performed.
(Overnight temperature was ± 0°F)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File 241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
	E. L. Backer 12/19/84 KEH Field Engineering	MD Robbins

(2A) Disposition

- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☒ Repair DD 1/3/85
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Remove and replace all patched areas exhibiting lack of strength or bond to the original concrete. Attached is a suggested product for use in cold weather for your consideration.

2C) The repair must develop adequate strength and bond to provide a watertight joint to protect reinforcing steel.

(2D) Additional Doc Required

- ☐ As-Builts
- ☐ DFC No. _____
- ☐ Other Specify _____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2h) Concurrence (Signature and Date)
Engr.	Design DD 1/3/85 EL Backer 1/2/85	Safety DL Barthen 1-2-85	Engr. [illegible] 1/10/85	A (ASME)
QA	QA [illegible] 1-3-85	PE JW Viita 1-4-85	QA [illegible] 1/10/85	DOE [illegible] 1/17/85

(3A)

- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

MD Robbins — Originator or Representative — 2-27-85 Date

(4A) List of Documents Affected	(4B) Documents Revised
NONE C: ESE/MDR JWV/TRE/FPF	By _____ Date _____

☆ U.S. GOVERNMENT PRINTING OFFICE: 1983-696-150/102

Manufactured By
CONCRETE PRODUCTS INCORPORATED

Judy Wolfe - Woodland, Calif (916) 666-3633
Bellevue Office (206) 747-0774

United Constr. Supply
Spokane 800-572-4303
Seattle 575-0090

all crete®

MP Concrete

ALL-CRETE MP CONCRETE is a Magnesia Poly phosphate concrete proved many times to give as good or better results as any other concrete patching material.

For example: On a test overlay where traffic count was estimated as 20,000 cars and trucks per day **ALL-CRETE MP CONCRETE'S** ½" overlay was still there months after two water-based materials (one of which was a magnesia phosphate material) broke up.

ALL-CRETE MP CONCRETE will bond to damp surfaces if all **FREE** water is removed and the area is primed with liquid activator.

ALL-CRETE MP CONCRETE DOES NOT have to be exact in recommended 1 to 5 ratio of liquid to dry material to maintain its properties. It can be mixed more fluid to pour into small cracks and to achieve thinner overlays.

It needs no saw-cutting. Just break out all loose rock, etc., blow out the dust and add **ALL-CRETE MP CONCRETE.** It feathers out to less than ⅛".

ALL-CRETE MP CONCRETE is easily mixed in small quantities by hand or trowel or in mixers up to 3 or 4 units at a time. It can also be "gunned" into place with a modified gunite type rig.

ALL-CRETE MP CONCRETE bonds to practically anything except slick plastics and oily surfaces.

ALL-CRETE MP CONCRETE can be used with glass or steel fibers where required with outstanding results.

ALL-CRETE MP CONCRETE will withstand heat up to 700-800° F.

ALL-CRETE MP CONCRETE can be put into place at sub-freezing temperatures, possibly needing only heating with a torch to start the exothermic reaction. Once started it needs no further "HELP". Warmed aggregate added in deeper sections will do the same.

To accelerate the set apply heat. To retard the set cool the liquid.

Clean-up is with water. Hand tools and mixing equipment should be washed off before firm set.

ALL-CRETE MP CONCRETE sets rapidly. Traffic can be resumed over repaired holes in as little as 30 minutes and on overlays in 2 to 3 hours.

NCR B340-100

App. Figure B-54. Nonconformance Report B-340-127

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No. (1520-87) B-340-127

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
~~*C A Rieck~~ LE Johnson
JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File 241-AP Tk Fm

*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date, (8): E. L. Backer, KEH Field Engineering, 12/20/84

(1H) Supervisors Review: MO Rollins

(2A) Disposition
- [X] Accept As Is
- [X] ~~Conditional~~ Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance of concrete strength requirements is based on lab cured cylinders which meet specified requirements.

2B Rev 1 & 2C Rev 1, see page 2 of 2

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

Rev 1 Signatures / Rev 2 Reinitial

Design	Safety	Engr	AI (ASME)
1/15/85	1/15/85	1/17/85	1/25/85
QA 1-15-85	PE 3-21-85 / 1-16-85	QA 1/28/85	DOE 1/20/85

(2E) Contr. Approval (Signature and Date)

(2F) A-E Approval (Signature and Date)

(2G) Opr. Contr. Approval (Signature and Date)

(2H) Concurrence (Signature and Date)

	Design	Safety	Engr	AI (ASME)
Engr.	12/27/84	12/27/84	1/2/85	
QA	12/27/84	PE 12-27-84	QA 1/3/85	DOE 1/3/85

(3A)
- [X] Disposition Effected As Directed, NCR Closed
- [ ] Other (Specify)

Originator or Representative — Date 3/28/85

(4A) List of Documents Affected

(4B) Documents Revised
By ____ Date ____

☆ U.S. GOVERNMENT PRINTING OFFICE 1983-695-150/102

NCR B-340-127 (1520-87)
Page 2 of 2

Tank 102 Dome concrete cylinder breaks at 28 days: field cured cylinders failed to make 5000 psi of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1.	3198- 4 (FC)	4240	
	- 5 (FC)	4190	
	- 6	5950	0.85(5950) = 5058
	- 7	5870	0.85(5870) = 4990
2.	3198-11 (FC)	3800	
	-12 (FC)	3850	
	-13	5200	0.85(5200) = 4420
	-14	5080	0.85(5080) = 4318

2B) Instructions Rev 1

Acceptance of curing and protection of the concrete pour shall be based on the results of tests on 45 day field cylinders taken for the dome and/or haunch pours on tanks 103, 104, 105 and 106.

2C) Justification Rev 1

Additional cylinders for 45 day strength tests are not available on this tank for testing. The results of tests on field cured cylinders from other tanks with the same concrete mix, protected by the same methods and exposed to similar weather extremes will verify the concrete will develop the specified strength.

2B) Instructions Rev 2

Accept as is

2C) Justification Rev 2

See attached letter dated 3/20/85 by EA Goakey and JW Viita

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution

DATE March 20, 1985

FROM E. A. Goakey
J. W. Viita

COPIES TO

JOB NO.

SUBJECT Project B-340, NCR's B-340 - 124, 127, 129 and 134

These NCR's were written because the field cured cylinder breaks did not meet the ACI guideline of being within 85% of the laboratory cured breaks. Acceptance of the concrete mix is based on the laboratory breaks where the field breaks indicate the acceptability of the curing procedures in place and the effect the weather may have on the in-place concrete.

Acceptance of NCR #134 per the original disposition was to be based on 45 day cylinder breaks for that pour. Acceptance of the other 3 NCR's was to be based on 45 day breaks for those pours for which spare cylinders were available since all curing blankets and heat were removed from all pours after the first week.

The results of the 28 day and 45 day field cured cylinder breaks are summarized as follows:

	Pour Slip #	28 day F.C.	45 day F.C.
Tank 103 Dome	3207	4308 psi	4198 psi
104 Dome	3204	4710	4905
105 Dome	3208	4720	4408
106 Dome	3202	4960	4832
106 Haunch	3200	5342	5660
104 Haunch	3203	4278	4725
103 Haunch	3205	4560	5042
105 Haunch	3206	5090	5110
	Average	4746 psi	4860 psi

The average 28 day Field Cured cylinder breaks for the pours with the open NCR's is:

	NCR #	28 day F.C.
107 Dome	124	3458 psi
102 Dome	127	4020
101 Dome	129	4205
103 Dome	134	4308
	Average	3998 psi

The specified concrete strength is 5000 psi for laboratory cured cylinders at 28 days. Using 85% for field cured cylinders would give us a value of 4250 psi for field cured cylinders. The average strength gain demonstrated by the 45 day cylinder breaks was lower than expected and does not give a firm indication that the field strength would meet the 4250 psi figure but does show that the concrete is continuing to gain strength despite the prolonged period of cold weather.

825 Richland, WA

Interoffice Memorandum
March 20, 1985

There are some notable inconsistancies in the test data such as the decrease in strength from 28 day field cure to 45 day field cure for 3 of the 8 pours for which 45 day field breaks are available. Due to these inconsistancies, it was decided to perform some tests on the in-place concrete with the Windsor Probe.

The Windsor Probe is approved for use by ASTM in comparing the relative strengths of concrete but not in determining the actual strength. To obtain a comparison to concrete which is known to be acceptable, testing was done on the Tank 108 dome in addition to the 4 domes with open NCR's. The Tank 108 dome had an average 28 day field cure strength of 4890 psi and a laboratory cure strength of 6325 psi.

A predicted field cure strength of the concrete was obtained by comparing the Windsor Probe results for Tank 108 and the other domes with the field cure strength for Tank 108. The following formula was used:

$$\frac{\text{Probe results Tank "X"}}{\text{Probe results Tank 108}} \times 4890 \text{ psi} = \text{Predicted Field Cure Strength}$$

Windsor Probe results for Tank 108 indicated an average strength of 5150psi (8 tests) (concrete age of 113 days)

Tank	Windsor Probe Strength	Predicted Strength	Age of Concrete
107	5213 psi (8 tests)	4949 psi	101 days
102	4933 (6 tests)	4685	106
101	5040 (5 tests)	4787	98
103	4530 (6 tests)	4303	82

(Tank 103 was tested twice. There were problems with the roughness of the concrete surface possibly effecting the results of the test so the first test was discarded; the test locations were ground to an acceptable smoothness (allowed by ASTM) and new tests performed.)

The results indicate predicted field cure strength in excess of 4250 psi with an actual increase of essentially zero (0) (4303 versus 4308) for the Tank 103 dome to approximately 1500 psi for the Tank 107 dome when compared to the field cured cylinder results. These predicted strengths are considered somewhat conservative since the base results from Tank 108 have the longest cure time with Tank 103 having 31 days less cure time.

In summary, considering the Windsor Probe results on the in-place concrete along with the cylinder test results (both lab. cured and field cured) all encasement concrete will develop the required strength to properly perform as intended in the design. Some of the individual tests may indicate a problem but the overall results indicate that the contractor has supplied and placed the concrete as specified

JWV/ss

Distribution: Attachment to NCR B-340-124
Attachment to NCR B-340-127
Attachment to NCR B-340-129
Attachment to NCR B-340-134
EA Goakey
JW Viita File
Central File
LB

KAISER ENGINEERS HANFORD

INSPECTION REPORT

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B-340	PHASE II	2-23-85	2-26-85		

DISCIPLINE

Civil/Structural	☒
Mechanical	☐
HVAC	☐
Electrical	☐
Instrumentation	☐

JOB SITE ACTIVITY

	YES	NO
Site visited	☒	☐
Construction in progress (personal observation)	☐	☒

WEATHER EFFECT INFORMATION

	YES	NO
Construction hindered by weather	☐	☒
Work rejected due to weather	☐	☒

Conditions/Comment

INSPECTION

Item	Acc	Rej	Other Documentation
No NCR this the Pour Slip #2189 TK 108 Dome Cyl. Tests were at Use as basis of comparison			

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING FOR COMPRESSIVE STRENGTH OF TANK 108 DOME. A TOTAL OF (9) TESTS WERE TAKEN EACH TEST CONSISTING OF THE AVE OF (3) PROBES. TEST # 1 IS NOT USED IN THE CALC. OF THE DATA DUE TO EXCESSIVE SPAWLING CAUSING INACCURATE MEASUREMENT.
SEE ATTACHED DATA SHEET FOR RESULTS OF TESTING.

Report continued on reverse side ☐

Signature [signature]

KEH 377 (2-83)

Client: RHO	Address:	Phone No.
Project Name: B-340	Project Location: AP TANK FARM (TANK 108 DOME)	Job Phone No.
Job Number: PHASE II	Date: 2-26-85 Test Date: 2-26-85	By: J D CUMMINGS

AV. STR. 5150 psi
R.(E.V.) 4500 psi
STD. DEV. 526.8 psi
COeff. of V. = % 10.23%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good X	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
~~1~~	108 DOME	NATURAL 3/4"	6	113	268609 268616	1.9375	~~4900~~
2					268622	2.050	5800
3					268609 268607	2.075	6000
4					268611	1.925	4800
5					268613	1.8875	4500
6					268615	1.9625	5100
7					268620	1.900	4600
8					268621	1.9625	5100
9					268623	1.9875	5300
TEST #1 RESULT ~~ARE~~ 5 ~~500~~ NOT USED DUE TO EXCESSIVE CONCRETE SPALLING. THE MOISTURE/MOIST WAS NOT ACCURATE.							

TABLE 3 - FACTORS FOR COMPUTING WITHIN-TEST STANDARD DEVIATION*

Number of Specimens		$1/d_2$
2		0.8865
3		0.5907
4		0.4857
5		0.4299
6		0.3946
7		0.3698
8		0.3512
9		0.3367
10		0.3249

* From Table B2, "Manual on Quality Control of Materials", ASTM Special Technical Publication No. 15-C.

USING TABLE 3 (Ex. 3 test report)

Assume Mob's #4 Aggregate

Exposed Probe Height

A	B	C
1.800 inch	1.750 inch	1.825 inch
psi conversion from Windsor column #4		
5100 psi	4750 psi	5275 psi

Range = 5275 (Hi) - 4750 (Low) = 525 psi

Std. Dev. = Range x 0.5907. (from Table 3)

Thus: 525 x .5907 = 310 (Std. Dev.)

Coeff. of Var. = Std. Dev. ÷ Av. psi x 100

or

310 ÷ 5041 (av.) = .614 x 100 = 6.14%

NOTE: Table may be used to report as many as ten tests.

AMERICAN CONCRETE INSTITUE COPY STANDARD 214-65

TABLE 2 - STANDARDS OF CONCRETE CONTROL

Class of operation	Coefficient of variation for different control standards			
	Excellent	Good	Fair	Poor
Over-all variation: General construction	Below 10.0	10.0 to 15.0	15.0 to 20.0	Above 20.0
Laboratory Control	Below 5.0	5.0 to 7.0	7.0 to 10.0	Above 10.0
Within-test variations: Field control	Below 4.0	4.0 to 5.0	5.0 to 6.0	Above 6.0
Laboratory Control	Below 3.0	3.0 to 4.0	4.0 to 5.0	Above 5.0

Note: These standards represent the average for 28-day cylinders computed from a large number of tests. Different values for other than average concretes can be expected.

ASTM-C 803-79

KAISER ENGINEERS HANFORD — **INSPECTION REPORT**

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B 340	PHASE II		2/23/85		

DISCIPLINE		JOB SITE ACTIVITY	YES	NO	WEATHER EFFECT INFORMATION	YES	NO
Civil/Structural	☑	Site visited	☑	☐	Construction hindered by weather	☐	☑
Mechanical	☐				Work rejected due to weather	☐	☑
HVAC	☐	Construction in progress (Personal observation)	☐	☑	Conditions/Comment		
Electrical	☐						
Instrumentation	☐						

INSPECTION

Item	Acc	Re	Other Documentation
WCK-13-340-124			

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING ON TANK 107 CONCRETE DOME. A TOTAL OF (9) TESTS WERE TAKEN, EACH TEST CONSISTING OF THE AVERAGE OF (3) PROBES. TEST #4 IS NOT USED IN THE CALCULATION OF THE DATA SINCE (2) OF THE (3) PROBES DRIVEN WERE AT AN ANGLE SUCH THAT THE INSTRUMENT MEASURING PLATE WOULD NOT RECEIVE THE PROBE ENDS.
SEE ATTACHED TEST DATA SHEET FOR RESULTS OF TESTING.
A MOH'S HARDNESS TEST WAS PERFORMED ON TWO DIFFERENT AGGREGATE SPECIMENS - BOTH INDICATED A #6 HARDNESS.

Report continued on reverse side ☐

Signature

KEH 317 (2 83)

NCR-NR-SMD-124

Client:	Address:	Phone No.
Project Name: B-340	Project Location: 200 TANK FARM (TK 107 DOME)	Job Phone No.
Job Number: PHASE II	Date: 2/23/85 Test Date: 2/23/85	By: J.D. CUMMINGS

AV. STR. 5213 psi

R.(E,V.) 200 psi

STD. DEV. 346 psi

Coeff. of V. = % 6.66%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent X	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Cage (Av. - 3 Probes)	Comp. Strength (psi)
1	TOP DOME	3/4" NATURAL	6	101	(3) 268618 (1) 268608	1.975	5200
2	"	"	6	101	268605	1.9125	4700
3			6	101	(2) 268614 (1) 268608	2.0125	5500
4*			6	101	268603	2.0643 QUEST 268611	~~5900~~ 5709
5			6	101	(2) 268604 (1) 268608	2.0125	5500
6			6	101	268617	1.9625	5100
7			6	101	268610	1.9875	5300
8			6	101	(3) 268602 (1) 268601	1.925	4800
9	TOP DOME	3/4" NATURAL	6	101	(3) 268601 (1) 268607 (2) 268606	2.025	5600

* (2) OF THE THREE PROBES WERE ANGLED SUCH THAT PLATENS COULD NOT FIT.

NCR-15340-137

Client: | Address: | Phone No.

Project Name: AZ PARK EXP | Project Location: TANK 102 DOME | Job Phone No.

Job Number: B-220 CONCRETE | Date: 3-5-85 | Test Date: 3-5-85 | By: J.D. CUMMINGS

AV. STR. 5222. psi

R.(E.V.) 600 psi

STD. DEV. 335.68 psi

Coeff. of V. = % 6.4%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
1	102 DOME	NATURAL 3/4"	6	106	273332	1.950	5000
2	"	"	"	"	273333	1.9375	4900
3	"	"	"	"	273334	1.875	4400
4	"	"	"	"	273335	1.9375	4900
5	"	"	"	"	(2) 273326, (1) 273327	1.975	5200
6	"	"	"	"	273337	1.975	5200
	102 DOME POURED				11-19-84		

NOV-15-84 - 127

Client:	Address:	Phone No.
Project Name: AP TANK FARM	Project Location: TANK 101 DOME	Job Phone No.
Job Number: B-345 PHASE II	Date: 3-5-85 Test Date: 3-5-85	By: V. D. CUMMINGS

AV. STR. 5742 psi

R.(E,V.) 1420. psi

STD. DEV. 668.86 psi

Coeff. of V. = % 11.9%

TOTAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good X	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Cage (Av. - 3 Probes)	Comp. Strength (psi)
1	101 DOME	NATURAL 3/4"	6	99	269624	2.050	5800
2					(2) 269625 (1) 269626	2.025	5600
3					~~(1) 273326~~ (2) 273329	UNEVEN HEIGHT - 1.975 OUT OF TOLERANCE	* 5200
4					273329	1.925	4800
5					273330	1.875	4400
6					273331	1.900	4400

* DUE TO UNEVEN HEIGHT OF THE (3) PROBES TEST #3 IS OUT OF THE PRECISION TOLERANCE AS GIVEN IN ASTM C803

101 DOME POURED 11.27.84

NCR-8-340-134

Retested due to questionable compressive strength results

Client:	Address:	Ticket No.
Project Title: AP TANK FARM	Project Location: TANK 103 DOME	Job Phone No.
Job Number: B-BOS Dome T	Date: 3-5-85 Test Date: 3-5-85	By: J. D. Cummings

Av. Str. 5400 psi

R.(S.V.) 6400 psi

STD. DEV. 1090.2 psi

Coeff. of V. = % 20.17%

SOIL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor X
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure /Days	Probe & Power Load Certification Number	Rt. of Probe Type (Av. - 3 Probes)	Comp. Strength (psi)
1	103 DOME	NATIVE 3/4"	6	76	273338	2.025	5600
2					273339	2.0125	5500
3					273340	1.775	3600
4					273341	1.7375	3300
5					(2) 273342 (1) 273342	1.725	3200
6					273344	1.9125	4700
7					273345	1.9375	4900

NOTE: TEST # 3, 4 & 5 WERE TAKEN ON THE SOUTH 1/2 OF THE TANK DOME.

103 DOME POURED 12-19-84

NCR-B-340-134

Client:	Address:	Phone No.
Project Name: B-340	Project Location: AP TANK FARM DOME 103	Job Phone No.
Job Number: B-340 TANK V	Date: 3-11-85 Test Date: 3-11-85	By: J.D. CUMMINGS

AV. STR. 4650 psi

R.(E.V.) 2000 psi

STD. DEV. 789.7 psi

Coeff. of V. = % 17%

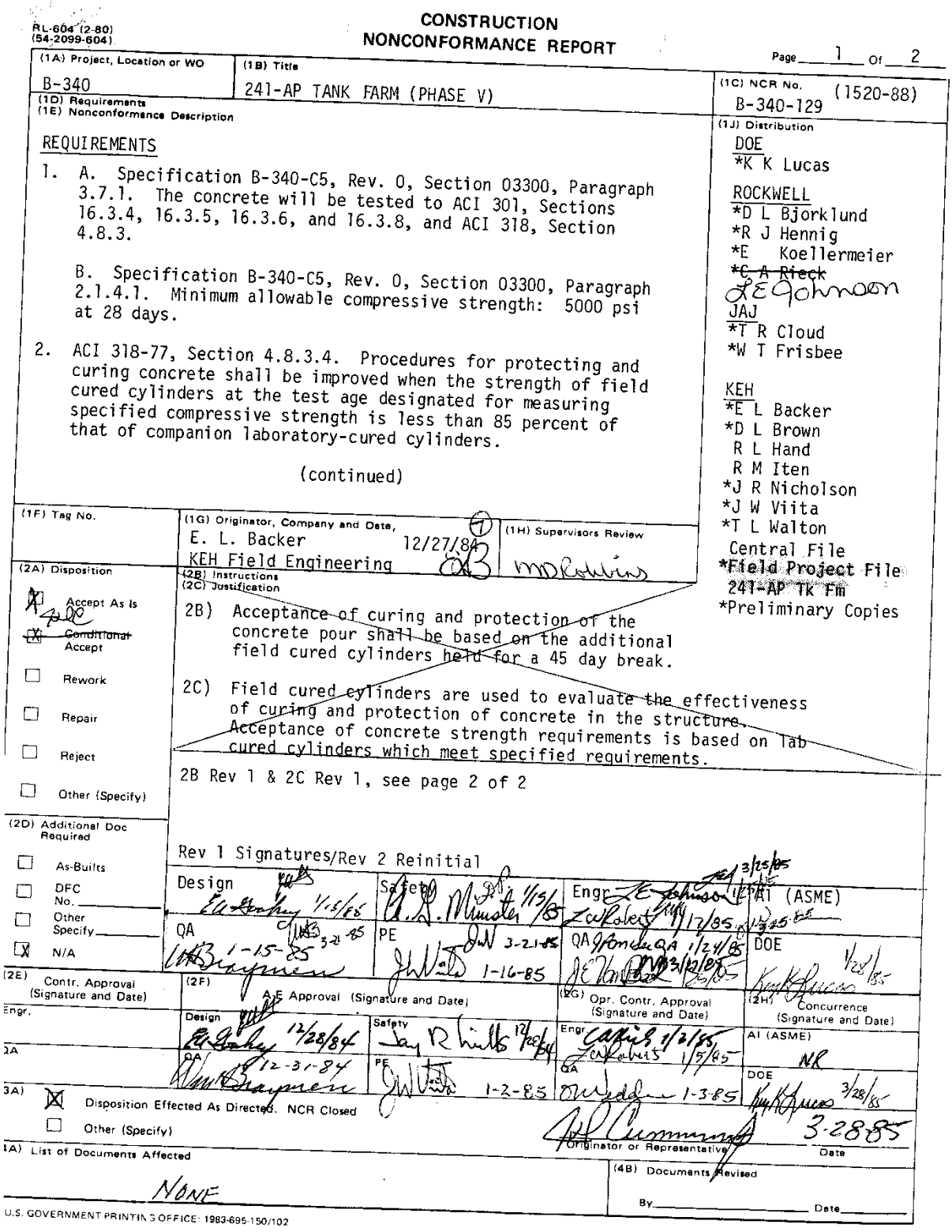
SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair K	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Area	Hole's No.	Cure Days	Probe & Power Lead Certification Number	Av. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
8	NEAR TEST #4 SW QUAD.		6		273346	1.8875	4500
9	NEAR TEST #5 SE QUAD.		1		(1) 273347 (2) 273348	1.950	5000
10	NEAR TEST #3 SW QUAD.				273349	1.8875	4500
11	NEAR TEST #1 NORTH OF 6				273350	1.7875	3700
12	NEAR TEST #7 SE QUAD.				273677	1.8875	4500
13	NEAR TEST #2 NE QUAD.				(2) 273676 (1) 273676	2.0375	5700

NOTE: ALL TEST AREA SURFACES WERE GROUND TO OBTAIN A SOMEWHAT FLAT SURFACE.

App. Figure B-55. Nonconformance Report B-340-129



RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No.: B-340-129 (1520-88)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution
DOE
*K K Lucas
ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
~~*C A Rieck~~
LE Johnson
JAJ
*T R Cloud
*W T Frisbee
KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File
241-AP Tk Fm
*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date, E. L. Backer 12/27/84 KEH Field Engineering

(1H) Supervisors Review: MD Rawlins

(2A) Disposition
- [X] Accept As Is
- [X] ~~Conditional~~ Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break.

2C) Field cured cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance of concrete strength requirements is based on lab cured cylinders which meet specified requirements.

2B Rev 1 & 2C Rev 1, see page 2 of 2

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. ____
- [ ] Other Specify ____
- [X] N/A

Rev 1 Signatures/Rev 2 Reinitial

Design	Safety	Engr	AI (ASME)
1-15-85	1-16-85	1-24-85	
QA	PE	QA	DOE
1-15-85	1-16-85	1-24-85	1/28/85

(2E) Contr. Approval (Signature and Date)

(2F) A/E Approval (Signature and Date)

(2G) Opr. Contr. Approval (Signature and Date)

(2H) Concurrence (Signature and Date)

Engr.	Design	Safety	Engr	AI (ASME)
	12/28/84	12/28/84	1/5/85	NR
QA	QA	PE	QA	DOE
	12-31-84	1-2-85	1-3-85	3/28/85

(3A)
- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Originator or Representative: 3-28-85 Date

(4A) List of Documents Affected: NONE

(4B) Documents Revised By ____ Date ____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-129 (1520-88)
Page 2 of 2

NONCONFORMANCE DESCRIPTION

Concrete cylinder breaks for Tank 101 Dome area: Field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1.	3199-4 (FC)	4230	
	-5 (FC)	4210	
	-6	5480	0.85(5480) = 4658
	-7	5360	0.85(5360) = 4556
2.	3199-11 (FC)	4210	
	-12 (FC)	4170	
	-13	5390	0.85(5390) = 4582
	-14	5540	0.85(5540) = 4709

2B) INSTRUCTIONS Rev 1
Acceptance of curing and protection of the concrete pour shall be based on the results of tests on 45 day field cylinders taken for the dome and/or haunch pours on tanks 103, 104, 105, and 106.

2C) JUSTIFICATION Rev 1
Additional cylinders for 45 day strength tests are not available on this tank for testing. The results of tests on field cured cylinders from other tanks with the same concrete mix, protected by the same methods and exposed to similar weather extremes will verify the concrete will develop the specified strength.

2B) Instruction Rev 2

Accept as is

2C) Justification Rev 2

See attached letter dated 3/20/85 by EA Goakey and JW Viita

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution

DATE March 20, 1985

FROM E. A. Goakey
J. W. Viita

COPIES TO

JOB NO.

SUBJECT Project B-340, NCR's B-340 - 124, 127, 129 and 134

These NCR's were written because the field cured cylinder breaks did not meet the ACI guideline of being within 85% of the laboratory cured breaks. Acceptance of the concrete mix is based on the laboratory breaks where the field breaks indicate the acceptability of the curing procedures in place and the effect the weather may have on the in-place concrete.

Acceptance of NCR #134 per the original disposition was to be based on 45 day cylinder breaks for that pour. Acceptance of the other 3 NCR's was to be based on 45 day breaks for those pours for which spare cylinders were available since all curing blankets and heat were removed from all pours after the first week.

The results of the 28 day and 45 day field cured cylinder breaks are summarized as follows:

	Pour Slip #	28 day F.C.	45 day F.C.
Tank 103 Dome	3207	4308 psi	4198 psi
104 Dome	3204	4710	4905
105 Dome	3208	4720	4408
106 Dome	3202	4960	4832
106 Haunch	3200	5342	5660
104 Haunch	3203	4278	4725
103 Haunch	3205	4560	5042
105 Haunch	3206	5090	5110
	Average	4746 psi	4860 psi

The average 28 day Field Cured cylinder breaks for the pours with the open NCR's is:

	NCR #	28 day F.C.
107 Dome	124	3458 psi
102 Dome	127	4020
101 Dome	129	4205
103 Dome	134	4308
	Average	3998 psi

The specified concrete strength is 5000 psi for laboratory cured cylinders at 28 days. Using 85% for field cured cylinders would give us a value of 4250 psi for field cured cylinders. The average strength gain demonstrated by the 45 day cylinder breaks was lower than expected and does not give a firm indication that the field strength would meet the 4250 psi figure but does show that the concrete is continuing to gain strength despite the prolonged period of cold weather.

DOE Richland, WA

Interoffice Memorandum
March 20, 1985

There are some notable inconsistancies in the test data such as the decrease in strength from 28 day field cure to 45 day field cure for 3 of the 8 pours for which 45 day field breaks are available. Due to these inconsistancies, it was decided to perform some tests on the in-place concrete with the Windsor Probe.

The Windsor Probe is approved for use by ASTM in comparing the relative strengths of concrete but not in determining the actual strength. To obtain a comparison to concrete which is known to be acceptable, testing was done on the Tank 108 dome in addition to the 4 domes with open NCR's. The Tank 108 dome had an average 28 day field cure strength of 4890 psi and a laboratory cure strength of 6325 psi.

A predicted field cure strength of the concrete was obtained by comparing the Windsor Probe results for Tank 108 and the other domes with the field cure strength for Tank 108. The following formula was used:

$$\frac{\text{Probe results Tank "X"}}{\text{Probe results Tank 108}} \times 4890 \text{ psi} = \text{Predicted Field Cure Strength}$$

Windsor Probe results for Tank 108 indicated an average strength of 5150psi (8 tests) (concrete age of 113 days)

Tank	Windsor Probe Strength	Predicted Strength	Age of Concrete
107	5213 psi (8 tests)	4949 psi	101 days
102	4933 (6 tests)	4685	106
101	5040 (5 tests)	4787	98
103	4530 (6 tests)	4303	82

(Tank 103 was tested twice. There were problems with the roughness of the concrete surface possibly effecting the results of the test so the first test was discarded; the test locations were ground to an acceptable smoothness (allowed by ASTM) and new tests performed.)

The results indicate predicted field cure strength in excess of 4250 psi with an actual increase of essentially zero (0) (4303 versus 4308) for the Tank 103 dome to approximately 1500 psi for the Tank 107 dome when compared to the field cured cylinder results. These predicted strengths are considered somewhat conservative since the base results from Tank 108 have the longest cure time with Tank 103 having 31 days less cure time.

In summary, considering the Windsor Probe results on the in-place concrete along with the cylinder test results (both lab. cured and field cured) all encasement concrete will develop the required strength to properly perform as intended in the design. Some of the individual tests may indicate a problem but the overall results indicate that the contractor has supplied and placed the concrete as specified

JWV/ss

Distribution: Attachment to NCR B-340-124
Attachment to NCR B-340-127
Attachment to NCR B-340-129
Attachment to NCR B-340-134
EA Goakey
JW Viita File
Central File
LB

KAISER ENGINEERS
HANFORD

INSPECTION REPORT

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B-340	PHASE V	2-23-85	2-26-85		

DISCIPLINE

Civil/Structural	☒
Mechanical	☐
HVAC	☐
Electrical	☐
Instrumentation	☐

JOB SITE ACTIVITY

	YES	NO
Site visited	☒	☐
Construction in progress (personal observation)	☐	☒

WEATHER EFFECT INFORMATION

	YES	NO
Construction hindered by weather	☐	Z
Work rejected due to weather	☐	Z

Conditions/Comment ______

INSPECTION

Item	Acc	Rej	Other Documentation
No NCR this item. Pour Slip #2189 Tk 108 Dome Cyl. test's were ok Use 25 basis of comparison			

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING FOR COMPRESSIVE STRENGTH OF TANK 108 DOME. A TOTAL OF (9) TESTS WERE TAKEN EACH TEST CONSISTING OF THE AVE OF (3) PROBES. TEST # 1 IS NOT USED IN THE CALC. OF THE DATA DUE TO EXCESSIVE SPAWLING CAUSING INACCURATE MEASUREMENT.
SEE ATTACHED DATA SHEET FOR RESULTS OF TESTING.

Report continued on reverse side ☐

[signature]
Signature

KEH 377 (2-83)

Client: RHO	Address:		Phone No.
Project Name: B-340	Project Location: AP TANK FARM (TANK 108 DOME)		Job Phone No.
Job Number: PHASE II	Date: 2-26-85	Test Date: 2-26-85	By: J.D CUMMINGS

AV. STR. 5150 psi

R.(E.V.) 6500 psi

STD. DEV. 526.8 psi

COeff. of V. = % 10.23%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
#1	108 DOME	NATURAL 3/4"	6	113	268609 268616	1.9375	~~4900~~
2					268622	2.050	5800
3					268609 268607	2.075	6000
4					268611	1.925	4800
5					268613	1.8875	4500
6					268615	1.9625	5100
7					268620	1.900	4600
8					268621	1.9625	5100
9					268623	1.9875	5300

TEST #1 RESULT ~~5~~ 8 ~~ARE~~ NOT USED DUE TO EXCESSIVE CONCRETE SPALLING. THE HOT SURFACE WAS NOT ACCURATE.

TABLE 3 - FACTORS FOR COMPUTING WITHIN-TEST STANDARD DEVIATION*

Number of Specimens		$1/d_2$
2		0.8865
3		0.5907
4		0.4857
5		0.4299
6		0.3946
7		0.3698
8		0.3512
9		0.3367
10		0.3249

* From Table B2, "Manual on Quality Control of Materials", ASTM Special Technical Publication No. 15-C.

USING TABLE 3 (Ex. 3 test report)

Assume Moh's #4 Aggregate

Exposed Probe Height

A	B	C
1.800 inch	1.750 inch	1.825 inch
psi conversion from Windsor column #4		
5100 psi	4750 psi	5275 psi

Range = 5275 (Hi) - 4750 (Low) = 525 psi

Std. Dev. = Range x 0.5907. (from Table 3)

Thus: 525 x .5907 = 310 (Std. Dev.)

Coeff. of Var. = Std. Dev. ÷ Av. psi x 100

or

310 ÷ 5041 (av.) = .614 x 100 = 6.14%

NOTE: Table may be used to report as many as ten tests.

AMERICAN CONCRETE INSTITUTE

COPY

STANDARD 214-65

TABLE 2 - STANDARDS OF CONCRETE CONTROL

Class of operation	Coefficient of variation for different control standards			
	Excellent	Good	Fair	Poor
Over-all variation: General construction	Below 10.0	10.0 to 15.0	15.0 to 20.0	Above 20.0
Laboratory Control	Below 5.0	5.0 to 7.0	7.0 to 10.0	Above 10.0
Within-test variations: Field control	Below 4.0	4.0 to 5.0	5.0 to 6.0	Above 6.0
Laboratory Control	Below 3.0	3.0 to 4.0	4.0 to 5.0	Above 5.0

Note: These standards represent the average for 28-day cylinders computed from a large number of tests. Different values for other than average concretes can be expected.

ASTM-C 803-74

KAISER ENGINEERS HANFORD

INSPECTION REPORT

Project No.	Spent Fuel (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B 340	DWPF II		2/23/85		

DISCIPLINE		JOB SITE ACTIVITY	YES	NO	WEATHER EFFECT INFORMATION	YES	NO
Civil/Structural	✓	Site visited	✓	☐	Construction hindered by weather	☐	✓
Mechanical	☐				Work rejected due to weather	☐	✓
HVAC	☐	Construction in progress	☐	✓	Conditions/Comment		
Electrical	☐	(personal observation)					
Instrumentation	☐						

INSPECTION

Item	Acc	Rej	Other Documentation
NCR-WB-87-0-124			

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING ON TANK 107 CONCRETE DOME. A TOTAL OF (9) TESTS WERE TAKEN, EACH TEST CONSISTING OF THE AVERAGE OF (3) PROBES. TEST #4 IS NOT USED IN THE CALCULATION OF THE DATA SINCE (2) OF THE (3) PROBES DRIVEN WERE AT AN ANGLE SUCH THAT THE TRIANGULAR LEVELING PLATE WOULD NOT RECEIVE THE PROBE ENDS.

SEE ATTACHED TEST DATA SHEET FOR RESULTS OF TESTING.

A MOHS HARDNESS TEST WAS PERFORMED ON TWO DIFFERENT AGGREGATE SPECIMENS - BOTH INDICATED A #6 HARDNESS.

Report continued on reverse side ☐

Signature

KEH 377 2 83

NCR N-SWS-124

Client:	Address:		Phone No.
Project Name: 3-340	Project Location: AD TANK FARM (TK 107 DOME)		Job Phone No.
Job Number: PAKEET	Date: 2/23/85	Test Date: 2/22/85	By: J.D. CUMMINGS

AV. STR. 5213 psi

R.(E.V.) 2000 psi

STD. DEV. 316 psi

COeff. of V. = % 6.06%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent X	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Cage (Av. - 3 Probes)	Comp. Strength (psi)
1	107 DOME	3/4"	6	101	(2) 208618 (1) 208608	1.975	5200
2	"	"	6	101	208605	1.9125	4700
3	"	"	6	101	(2) 208614 (1) 208608	2.0125	5500
4*	"	"	6	101	208603	2.0643 GUEST 2.125 LT	~~4900~~
5	"	"	6	101	(2) 208604 (1) 208608	2.0125	5500
6	"	"	6	101	208617	1.9625	5100
7	"	"	6	101	208610	1.9875	5300
8	"	"	6	101	(2) 208602 (1) 208601	1.925	4800
9	107 DOME	3/4"	6	101	(2) 208601 - 208606 (1) 208607	2.025	5600

* (2) OF THE THREE PROBES WERE PULLED SLIGHTLY THAT RATED AND NOT FIT.

NCR-W-2400-137

Client: | Address: | Phone No.

Project Name: 242 TANK FARM | Project Location: TANK 102 DOME | Job Phone No.

Job Number: B-2420 Change #7 | Date: 3-5-85 | Test Date: 3-5-85 | By: J.D CUMMINGS

AV. STR. 7233. psi

R.(E.V.) 600 psi

STD. DEV. 546.8 psi

COEF. OF V. = % 6.4%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mach's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Case (Av. - 3 Probes)	Comp. Strength (psi)
1	102 DOME	NATURAL 3/4"	6	106	273332	1.950	5000
2	"	"	"	"	273333	1.9375	4900
3	"	"	"	"	273334	1.875	4400
4	"	"	"	"	273335	1.9375	4900
5	"	"	"	"	(2) 273336 (1) 273327	1.975	5200
6	"	"	"	"	273337	1.975	5200
	102 DOME POURED				11-19-84		

NCR-B-340-134

Firm:

Address:

Phone No.

Project Name: 200 TANK FARM

Project Location: TANK 103 DOME

Job Phone No.

Job Number: 8-340 Date: 3-5-85 Test Date: 3-5-85 By: J. D. Cummins

AV. STR. 5480 psi

R.(S.V.) 6000 psi

STD. DEV. 1078.2 psi

Coeff. of V. = % 20.17 %

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0% X

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Rt. of Probe Caps (Av. - 3 Probes)	Comp. Strength (psi)
1	103 DOME	3/4"	6	76	273338	2.025	5600
2					273339	2.0175	5500
3					273340	1.775	3600
4					273341	1.7375	3300
5					(2) 273342 (1) 273342	1.725	3200
6					273344	1.9125	4700
7					273345	1.9375	4900

NOTE: TEST # 3, 4 & 5 WERE TAKEN ON THE SOUTH 1/2 OF THE TANK DOME.

103 DOME POURED 12-19-84

Nex-13-3410-129

Client:	Address:	Phone No.
Project Name: HP TANK FARM	Project Location: TANK 101 DOME	Job Phone No.
Job Number: B-3-05 PHASE II	Date: 3-5-85 / Test Date: 3-5-85	By: V.D. Cummings

AV. STR. 5240 psi

R.(E.V.) 1400 psi

STD. DEV. 624.86 psi

COeff. of V. = % 11.9%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good X	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
1	101 DOME	NATURAL 3/4"	6	98	268624	2.050	5800
2	|	|	|	|	(2) 268625 (1) 268646	2.025	5600
~~3~~	|	|	|	|	~~(1) 273326 (2) 273329~~	UNEVEN HEIGHT - ~~1.975~~ OUT OF TOLERANCE	* ~~5200~~
4	|	|	|	|	273329	1.925	4800
5	|	|	|	|	273330	1.875	4400
6	|	|	|	|	273331	1.900	4600

* DUE TO UNEVEN HEIGHT OF THE (3) PROBES TEST #3 IS OUT OF THE PRECISION TOLERANCE AS GIVEN IN ASTM C803

101 DOME POURED 11-27-84

NCR-B-340-134

Client:	Address:	Phone No.
Project Name: B-340	Project Location: AP TANK FARM DOME 103	Job Phone No.
Job Number: B-340 DIKE J	Date: 3-11-85 Test Date: 3-11-85	By: J.D. CUMMINGS

AV. STR. 4650 psi

R.(E.V.) 4000 psi

STD. DEV. 789.7 psi

Coeff. of V. = % 17%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Area	Mold's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
8	NEAR TEST #4 SW QUAD.		6		273346	1.8875	4500
9	NEAR TEST #5 SE QUAD.		1		(1) 273347 (2) 273348	1.950	5000
10	NEAR TEST #3 SW QUAD.				273349	1.8875	4500
11	NEAR TEST #1 NORTHEAST				273350	1.7875	3700
12	NEAR TEST #7 SE QUAD.				273677	1.8875	4500
13	NEAR TEST #2 NE QUAD.				(2) 273676 (1) 273676	2.0375	5700

NOTE: ALL TEST AREA SURFACES WERE GROUND TO OBTAIN A SOMEWHAT FLAT SURFACE.

App. Figure B-56. Nonconformance Report B-340-130

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No. (1520-89): B-340-130

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
*Field Project File 241-AP Tk Fm
*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date: E. L. Backer 1/4/85 (7)
KEH Field Engineering EZB

(1H) Supervisors Review: M D Robbins

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break.

2C) Field cured cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance of concrete strength requirements is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: Eli Gerhey 1/11/85	Safety: D Rathbun 1-11-85	Engr. E Johnson 1/17/85	QA (ASME) —
QA	QA: L M Scrapmen 1-14-85	PE: JWS 1-14-85	QA: 1/24/85 J E Von Beck 1/25/85	DOE: 1/29/85

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

M D Robbins — Originator or Representative — 3/19/85 Date

(4A) List of Documents Affected

NONE EZB/MDR/JWW/TPS 4/17

(4B) Documents Revised

By ____ Date ____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-130 (1520-89)
Page 2 of 2

Concrete cylinder breaks for Tank 104 Haunch area: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
3	3203-23 (FC)	4050	
	-24 (FC)	3990	
	-25	5340	0.85(5340) = 4539
	-26	5200	0.85(5200) = 4420

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution below

DATE March 18, 1985

FROM E. A. Goakey

COPIES TO

JOB NO.

SUBJECT B-340 241-AP TANK FARM NCR B-340-130

A total of three (3) pairs of field cured and three (3) pairs of laboratory cured cylinders were tested at twenty-eight (28) days and forty-five (45) days for the concrete in question on NCR B-340-130.

The following summarizes the results:

Test No.	28 day Lab. Cured Strength	28 day Field Cured Strength
1	5355 psi	4555 psi
2	5415 psi	4260 psi
3	5270 psi	4020 psi
Average	5345 psi	4280 psi

Test No.	45 day Lab. Cured Strength	45 day Field Cured Strength
1	6150 psi	4865 psi
2	6000 psi	4730 psi
3	5510 psi	4580 psi
Average	5885 psi	4725 psi

Increase in Average Strength 28 day to 45 day	Lab. Cured	Field Cured
	540 psi	445 psi

The gain in strength of 445 psi from the 28 day to the 45 day field cured breaks provides assurance that the curing of the concrete was continuing despite the extended period of cold weather. The in place concrete would be better protected due to the increased mass of the haunch area and based on engineering judgement would have an in place strength in excess of 5000 psi.

EAG/ss

Distribution: Attachment to NCR B-340-130
J. W. Viita
Central File
E. A. Goakey File
LB

DOE-Richland, WA

App. Figure B-57. Nonconformance Report B-340-132

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 of 2

(1A) Project, Location or WO	(1B) Title	(1C) NCR No.
B-340	241-AP TANK FARM (PHASE V)	B-340-132 (1520-90)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File

*Field Project File
241-AP Tk Fm
*Preliminary Copies

(1F) Tag No.	(1G) Originator, Company and Date,	(1H) Supervisors Review
	E. L. Backer 1/15/85 (7) KEH Field Engineering	MDRobbins

(2A) Disposition
- ☐ Accept As Is
- ☒ Conditional Accept
- ☐ Rework
- ☐ Repair
- ☐ Reject
- ☐ Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break.

2C) Field cure cylinders are used to evaluate the effectiveness of curing the protection of concrete in the structure. Acceptance of concrete strength requirements is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required
- ☐ As-Builts
- ☐ DFC No. ____
- ☐ Other Specify ____
- ☒ N/A

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design 1/17/85	Safety C E Kennedy 1-17-85	Engr. 1/25/85	AI (ASME) N/A
QA	QA 1-17-85	PE 1-17-85	QA 1/25/85	DOE 1/28/85

(3A)
- ☒ Disposition Effected As Directed. NCR Closed
- ☐ Other (Specify)

MDRobbins
Originator or Representative
3/19/85
Date

(4A) List of Documents Affected

cc: EZB/MDB/JWV/TRC/TPH

(4B) Documents Revised

By ____ Date ____

? U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

B-340-132 (1520-90)
Page 2 of 2

Field cured cylinders for the Tank 103 Haunch Area failed to make 5000 psi or 85% of the laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days
1.	3205-23 (FC)	4160
	-24 (FC)	4170
	-25	5570 0.85(5570) = 4735
	-26	5300 0.85(5300) = 4505

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution below

DATE March 18, 1985

FROM E. A. Goakey

COPIES TO

JOB NO.

SUBJECT Project B-340 241-AP TANK FARM NCR B-340-132

A total of three (3) pairs of laboratory cured and three (3) pair of field cured cylinders were tested at twenty-eight (28) days and forty-five (45) days for the concrete in question on NCR-B-340-132. The results are summarized as follows:

Test No.	28 day Lab. Cured Strength	28 day Field Cured Strength
1	5290 psi	4435 psi
2	6200 psi	5080 psi
3	5435 psi	4165 psi
Average	5640 psi	4560 psi

Test No.	45 day Lab. Cured Strength	45 day Field Cured Strength
1	5785 psi	4825 psi
2	6660 psi	5605 psi
3	5555 psi	4955 psi
Average	6000 psi	5130 psi

Increase in Average Strength 28 days to 45 days	Lab. Cured	Field Cured
	360 psi	570 psi

The gain in strength of 570 psi from the twenty-eight (28) day to forty-five (45) day field cured breaks provides assurance that the curing of the concrete was continuing despite the extended period of cold weather. The forty-five (45) day average field cured strenth of 5130 is greater than the minimum design strength of 5000 psi.

EAG/ss

Distribution: Attachment to NCR B-340-132
J. W. Viita
Central File
E. A. Goakey File
LB

DOE-Richland, WA

App. Figure B-58. Nonconformance Report B-340-134

RL-604 (2-80)
(54-2099-604)

CONSTRUCTION NONCONFORMANCE REPORT

Page 1 Of 2

(1A) Project, Location or WO: B-340

(1B) Title: 241-AP TANK FARM (PHASE V)

(1C) NCR No.: B-340-134 (1520-92)

(1D) Requirements
(1E) Nonconformance Description

REQUIREMENTS

1. A. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 3.7.1. The concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8, and ACI 318, Section 4.8.3.

   B. Specification B-340-C5, Rev. 0, Section 03300, Paragraph 2.1.4.1. Minimum allowable compressive strength: 5000 psi at 28 days.

2. ACI 318-77, Section 4.8.3.4. Procedures for protecting and curing concrete shall be improved when the strength of field cured cylinders at the test age designated for measuring specified compressive strength is less than 85 percent of that of companion laboratory-cured cylinders.

(continued)

(1J) Distribution

DOE
*K K Lucas

ROCKWELL
*D L Bjorklund
*R J Hennig
*E Koellermeier
*C A Rieck

JAJ
*T R Cloud
*W T Frisbee

KEH
*E L Backer
*D L Brown
R L Hand
R M Iten
*J R Nicholson
*J W Viita
*T L Walton
Central File
Field Project File 241-AP Tk Fm
*Preliminary Copies

(1F) Tag No.

(1G) Originator, Company and Date: E. L. Backer 1/18/85 (7)
KEH Field Engineering

(1H) Supervisors Review

(2A) Disposition
- [X] Accept As Is
- [X] ~~Conditional~~ Accept
- [ ] Rework
- [ ] Repair
- [ ] Reject
- [ ] Other (Specify)

(2B) Instructions
(2C) Justification

2B) Acceptance of curing and protection of the concrete pour shall be based on the additional field cured cylinders held for a 45 day break.

2C) Field cure cylinders are used to evaluate the effectiveness of curing and protection of concrete in the structure. Acceptance of concrete strength requirements is based on lab cured cylinders which meet specified requirements.

(2D) Additional Doc Required
- [ ] As-Builts
- [ ] DFC No. _____
- [ ] Other Specify _____
- [X] N/A

Rev 1 Reinitial

(2E) Contr. Approval (Signature and Date)	(2F) A-E Approval (Signature and Date)		(2G) Opr. Contr. Approval (Signature and Date)	(2H) Concurrence (Signature and Date)
Engr.	Design: E L Backer 1/18/85	Safety: CE Kamer 1/18/85	Engr: 3/27/85	H (ASME)
QA	QA: Wm. Brayman 1-21-85	PE: 3-21-85 1-24-85	QA: 2/1/85	DOE: 1/31/85

(3A)
- [X] Disposition Effected As Directed. NCR Closed
- [ ] Other (Specify)

Originator or Representative: 3-25-85 Date: 3.28.85

(4A) List of Documents Affected

(4B) Documents Revised By _____ Date _____

U.S. GOVERNMENT PRINTING OFFICE: 1983-695-150/102

NCR B-340-134 (1520-92)
Page 2 of 2

Tank 103 Dome concrete cylinder breaks at 28 days: field cured cylinders failed to make 5000 psi or 85% of laboratory-cured cylinders.

Test No.	Cylinder No.	PSI @ 28 Days	
1.	3207-4 (FC)	4080	
	-5 (FC)	4320	
	-6	5230	0.85(5230) = 4446
	-7	5010	0.85(5010) = 4256

2B) Instructions Rev 1

Accept as is

2C) Justification Rev 1

See attached letter dated 3/20/85 by EA Goakey and JW Viita

KAISER ENGINEERS HANFORD

INTEROFFICE MEMORANDUM

TO Distribution

DATE March 20, 1985

FROM E. A. Goakey
J. W. Viita

COPIES TO

JOB NO.

SUBJECT Project B-340, NCR's B-340 - 124, 127, 129 and 134

These NCR's were written because the field cured cylinder breaks did not meet the ACI guideline of being within 85% of the laboratory cured breaks. Acceptance of the concrete mix is based on the laboratory breaks where the field breaks indicate the acceptability of the curing procedures in place and the effect the weather may have on the in-place concrete.

Acceptance of NCR #134 per the original disposition was to be based on 45 day cylinder breaks for that pour. Acceptance of the other 3 NCR's was to be based on 45 day breaks for those pours for which spare cylinders were available since all curing blankets and heat were removed from all pours after the first week.

The results of the 28 day and 45 day field cured cylinder breaks are summarized as follows:

	Pour Slip #	28 day F.C.	45 day F.C.
Tank 103 Dome	3207	4308 psi	4198 psi
104 Dome	3204	4710	4905
105 Dome	3208	4720	4408
106 Dome	3202	4960	4832
106 Haunch	3200	5342	5660
104 Haunch	3203	4278	4725
103 Haunch	3205	4560	5042
105 Haunch	3206	5090	5110
	Average	4746 psi	4860 psi

The average 28 day Field Cured cylinder breaks for the pours with the open NCR's is:

	NCR #	28 day F.C.
107 Dome	124	3458 psi
102 Dome	127	4020
101 Dome	129	4205
103 Dome	134	4308
	Average	3998 psi

The specified concrete strength is 5000 psi for laboratory cured cylinders at 28 days. Using 85% for field cured cylinders would give us a value of 4250 psi for field cured cylinders. The average strength gain demonstrated by the 45 day cylinder breaks was lower than expected and does not give a firm indication that the field strength would meet the 4250 psi figure but does show that the concrete is continuing to gain strength despite the prolonged period of cold weather.

DOE Richland, WA

Interoffice Memorandum
March 20, 1985

There are some notable inconsistancies in the test data such as the decrease in strength from 28 day field cure to 45 day field cure for 3 of the 8 pours for which 45 day field breaks are available. Due to these inconsistancies, it was decided to perform some tests on the in-place concrete with the Windsor Probe.

The Windsor Probe is approved for use by ASTM in comparing the relative strengths of concrete but not in determining the actual strength. To obtain a comparison to concrete which is known to be acceptable, testing was done on the Tank 108 dome in addition to the 4 domes with open NCR's. The Tank 108 dome had an average 28 day field cure strength of 4890 psi and a laboratory cure strength of 6325 psi.

A predicted field cure strength of the concrete was obtained by comparing the Windsor Probe results for Tank 108 and the other domes with the field cure strength for Tank 108. The following formula was used:

$$\frac{\text{Probe results Tank "X"}}{\text{Probe results Tank 108}} \times 4890 \text{ psi} = \text{Predicted Field Cure Strength}$$

Windsor Probe results for Tank 108 indicated an average strength of 5150psi (8 tests) (concrete age of 113 days)

Tank	Windsor Probe Strength	Predicted Strength	Age of Concrete
107	5213 psi (8 tests)	4949 psi	101 days
102	4933 (6 tests)	4685	106
101	5040 (5 tests)	4787	98
103	4530 (6 tests)	4303	82

(Tank 103 was tested twice. There were problems with the roughness of the concrete surface possibly effecting the results of the test so the first test was discarded; the test locations were ground to an acceptable smoothness (allowed by ASTM) and new tests performed.)

The results indicate predicted field cure strength in excess of 4250 psi with an actual increase of essentially zero (0) (4303 versus 4308) for the Tank 103 dome to approximately 1500 psi for the Tank 107 dome when compared to the field cured cylinder results. These predicted strengths are considered somewhat conservative since the base results from Tank 108 have the longest cure time with Tank 103 having 31 days less cure time.

In summary, considering the Windsor Probe results on the in-place concrete along with the cylinder test results (both lab. cured and field cured) all encasement concrete will develop the required strength to properly perform as intended in the design. Some of the individual tests may indicate a problem but the overall results indicate that the contractor has supplied and placed the concrete as specified

JWV/ss

Distribution: Attachment to NCR B-340-124
Attachment to NCR B-340-127
Attachment to NCR B-340-129
Attachment to NCR B-340-134
EA Goakey
JW Viita File
Central File
LB

KAISER ENGINEERS HANFORD — **INSPECTION REPORT**

Project No.	Ident. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B-340	PHASE I	2-23-85	2-26-85		

DISCIPLINE

Civil/Structural	☒
Mechanical	☐
HVAC	☐
Electrical	☐
Instrumentation	☐

JOB SITE ACTIVITY

	YES	NO
Site visited	☒	☐
Construction in progress (personal observation)	☐	☒

WEATHER EFFECT INFORMATION

	YES	NO
Construction hindered by weather	☐	☒
Work rejected due to weather	☐	☒

Conditions/Comment: _____

INSPECTION

Item	Acc	Rej	Other Documentation

OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING FOR COMPRESSIVE STRENGTH OF TANK 108 DOME. A TOTAL OF (9) TESTS WERE TAKEN EACH TEST CONSISTING OF THE AVE. OF (3) PROBES. TEST # 1 IS NOT USED IN THE CALC. OF THE DATA DUE TO EXCESSIVE SPALLING CAUSING INACCURATE MEASUREMENT.

SEE ATTACHED DATA SHEET FOR RESULTS OF TESTING.

Report continued on reverse side ☐

Signature

KEH-377 .2-83

Client: RHO	Address:		Phone No.
Project Name: B-340	Project Location: AP TANK FARM (TANK 108 DONE)		Job Phone No.
Job Number: PHASE II	Date: 2-26-85	Test Date: 2-26-85	By: J.D CUMMINGS

AV. STR. 5150 psi
R.(E.V.) 1500 psi
STD. DEV. 526.8 psi
COeff. of V. = % 10.23%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
#1	108 DONE	NATURAL 3/4"	6	113	268609 268616	1.9375	~~4900~~
2					268622	2.050	5800
3					268609 268607	2.075	6000
4					268611	1.925	4800
5					268613	1.8875	4500
6					268615	1.9625	5100
7					268620	1.900	4600
8					268621	1.9625	5100
9					268623	1.9875	5300

TEST #1 RESULT ~~ARE~~ 5200 NOT USED DUE TO EXCESSIVE CONCRETE SPALLING. THE HOT SURROUNDING WAS NOT ACCURATE.

TABLE 3 - FACTORS FOR COMPUTING WITHIN-TEST STANDARD DEVIATION*

Number of Specimens		$1/d_2$
2		0.8865
3		0.5907
4		0.4857
5		0.4299
6		0.3946
7		0.3698
8		0.3512
9		0.3367
10		0.3249

* From Table B2, "Manual on Quality Control of Materials", ASTM Special Technical Publication No. 15-C.

NOTE: Table may be used to report as many as ten tests.

USING TABLE 3 (Ex. 3 test report)

Assume Moh's #4 Aggregate

Exposed Probe Height

A	B	C
1.800 inch	1.750 inch	1.825 inch
psi conversion from Windsor column #4		
5100 psi	4750 psi	5275 psi

Range = 5275 (Hi) - 4750 (Low) = 525 psi

Std. Dev. = Range x 0.5907. (from Table 3)

Thus: 525 x .5907 = 310 (Std. Dev.)

Coeff. of Var. = Std. Dev. ÷ Av. psi x 100

or

310 ÷ 5041 (av.) = .614 x 100 = 6.14%

AMERICAN CONCRETE INSTITUTE

COPY

STANDARD 214-65

TABLE 2 - STANDARDS OF CONCRETE CONTROL

Class of operation	Coefficient of variation for different control standards			
	Excellent	Good	Fair	Poor
Over-all variation: General construction	Below 10.0	10.0 to 15.0	15.0 to 20.0	Above 20.0
Laboratory Control	Below 5.0	5.0 to 7.0	7.0 to 10.0	Above 10.0
Within-test variations: Field control	Below 4.0	4.0 to 5.0	5.0 to 6.0	Above 6.0
Laboratory Control	Below 3.0	3.0 to 4.0	4.0 to 5.0	Above 5.0

Note: These standards represent the average for 28-day cylinders computed from a large number of tests. Different values for other than average concretes can be expected.

ISTM-C 803-79

KAISER ENGINEERS HANFORD

INSPECTION REPORT

Project No.	Dept. No. (if applicable)	Date - Previous Report	Date - This Report	Reviewer	Copy
B 340	DIVISION II		2/23/85		

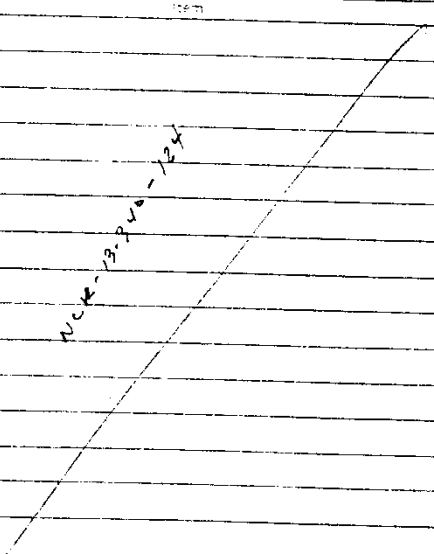
DISCIPLINE		JOB SITE ACTIVITY	YES	NO
Civil/Structural	✓	Site visited	✓	
Mechanical		Construction in progress (personal observation)		✓
HVAC				
Electrical				
Instrumentation				

WEATHER EFFECT INFORMATION	YES	NO
Construction hindered by weather		✓
Work rejected due to weather		✓

Conditions/Comment _____

INSPECTION

Item	Acc.	Rej.	Other Documentation



OTHER ACTIVITIES GENERAL COMMENTS

PERFORMED WINDSOR PROBE TESTING ON TANK 107 CONCRETE DOME. A TOTAL OF (9) TESTS WERE TAKEN, EACH TEST CONSISTING OF THE AVERAGE OF (3) PROBES. TEST #4 IS NOT USED IN THE CALCULATION OF THE DATA SINCE (2) OF THE (3) PROBES DRIVEN WERE AT AN ANGLE SUCH THAT THE TRIANGULAR MEASURING PLATE WOULD NOT RECEIVE THE PROBE ENDS.

SEE ATTACHED TEST DATA SHEET FOR RESULTS OF TESTING.

A MOH'S HARDNESS TEST WAS PERFORMED ON TWO DIFFERENT AGGREGATE SPECIMENS - BOTH INDICATED A #6 HARDNESS.

Report continued on reverse side ☐

Signature

KE-227-2 (83)

NCR-W-[illegible]-124

Client:	Address:		Phone No.
Project Name: B-340	Project Location: AD TANK FARM (TK 107 DOME)		Job Phone No.
Job Number: PHASE II	Date: 2/23/85	Test Date: 2/23/85	By: J.D. Cummings

AV. STR. 5213 psi

R.(E.V.) 200. psi

STD. DEV. 316 psi

COeff. of V. = % 6.06%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent X	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Moh's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
1	107 DOME	3/4" NATURAL	6	101	(2) 268618 (1) 268608	1.975	5200
2	|	|	6	101	268605	1.9125	4100 [illegible]
3			6	101	(2) 268614 (1) 268608	2.0125	5500
~~4*~~			~~6~~	~~101~~	~~268603~~	~~2.0643~~ QUEST. RESULT	~~5900~~
5			6	101	(2) 268604 (1) 268608	2.0125	5500
6			6	101	268617	1.9625	5100
7			6	101	268610	1.9875	5300
8			6	101	(2) 268602 (1) 268601	1.925	4800
9	107 DOME	3/4" NATURAL	6	101	(1) 268601 (1) 268607 (1) 268606	2.025	5600

* (2) OF THE THREE PROBES WERE ANGLED SUCH THAT PLATE WOULD NOT FIT.

NCR-15340-137

Firm: | Address: | Phone No.

Project Name: 241 AR TANK FARM | Project Location: TANK 102 DOME | Job Phone No.

Job Number: P-240 Element | Date: 3-5-85 | Test Date: 3-5-85 | By: J.D. Cummings

AV. STR. 7333. psi

R.(E.V.) 600 psi

STD. DEV. 475.68 psi

COEF. of V. = % 6.49%

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Av. of Probe Cage (Av. - 3 Probes)	Comp. Strength (psi)
1	102 DOME	NATURAL 3/4"	6	106	273332	1.950	5000
2	"	"	"	"	273333	1.9375	4900
3	"	"	"	"	273334	1.875	4400
4	"	"	"	"	273335	1.9375	4900
5	"	"	"	"	(2) 273336, (1) 273327	1.975	5200
6	"	"	"	"	273337	1.975	5200
	102 DOME POURED				11-19-84		

NEC-15-3-0-129

Client:	Address:			Phone No.
Project Name: AP TANK FARM	Project Location: TANK 101 DOME			Job Phone No.
Job Number: B-340 PHASE II	Date: 3-5-85	Test Date: 3-5-85	By: V.D. Cummings	

AV. STR. 5240 psi

R.(E.V.) 1400 psi

STD. DEV. 6286 psi

COeff. of V. = % 11.9%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	X Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Agg.	Mch's No.	Cure Days	Probe & Power Load Certification Number	Ht. of Probe Gage (Av. - 3 Probes)	Comp. Strength (psi)
1	101 DOME	NATURAL 3/4"	6	99	268624	2.050	5800
2					(2) 264625 (1) 268946	2.025	5600
~~3~~					~~(1) 273326 (2) 273329~~	UNEVEN HEIGHT - ~~1.975~~ OUT OF TOLERANCE	* ~~5200~~
4					273329	1.925	4800
5					273330	1.875	4400
6					273331	1.900	4600

* DUE TO UNEVEN HEIGHT OF THE (3) PROBES TEST #3 IS OUT OF THE PRECISION TOLERANCE AS GIVEN IN ASTM C803

101 DOME POURED 11-27-84

NCR-87-342-134

Client: | Address: | Phone No.

Project Name: AP TANK FARM | Project Location: TANK 103 DOME | Job Phone No.

Job Number: B-BOO Order No. | Date: 3-5-85 | Test Date: 3-5-85 | By: J. A. CUMMINGS

AV. STR. 5460 psi

R.(S.V.) 2492 psi

STD. DEV. 1102 psi

Coeff. of V. = % 20.17%

SCAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2

Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor X
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Num	Type	Agg.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Rt. of Probe Rise (Av. - 3 Probes)	Comp. Strength (psi)
1	103 DOME	3/4"	6	76	273338	2.025	5600
2					273339	2.0125	5500
3					273340	1.775	3600
4					273341	1.7375	3300
5					273342 (2) 273342 (1)	1.725	3200
6					273344	1.9125	4700
7					273345	1.9375	4900

NOTE: TEST # 3, 4, & 5 WERE TAKEN ON THE SOUTH 1/2 OF THE TANK DOME.

103 DOME POURED 12-19-84

NCR-B-340-134

Client:	Address:		Phone No.
Project Name: B-340	Project Location: AP TANK FARM DOME 103		Job Phone No.
Job Number: B-340 DOME T	Date: 3-11-85	Test Date: 3-11-85	By: J. D. CUMMINGS

AV. STR. 4650 psi

R.(E.V.) 2000 psi

STD. DEV. 789.2 psi

Coeff. of V. = % 17%

SEAL

AMERICAN CONCRETE INSTITUTE 214-65 STANDARDS OF CONCRETE CONTROL TABLE 2				
Class of operation	Coefficients of variation for standard control concrete			
	Excellent	Good	Fair	Poor
General Construction	Below 10.0%	10.0 - 15.0%	15.0 - 20.0%	Above 20.0%

Test Area	Type	Age.	Mold's No.	Cure Days	Probe & Power Load Certification Number	Wt. of Probe Cage (Av. - 3 Probes)	Comp. Strength (psi)
8	NEAR TEST #4 SW QUAD.		6		273346	1.8875	4500
9	NEAR TEST #5 SE QUAD.		1		(1) 273347 (2) 273348	1.950	5000
10	NEAR TEST #3 SW QUAD.				273349	1.8875	4500
11	NEAR TEST #1 NORTHEAST				273350	1.7875	3700
12	NEAR TEST #7 SE QUAD.				273677	1.8875	4500
13	NEAR TEST #2 NE QUAD.				(2) 273675 (1) 273676	2.0375	5700

NOTE: ALL TEST AREA SURFACES WERE GROUND TO OBTAIN A SOMEWHAT FLAT SURFACE.