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HISTORY OF WASTE TANK 6
1954 THROUGH 1974

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INTRODUCTION

Alkaline radioactive wastes resulting from the chemical separation of fission products from plutonium and uranium at the Savannah River Plant are stored underground in carbon steel tanks having capacities that range from 0.75 to 1.3 million gal. The waste falls into two general categories: high heat waste (HW), which contains the majority of the fission products, and low heat waste (LW), which results from purification processes and from dissolving aluminum cladding from reactor fuels. Some tanks equipped with cooling coils are for storage of high heat waste while other tanks without cooling coils are for low heat waste.

Tank 6 is a 750,000 gal, type I tank that is located in F Area and used for the storage of high heat waste (figure 1). It is 75 ft in diameter, 24-1/2 ft high, and has 34 vertical cooling coils distributed throughout the tank. There are two horizontal coils at the bottom, where the sludge and most of the fission products concentrate. The tank is constructed from type ASTM A-285-B steel with non-stress-relieved welds, and it is inside a concrete vault with an annular space surrounding the tank. Lining the bottom of the vault is a 5-ft-high steel annulus pan (secondary container) to collect leakage from the primary tank. There are eight risers providing access to the tank interior and four risers to the annulus.

Events in the history of tank 6 are listed chronologically in figure 2 and discussed briefly in this report. Listing of a date by month and year at any place in this report serves as a reference to the Works Technical Report for that month. The history covers a period from November 1954 through December 1974.

SUMMARY

Tank 6 was placed in service as a receiver of HW in November 1964; the tank became filled in October 1966. In November 1969, approximately 694,000 gal of supernate was decanted to tanks 1 and 7. The tank started receiving high heat waste again and became filled in March 1972. Approximately 36,000 gal of supernate was decanted to tank 7. In June 1972, approximately 355,000 gal of supernate was decanted to tank 7. In September 1972, tank 6 received about 209,000 gal from tank 18.

Inspections of the tank interior and annulus were made by direct observation and by using a 40-ft optical periscope. Samples were taken of material in the annulus and of vapor from the tank interior. Wall thickness measurements were made. Several equipment modifications and various equipment repairs were made.

DISCUSSION

Overall Chronology

In 1963, tank 6 was placed in service as an emergency spare tank. Fresh HW from the Purex process in Building 221-F was routed to tank 6 when tank 4 became filled in October 1964. The tank's vent filter (figure 3) ignited on March 31, 1965. The fire started when forced ventilation was restored after being off for about 10 hours. The fire was caused by the combination of high temperature, stagnant air in the steam jacketed filter, and an organic rust inhibitor, VPI-220, which accumulated in the fiberglass filter packing. There was no release of contamination to the environment. In December 1965, a bluish fog was seen coming from the ventilation filter. Investigation indicated the fog was derived from degraded solvent, tributylphosphate (TBP), in the waste tank. Fog analysis is shown in table 2.

Approximately 1,000 and 6,000 gal of process solvent from Building 221-F was received in tank 6 in August and December 1966, respectively. In November 1969, 700,000 gal of waste from tank 6 was transferred to tanks 1 and 7. This made room for 80,000 gal of waste from SRL in October 1970. In June 1972 and March 1973, 374,000 gal and 510,000 gal of supernate were respectively transferred to tank 7.

Chronology of Events

Nov 1963	Tank 6 was classified as an unused emergency spare.
Feb 1974	Rust samples from the annulus were taken for metallurgical examination.
Mar 1964	600 lb of VPI-220, a rust inhibitor, were added to the tank.
May 1964	The cooling coils were hydrostatically tested.
Oct 1964	Hydrogen purge blowers and pressure indicators and alarms were installed.
Nov 1964	High heat waste was routed to tank 6 when tank 4 became filled.
Apr 1965	A fire started in the vent filter when the VPI-220 inhibitor in the vent piping and filter ignited spontaneously.
May 1965	A temperature profile was taken. Cooling water was increased 20% to overcome the flow resistance in the line. A reel tape was installed.
Oct 1965	The filter involved in the fire was disassembled and inspected. The old packing was removed and burned in a steel container. The filter housing was recharged with fiberglass and installed in tank 2.
Dec 1965	A bluish fog, believed to be derived from degraded TBP, was seen coming from the ventilation filter.
June 1966	Coil tests were made to determine the importance of coil location in the tank.
Sep 1966	Approximately 7,000 lb of process solvent was transferred from Building 221-F to tank 6.
Oct 1966	The hydrogen level increased to within 15% of lower explosive limit when the tank ventilation was shut down. The hydrogen concentration decreased to normal levels when the blower was started.
Dec 1966	About 6,000 gal of solution containing some organic was transferred from Building 221-F.
Jan 1970	High heat waste header 2 was connected to tank 6.
Sep 1970	Approximately 62 lb of silver from the Building 221-F iodine reaction flushing was transferred to tanks 6 and 7.

Oct 1970	180,000 gal of waste from SRL was received.
Nov 1970	Tank vapor space ventilation measurements were taken.
Jun 1972	The annulus was inspected.
Jul 1972	Samples were taken from the annulus.
Dec 1972	The annulus dehumidification motor burned out following bearing failure.
Apr 1973	The annulus leak detection probes were repaired.
Jan 1974	Primary wall thicknesses were checked under east riser.
Mar 1974	Primary wall thicknesses were checked under west riser.
Sep 1974	An emergency transfer jet was installed in south annulus riser.
Oct 1974	Reel tape probes were not indicating salt and sludge layers.

Inspections of Tank Interior and Annulus

Visual inspections of the tank interior and annulus are made by lowering a 2.5-in. dia optical periscope into access risers. The tank interior was inspected in February 1964 and December 1965. The annulus was inspected in November 1963 and June 1972. The cooling coils were observed. No leaks were detected in either the tank interior or the annulus. Photographs taken during the inspections are listed in table 1.

Chronology of Events Related to Inspection

Nov 1963	Rust on the tank floor and the lower portions of some cooling coils was observed.
Feb 1964	Inspection of the tank bottom before being placed in service showed pits 0.02 and 0.04 in. deep; the maximum pit depth was 0.096 in. The coils were in good condition.
Dec 1965	Inspection of the tank interior showed a bluish fog in the vapor space and an oily film over part of the liquid surface.
Jun 1972	Inspection of the annulus showed deposits of white solids containing tan porous particles. Later analysis showed that the tan porous particles contained mainly sodium and some carbonate. The source is unknown, but it is believed to be the result of drying groundwater containing dissolved solids. Large rust or paint flakes were noted at the junction of the knuckle plate and underlying grout layer.

Samples of Tank and Annulus Contents

Tank 6 was sampled three times: twice from the annulus and once from the tank interior. Rust observed during inspection of the annulus was sampled in February 1964, and sent for metallurgical examination. In December 1965, a bluish fog was observed coming from the tank's ventilation filter. It was sampled, and analyses are shown in table 2. Another sample was taken from the annulus in July 1972; analysis showed the sample contained tan porous particles that were made up of sodium and carbonate. The sample was not radioactive.

Chronology of Events Related to Sampling

Jun 1964	Rust samples were taken for metallurgical examination.
Dec 1965	Samples of condensed vapor were analyzed by SRL.
Jul 1972	Samples of solids observed during the tank annulus inspection were taken.

Physical Measurements

Vertical temperature profiles of the tank interior were taken through the thermowells in risers 1, 3, 5, and 8 in April 1965. The profiles were taken by incrementally lowering a 40-ft thermocouple into the existing thermowells. The temperature profiles are shown in figure 2. Vapor space measurements were taken in November 1970. Primary wall thicknesses under the east and west annulus risers were checked and found to be within specifications. The wall thickness measurements are shown in figures 6 and 7.

Chronology of Events Related to Physical Measurements

May 1965	Temperature profiles were taken in risers 1, 3, 5, and 8.
Nov 1970	Vapor space measurements were taken and are as follows: Air flow in -- 128 cfm Air flow out -- 49 cfm Tank pressure (in H_2O) -- 1.0 Vent filter radiation, R/hr at 2 in. -- 0.03 Type of ventilation -- positive pressure
Jan 1974	Primary wall thicknesses under east riser were checked and found to be within specifications.
Mar 1974	Primary wall thicknesses under west riser were checked and found to be within specifications.

Cooling Coil Failures

There were no known cooling coil leaks in tank 6 through December 1974.

Tests Conducted

The vertical and horizontal cooling coils in tank 6 were hydrostatically tested in May 1964. In June 1966, the cooling coils were tested to determine the effect of isolating cooling water from different coil groups on the temperature distribution in the tank. The effect of cooling surface is shown in figure 4. The test concluded that the coil arrangement was adequate to maintain a uniform temperature in the tank.

Chronology of Events Related to Tests Conducted

May 1964	The cooling coils were hydrostatically tested.
Jun 1966	The coil tests were made to determine the effect of cooling coil location and temperature distribution in the tank.

Equipment Modifications and Repairs

Several additions, modifications, and repairs were made to tank 6. A hydrogen blower, pressure indicator, reel tape, and transfer jet were added to the tank. High heat waste header 2 was connected to tank 6, and the ventilation filter was recharged with fiberglass packing. Repairs were made to the annulus dehumidification motor and annulus leak detection probes.

Chronology of Events Related to Equipment Modification and Repairs

Oct 1964	Hydrogen purge blowers and pressure indicators and alarms were installed.
May 1965	A new reel tape with a mercury seal was installed on May 14.
Oct 1965	The purge system filter housing was recharged with fiberglass and installed in tank 2.
Jun 1970	High heat waste header 2 was connected to tank 6.
Dec 1972	The annulus dehumidification fan motor burned out following bearing failure. Repairs followed.
Apr 1973	Annulus leak detection probes were repaired. One was broken and another was out of position.
Sep 1974	An emergency transfer jet was installed in the south annulus riser.

TABLE 1
TANK 6 PHOTOGRAPHS

Date	Riser	Object	PRD No.	Sep Tech File Location	
				Box	Slots
5/2/62	North	Annulus, welds	8275-1 thru 27	6	88-114
5/4/62	West	Annulus, welds	8269-1 thru 27	6	115-141
6/1/72	South	Annulus, welds	15958-1 thru 29	9	26-52
6/7/72	North	Annulus, welds	15971-1 thru 25	9	1-25
7/12/72	West	Annulus, welds	16072-1 thru 32	9	55-86
7/17/72	East	Annulus, welds	16096-1 thru 25	9	87-111
7/23/73	East	Annulus, welds	17193-1 thru 23	9	112-134

TABLE 2
TANK 6 SAMPLE ANALYSES

Component	Sample 1, vol %	Sample 2, vol %	Normal Air, vol %
H_2	0.07	0.08	0.01-0.02
CO_2	0.03	0.03	0.03
N_2	77.98	77.00	77.78
O_2	21.00	21.24	21.00
Argon	0.92	0.94	0.9

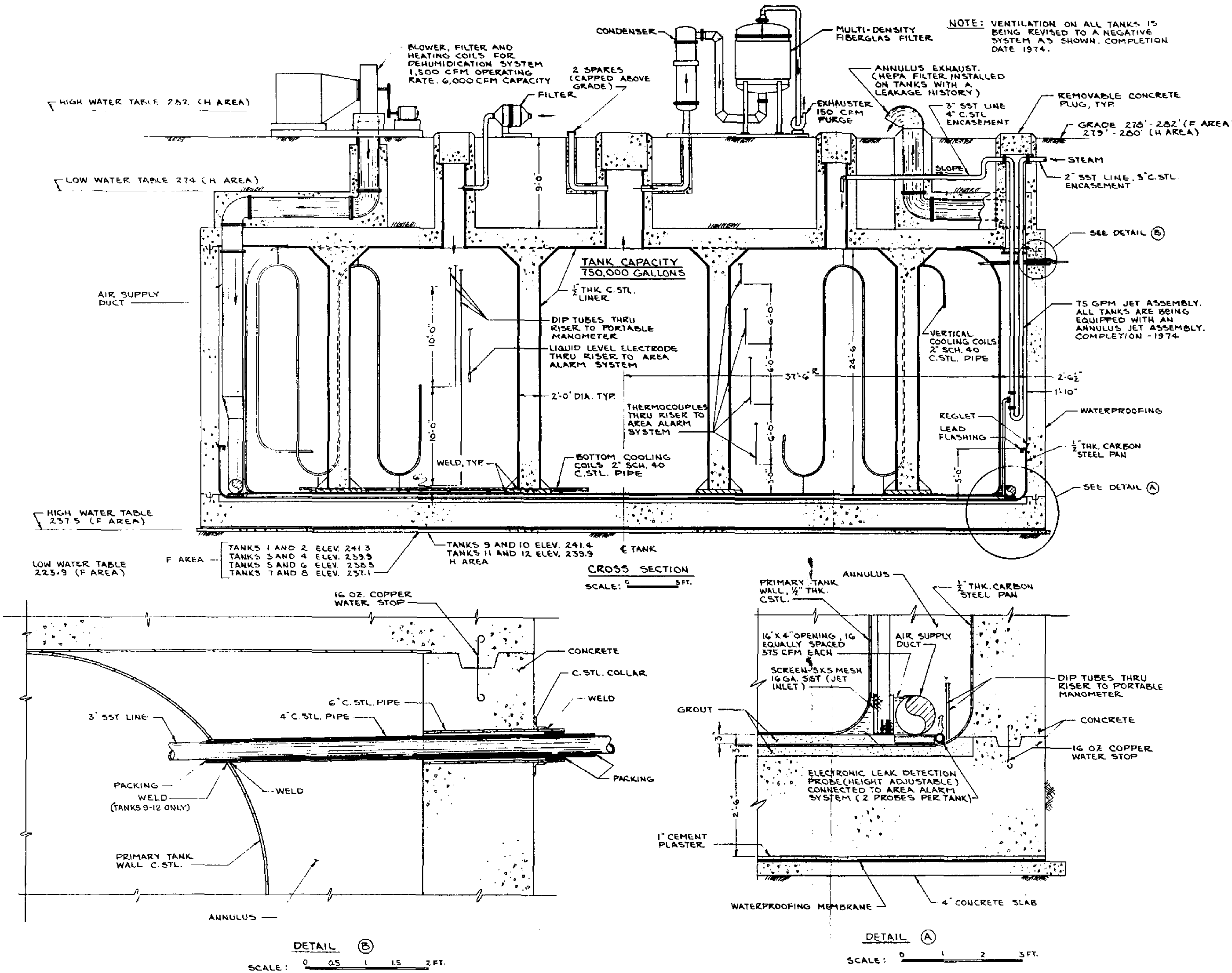

FIGURE 1. WASTE STORAGE TANK 6

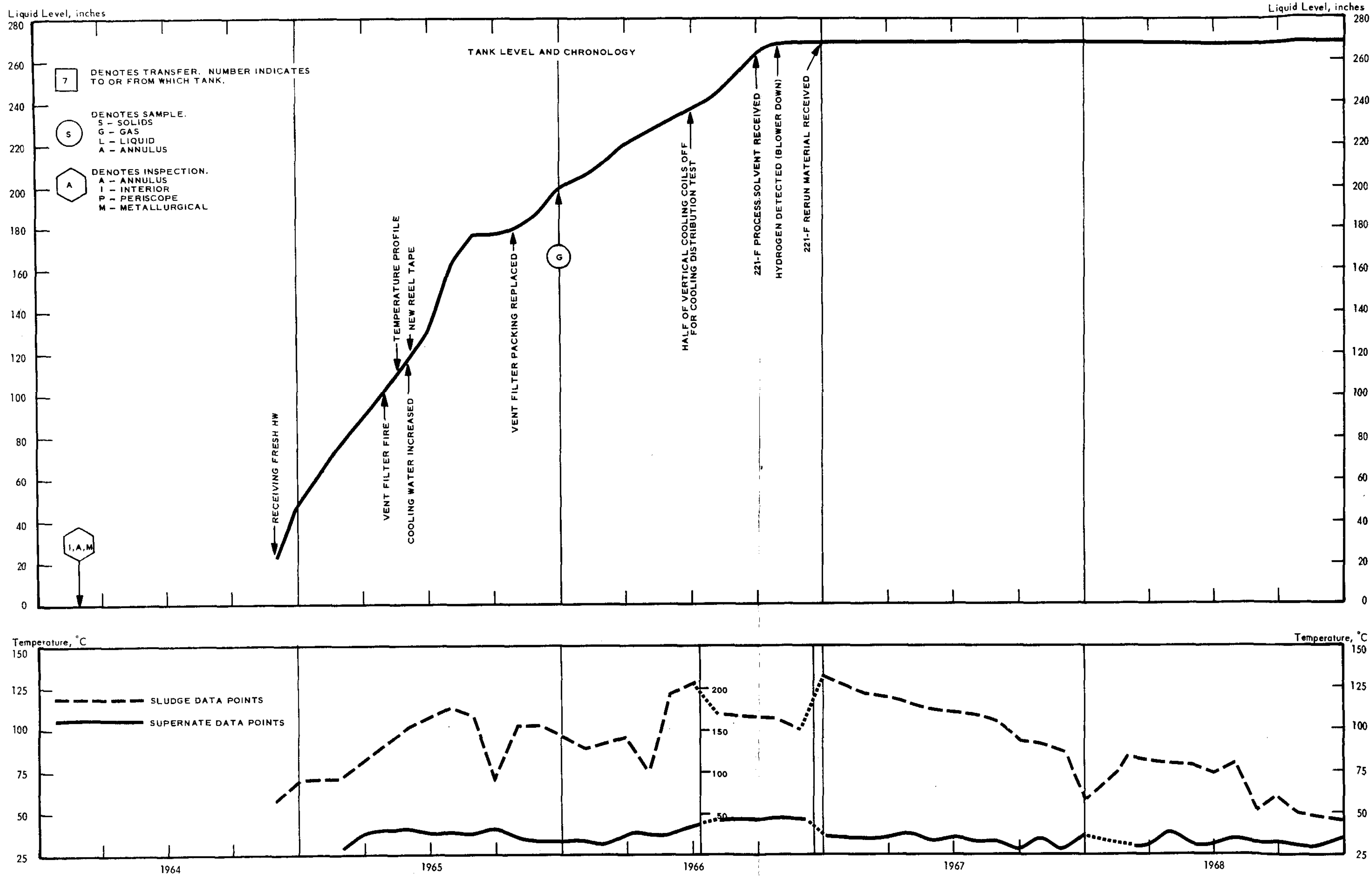

FIGURE 2. TANK 6 LIQUID LEVELS AND TEMPERATURES

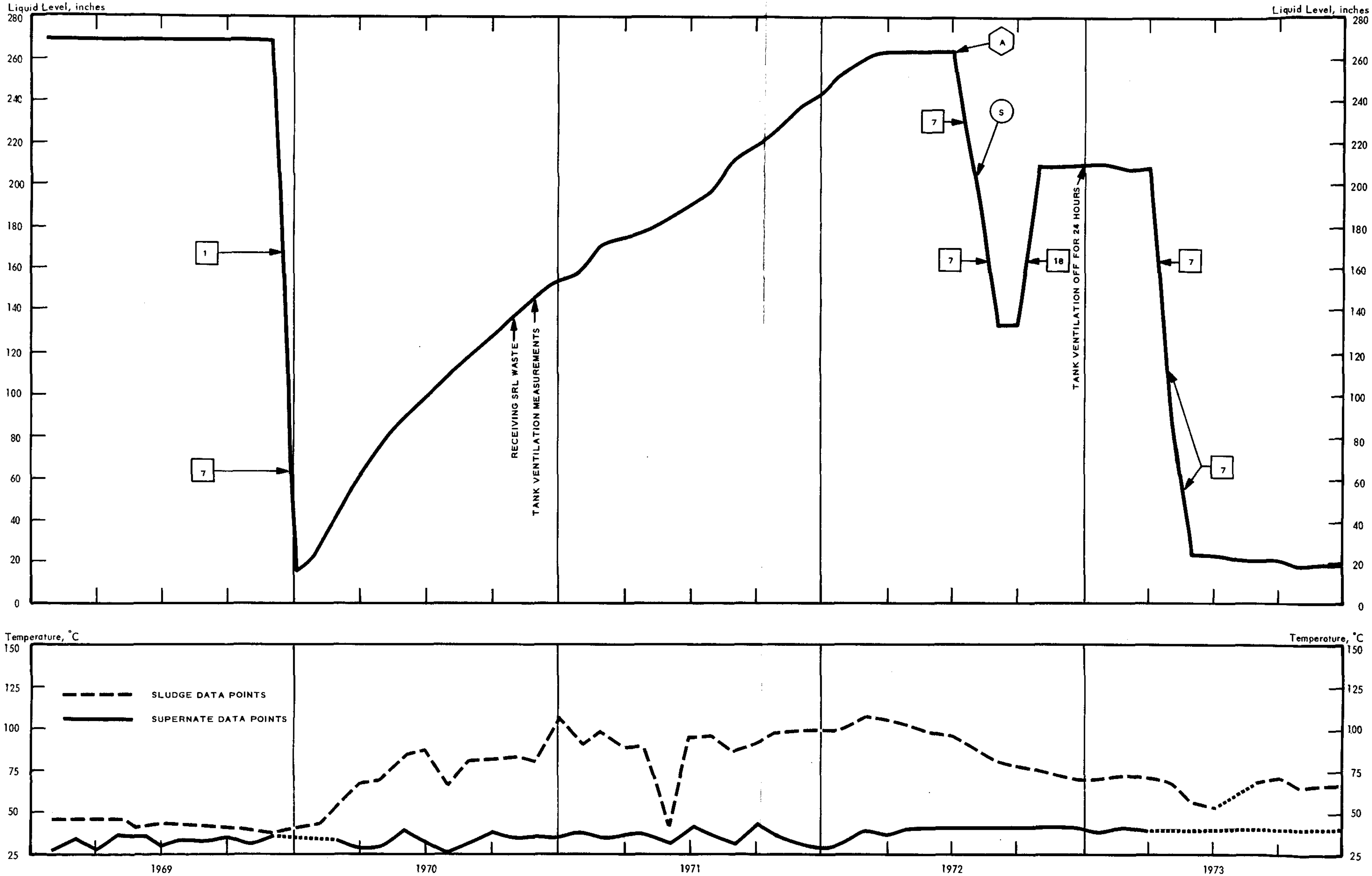

FIGURE 2 (contd)

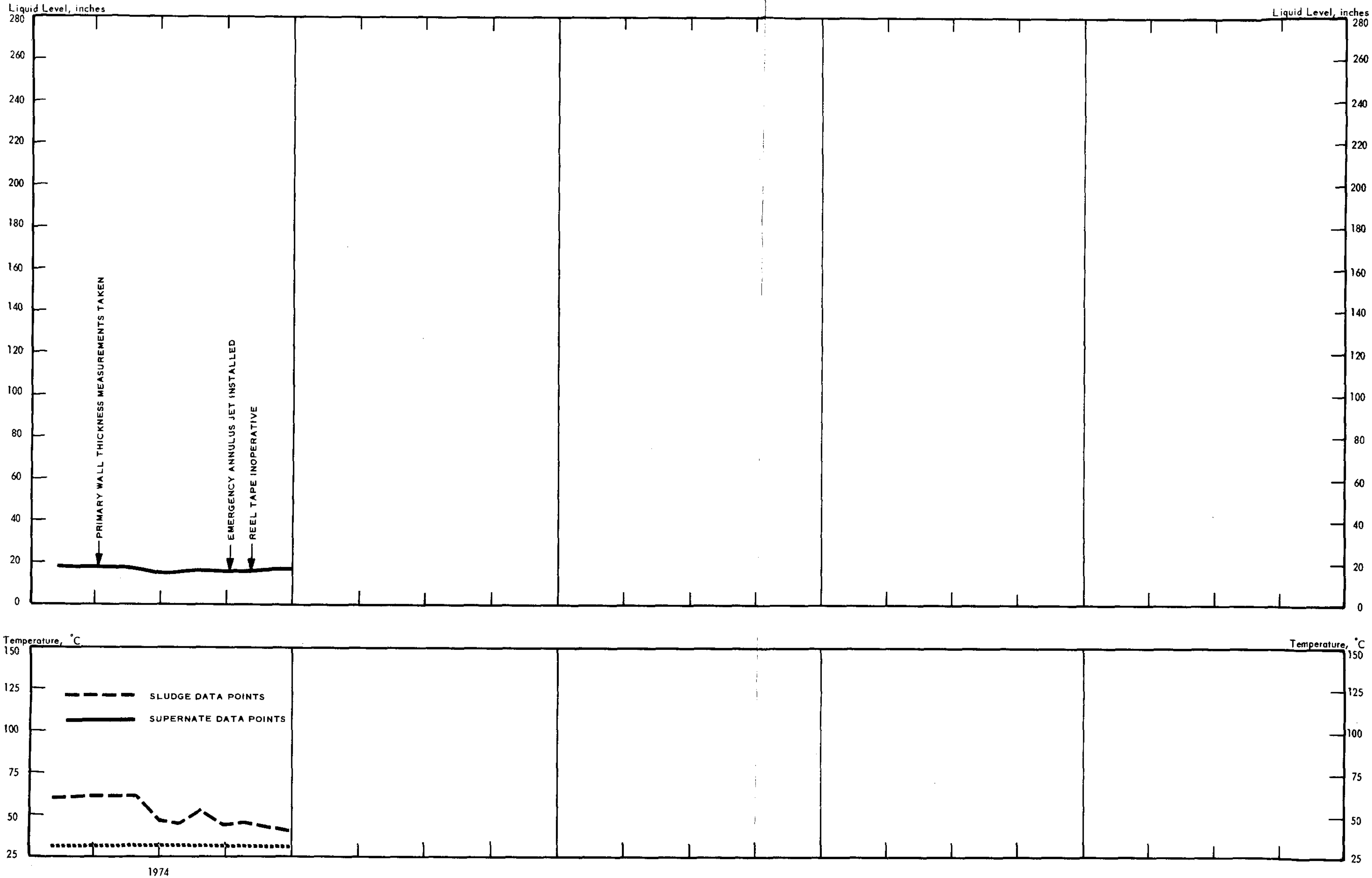

FIGURE 2 (contd)

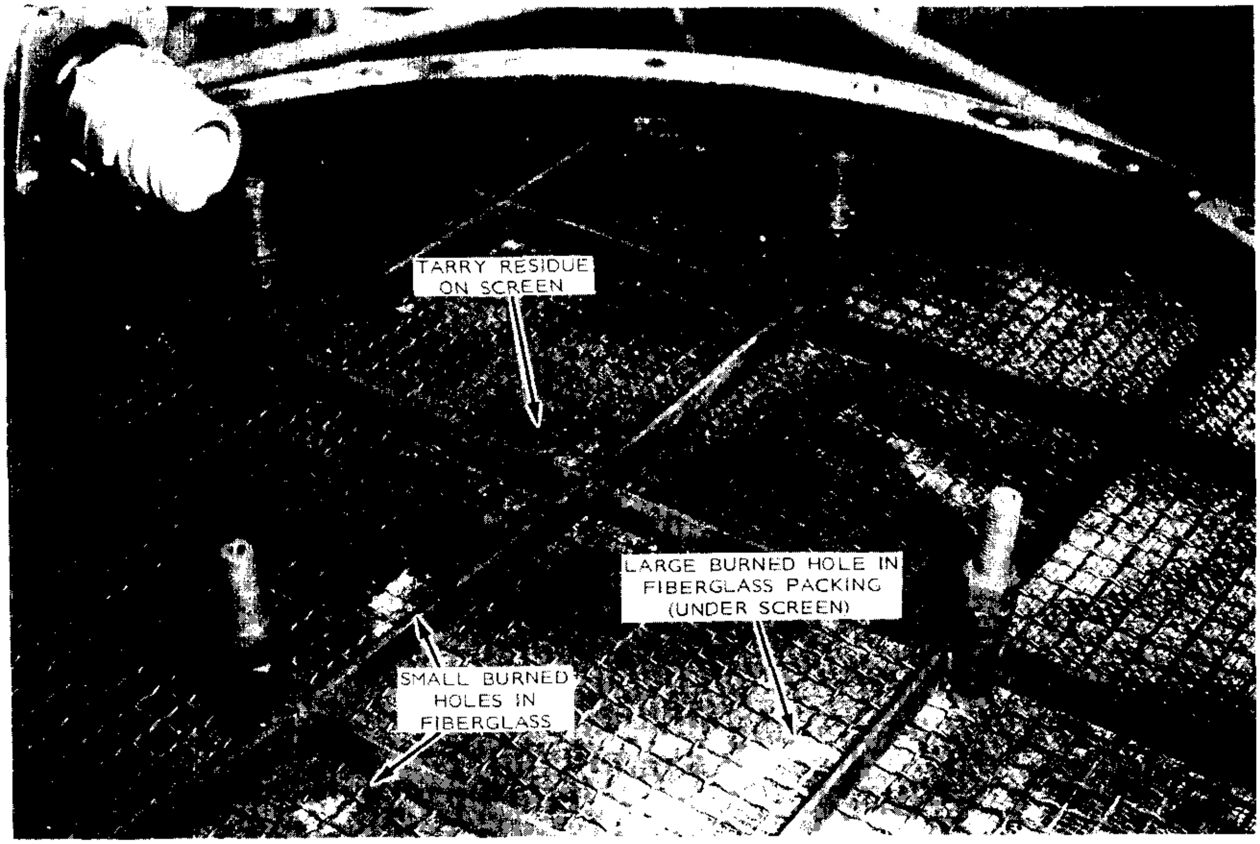

FIGURE 3. TANK 6 FILTER FOLLOWING FIRE. View of 5-in.-diameter top (exit) surface of tank 6 vent filter. Object at upper left is an HP air sampler. DPSPF 10267-3.

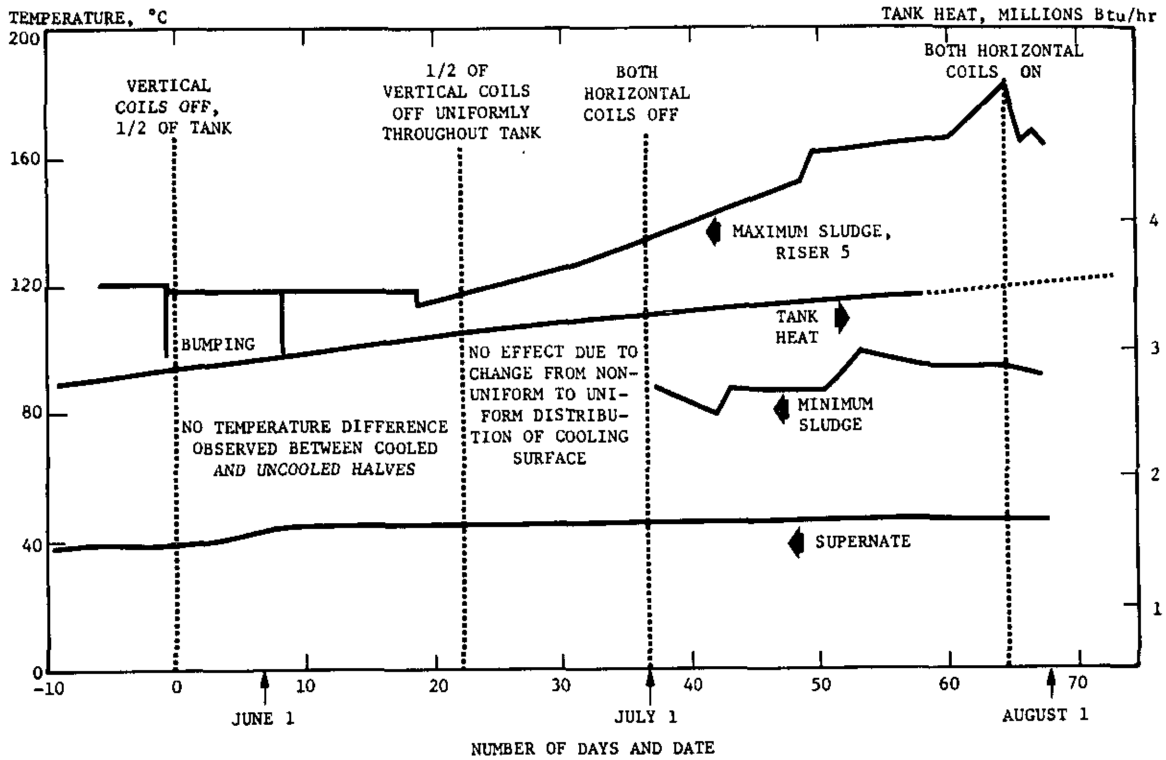

FIGURE 4. EFFECT OF COOLING SURFACE DISTRIBUTION - TANK 6, 1966

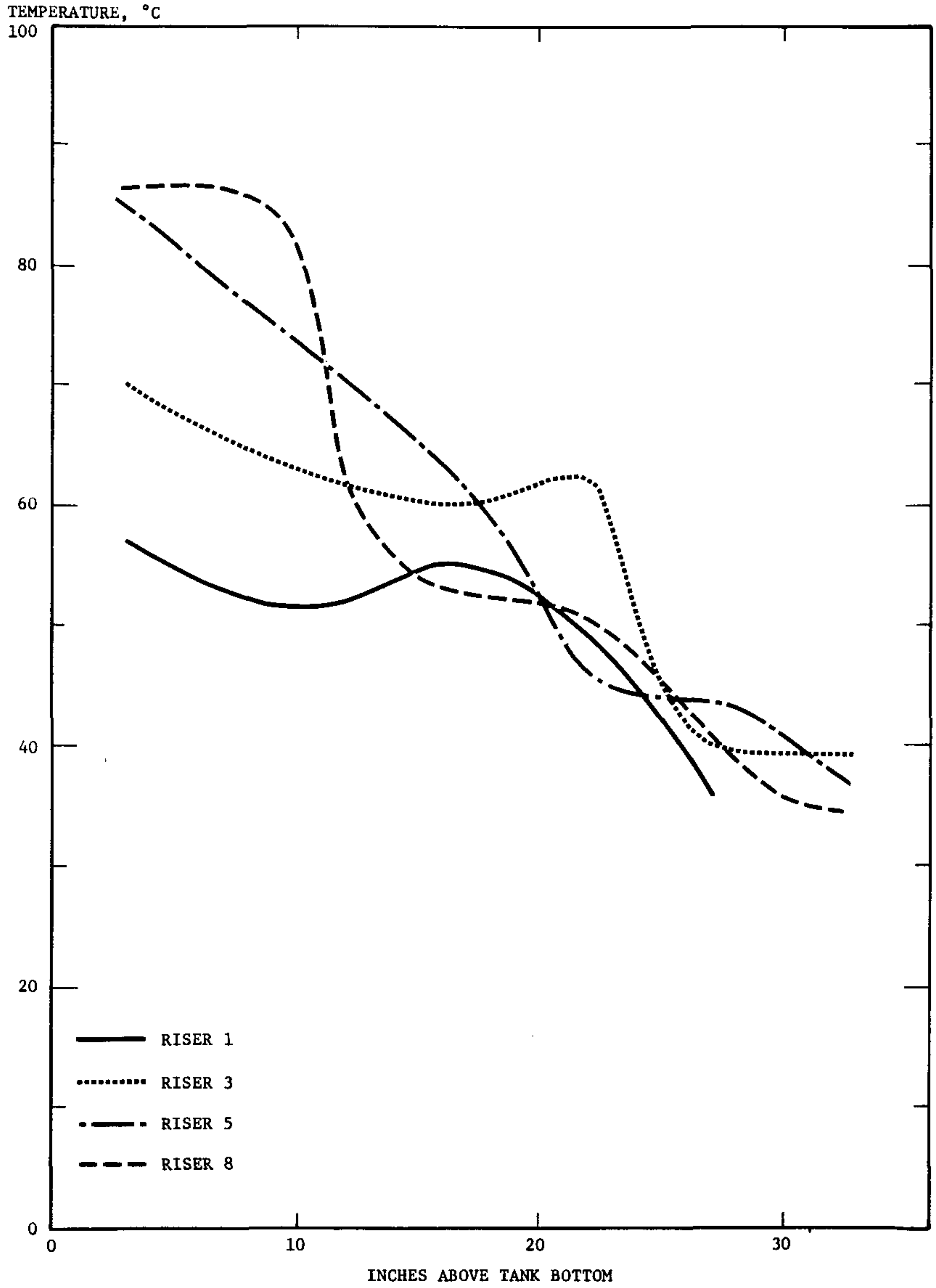

FIGURE 5. SLUDGE TEMPERATURES IN TANK 6 ON APRIL 29, 1965

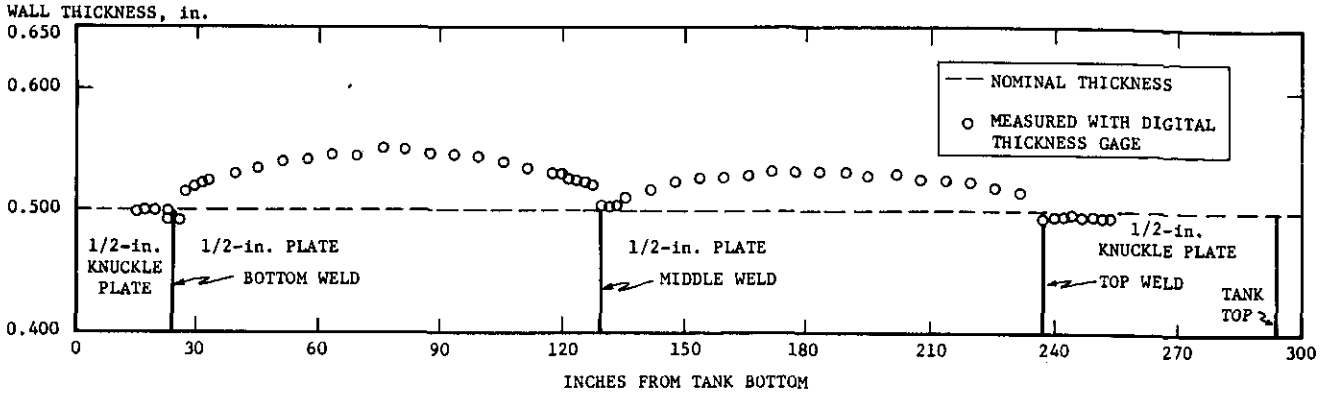

FIGURE 6. TANK 6 WALL THICKNESS MEASUREMENTS AT THE EAST RISER

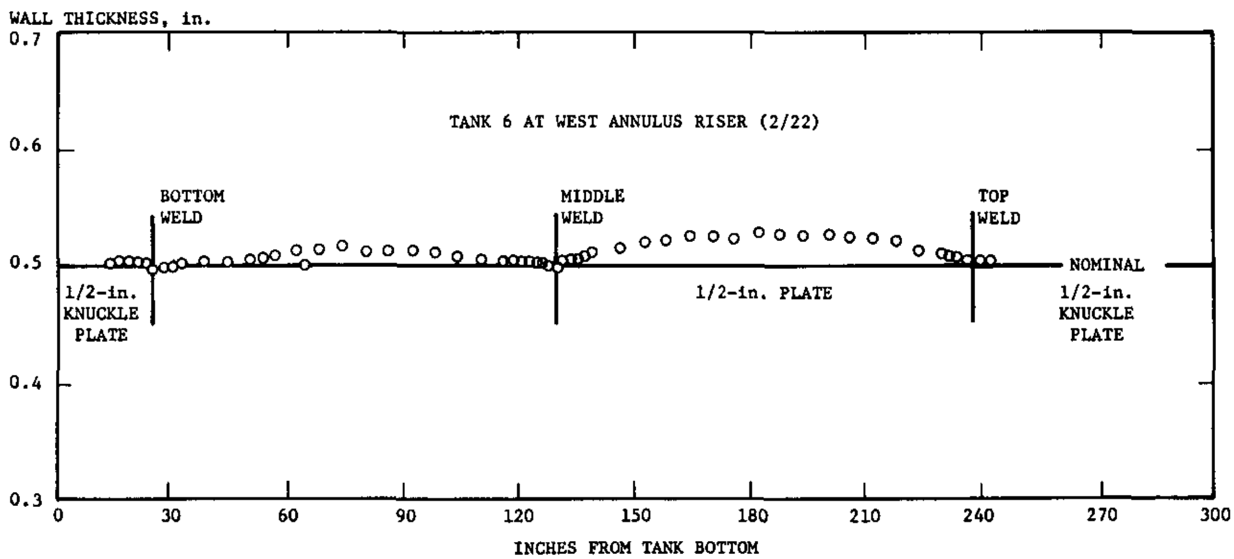

FIGURE 7. PRIMARY WALL THICKNESS MEASUREMENTS

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