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HISTORY OF WASTE TANK 5

C. J. THOMAS
Waste Management Technology

B. ROBNETT
Student, Cooperative Education Program
Clemson University

E. I. du Pont de Nemours & Company
Savannah River Plant

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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 gallons. 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 5 is a 750,000 gal, type I tank, located in F Area and used for the storage of HW (figure 1). It is 75 ft in diameter, 24-1/2 ft high, and has 34 vertical cooling coils distributed throughout the tanks. At the bottom, where the sludge and most of the fission products concentrate, there are two horizontal coils. The tank is constructed from type ASTM A-285-B steel with non-stress-relieved welds. 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 5 are listed chronologically in figure 2 and discussed briefly in the 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 period this history covers is from March 1959 through December 1974.

SUMMARY

Tank 5 was put in service as a receiver of HW in March 1959. The tank became filled in May 1960. Supernate was decanted to evaporator feed tank 7 in October 1966. The tank became filled for the second time in February 1969. The supernate from the second fill was decanted to tank 7 in March 1973.

Inspections of the tank interior and annulus were made by direct observation and by using an optical periscope. There were no leak sites observed through December 1974. Temperature profiles were taken with a 40-ft thermocouple inserted incrementally in tank thermowells. Corrosion rate tests were made on assemblies of coupons which were placed in the tank at various depths. Several equipment modifications and various equipment repairs were made.

DISCUSSION

Overall Chronology

In March 1959 tank 5 was put in service and received HW from the Purex process in Building 221-F. The tank was filled by April 1960; the waste was allowed to cool and decay radioactively. Sludge temperatures peaked at 215°C. This was coincident with the tank fill. The fission product heat release was calculated to be 3.9 X 10^6 Btu/hr. Sludge temperatures decreased gradually and remained constant at 50°C by 1963. In October 1966 approximately 650,000 gal of waste were transferred to tank 7. Tank 5 began receiving waste in January 1967 and became filled by February 1969. The tank remained filled until March 1973 when approximately 664,000 gal of supernate were transferred to tank 7.

Tank 5 has no known leaks in the primary liner.

Chronology of Events

Mar 1959	Tank 5 was placed in service. Full cooling water flow was valved to the 36 cooling coils.
Jun 1959	The maximum sludge temperature increased to 111°C. A temperature profile was taken in riser 8.
Sep 1959	The annulus necklace alarm was modified. Fission product heat release was calculated to be 3.9 X 10^6 Btu/hr.
Oct 1959	Fifty corrosion coupons in three assemblies were suspended in the tank at different levels.
Nov 1959	The temperature recorder checkout indicated that the temperature for sludge (138°C) was hight by 20°C.
Feb 1960	Tank 5 was connected to waste header 1 and disconnected from waste header 2.
	The first set of corrosion coupons were removed.
Mar 1960	The sensitivity of the annulus leak alarm was reduced.
May 1960	Tank 5 became filled on May 1. High heat waste was diverted to tank 8.
Jun 1960	Temperature profiles were taken through risers 1, 5, and 8.
Jul 1960	The tank showed evidence of thermal agitation.
Sep 1960	The necklace alarm was disconnected.
Apr 1962	The uranium and plutonium contents of tank 5 were estimated.

Sep 1963	Restrictive orifices were placed on both vertical and horizontal cooling coils.
	Annulus dehumidification data was collected.
Oct 1963	Dehumidification system data was collected.
Jul 1964	The radioactivity in tank 5 was calculated.
Jul 1965	Pressure indicators and alarms were installed.
Apr 1966	A transfer jet was installed in riser 6. Radiation measurements were made over riser 6.
Jun 1967	Corrosion coupons installed in October 1959 were removed.
Apr 1968	Vertical temperature gradients were measured in risers 1, 3, and 5.
Jul 1971	A transfer from tank 7 was made using the 1A pump tank and pump.
	The reel tape counter was replaced.
Oct 1971	Tank ventilation measurements were taken.
May 1974	A new reel tape was installed.
Sep 1974	An emergency transfer jet was installed in the north annulus riser.
Nov 1974	Reel tape was out of service temporarily for repairs.

Inspection of Tank Interior and Annulus

The annulus was inspected in May 1972, through the north and south annulus riser. No leaks or abnormalities were observed.

Chronology of Events Related to Inspection

May 1972	Inspections through the north and south annulus risers showed no abnormalities.
May 1974	Photographs of the tank interior were taken.

Samples of Tank and Annulus Contents

No samples of the tank contents or annulus contents were taken during this period.

Physical Measurements

Vertical temperature profiles of the tank interior were taken through the thermowells in risers 1, 3, 5, and 8. The temperature measurements were taken by lowering a 40-ft thermocouple at specified increments into existing thermowells. Temperature profiles were taken in June 1959, June 1960, and April 1968. The temperature profiles are shown in figures 3, 5, and 6.

A temperature profile for the cooling coil cooling water was made for the period April 1959 to April 1960 (figure 4).

Chronology of Events Related to Physical Measurements

Jun 1959 Temperature profiles were taken in riser 8.

Jun 1960 Temperature profiles were taken through risers 1, 5, and 8.

Sep 1963 Annulus ventilation data was taken.

Oct 1963 Dehumidification system data was taken.

Apr 1966 Radiation measured over open riser 6 was 2,500 mR/hr. The radiation decreased when the transfer jet was installed in riser 6.

Apr 1968 Temperature profiles were taken in risers 1, 3, and 5.

Oct 1971 Tank vapor space ventilation measurements were taken:

Air flow (CFM) in: 100
Air flow (CFM) out: 64
Tank pressure (inches H_2O), 0.2
Vent filter radiation (R/hr at 2 in.), 0.03
Type of ventilation: Positive pressure

Cooling Coil Failures

There were no known cooling coil leaks in tank 5 through December 1974.

Tests Conducted

Corrosion rate tests were conducted on assemblies of coupons that were inserted in three risers. The coupons were suspended in the following layers: sludge, sludge-supernate interface, supernate, and vapor space. The objective was to determine if location in the tank had an effect on corrosion on the coupons. The coupons were removed in January 1967; all coupons showed only a modest corrosion rate.

Chronology of Events Related to Tests Conducted

Oct 1959 Fifty corrosion coupons in three assemblies were suspended in the tank to be removed periodically for inspection.

Feb 1960 The first set of corrosion coupons were removed and the maximum radiation observed at 4 in. from the assembly was 250 R/hr.

Jan 1967 Corrosion coupons installed on October 13, 1959, were removed on December 28, 1966. The corrosion rates on the coupons averaged 0.24 mil/yr. Corrosion rates of individual coupons showed no correlation with location in the tank.

Equipment Modification and Repairs

In February 1960 diversion box changes were made which involved disconnecting tank 5 from header 2 and connecting to header 1. In September 1963 minimum flow orifices were inserted on both the horizontal and the vertical cooling coils to direct more water to tank 1. Reel tape repairs or replacements were made in July 1971, May 1974, and November 1974. In April 1966 a transfer jet was installed in riser 6. In September 1974 an emergency transfer jet was installed in the north annulus riser.

Chronology of Events Related to Equipment Modification and Repairs

Sep 1959 Low voltage relays were installed on the necklace alarm system because the high voltage alarm was falsely sounding during wet weather.

Nov 1959 Instrument repair and temperature recorder checkout indicated maximum sludge temperature, 138°C, was high by 20°C.

Feb 1960 Diversion box changes were made on February 17. Tank 5 was connected to header 1 and disconnected from header 2.

Sep 1960 The necklace alarm was disconnected on August 26 because it was continuously alarming and shorting out.

Sep 1963 Restrictive orifices were placed on the vertical and horizontal cooling water coils on September 12 to provide more cooling water for tank 1.

Jul 1965 Pressure indicators and alarms were installed on tank 5.

Apr 1966 A transfer jet from tank 2 was installed in riser 6 on tank 5.

Jul 1971 The reel tape counter was replaced because of damage caused by excessive friction in the readout counter.

May 1974 A new reel tape was installed.

Sep 1974 An emergency transfer jet with its suction 1 in. above the floor was installed in the north annulus riser.

Nov 1974 The reel tape was inoperative; parts were removed from it to repair the reel tape on tank 4.

TABLE 1
TANK 5 PHOTOGRAPHS

Date	Riser	Object	PRD Number	WMT File Location Box	WMT File Location Slots
5/17/72	N	Annulus, welds	15917-1 through 22	21	126-147
5/18/72	S	Annulus, welds	15918-1 through 23	22	1-23
7/19/72	W	Annulus, welds	16104-1 through 25	8	24-48
7/20/72	E	Annulus, welds	16105-1 through 32	8	49-80
7/16/73	W	Annulus, welds	17170-1 through 23	8	81-103
10/18/73	W	Annulus, welds	34907-28 through 54	46	29-55
5/8/74	5	Interior, reel tape and tank bottom	17953-1 through 13	8	104-116

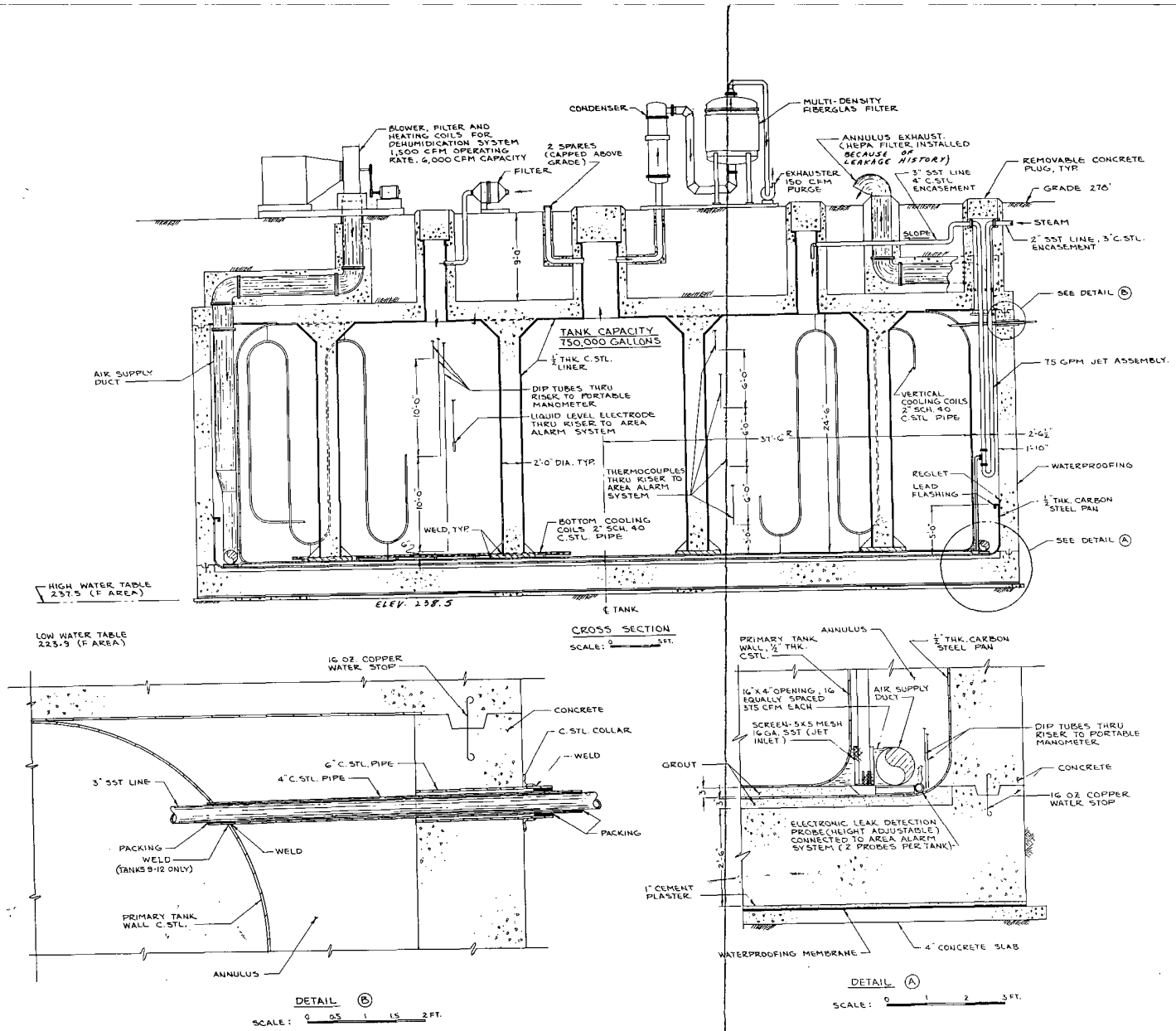

FIGURE 1. WASTE STORAGE TANK 5

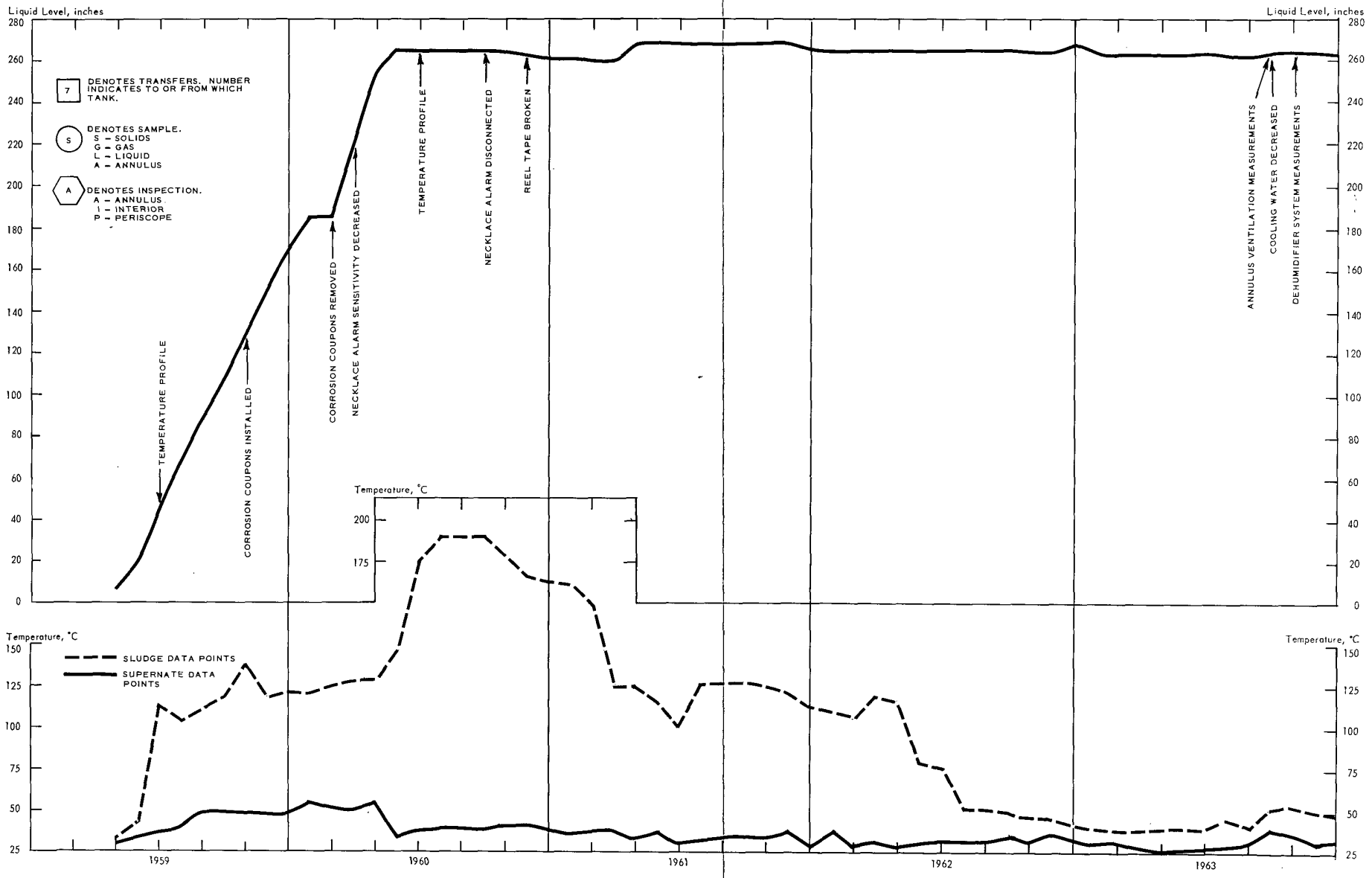

FIGURE 2 TANK 5 LIQUID LEVELS AND TEMPERATURES

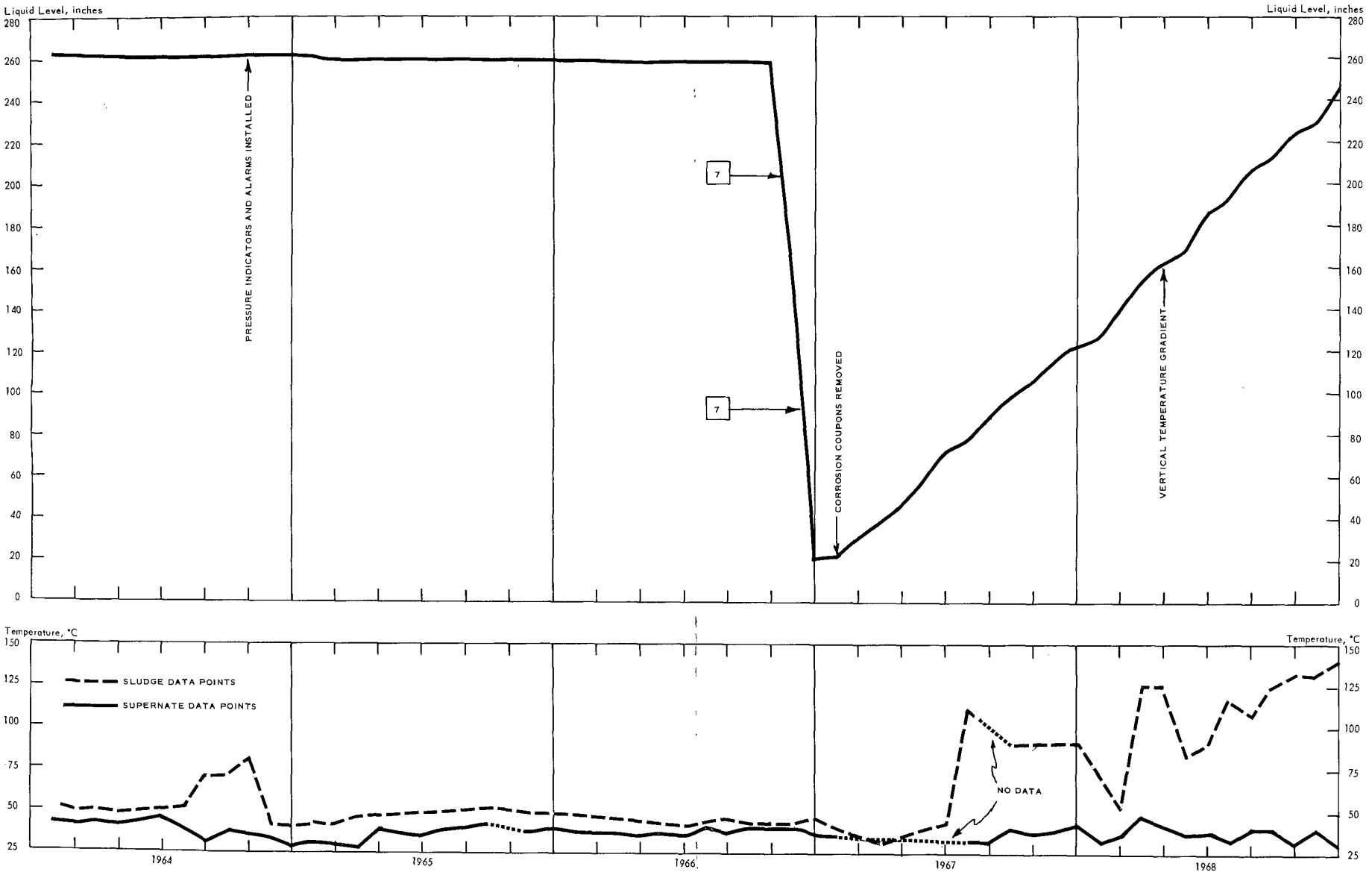

FIGURE 2 (contd)

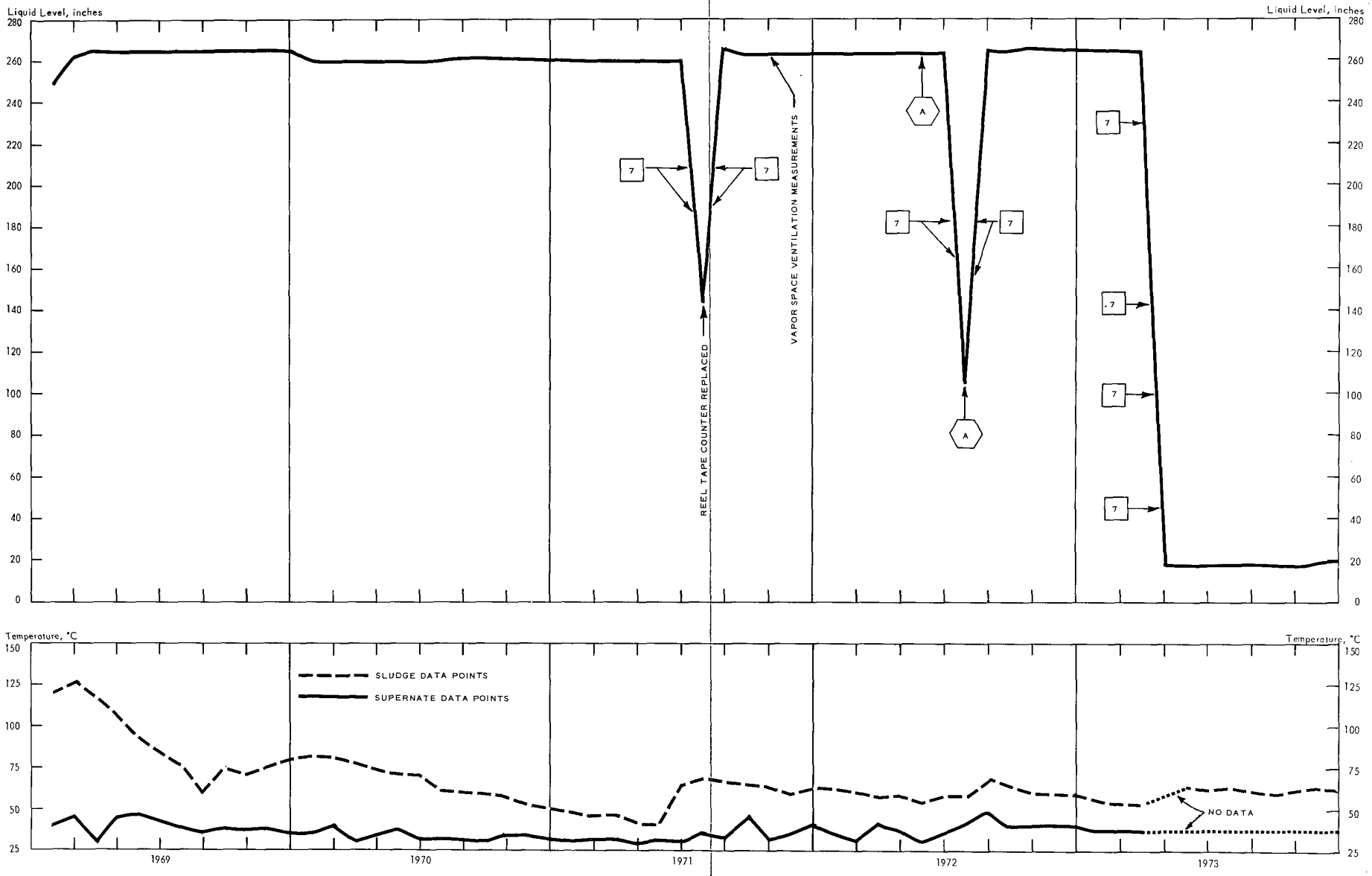

FIGURE 2 (contd)

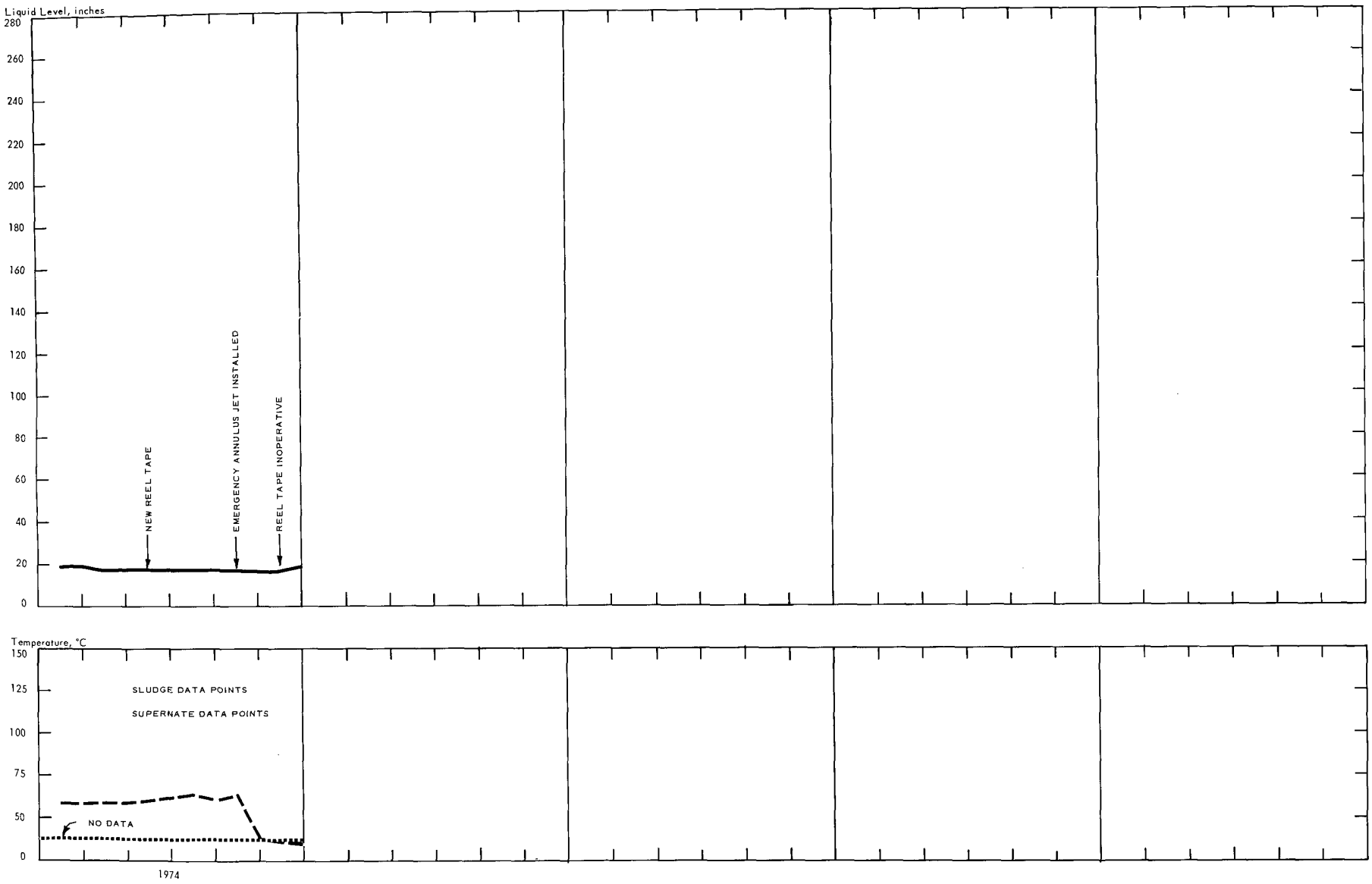

FIGURE 2 (contd)

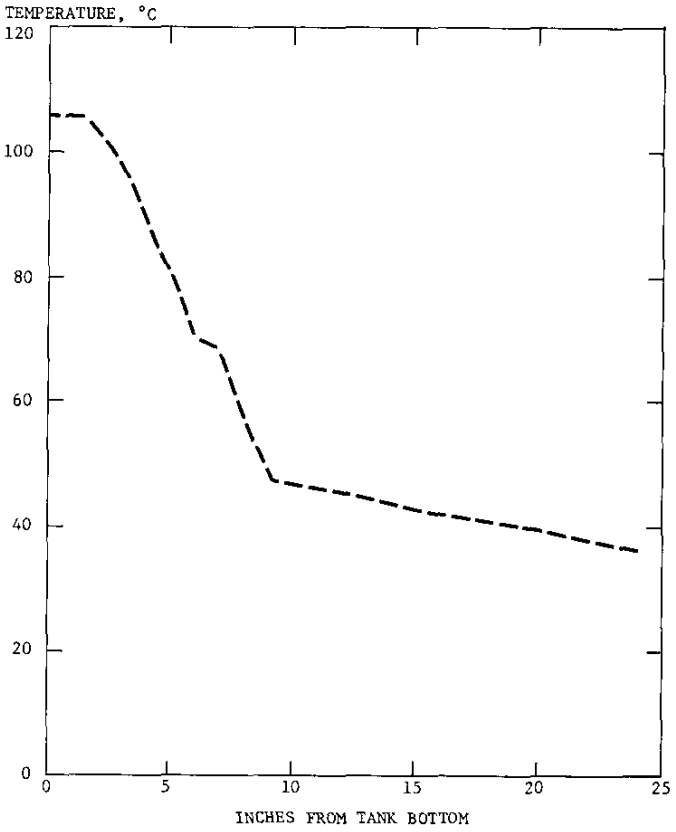

FIGURE 3. TEMPERATURE PROFILE: RISER 8, 6/59

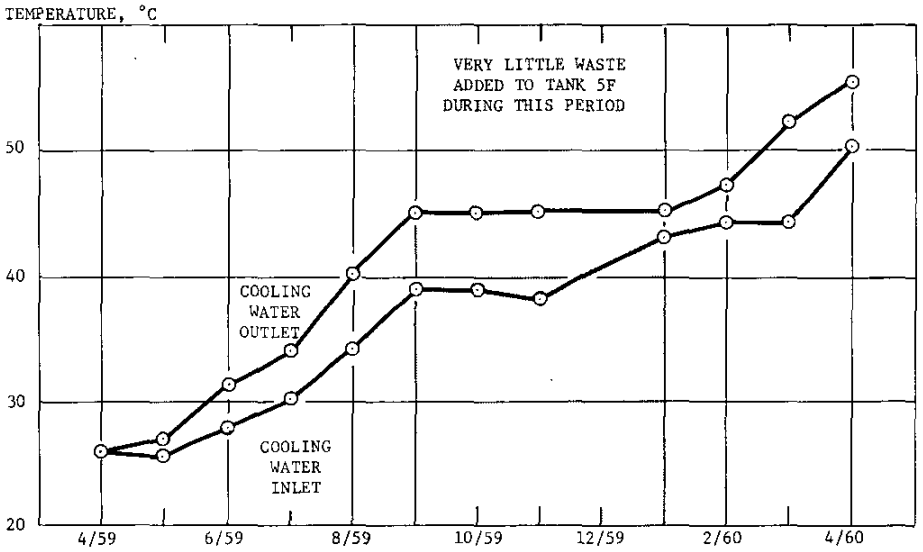

FIGURE 4. WASTE TANK 5F COOLING-COIL TEMPERATURE HISTORY

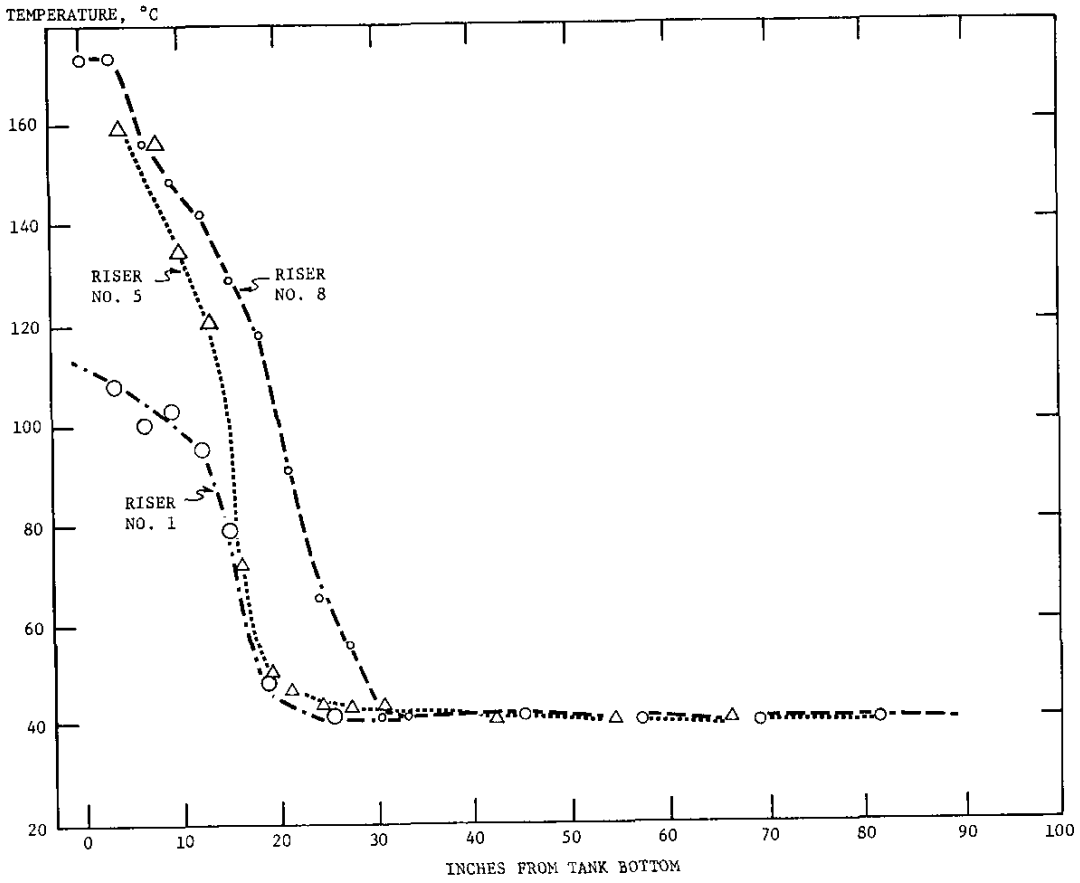

FIGURE 5. TEMPERATURE PROFILES TANK 5F, JUNE 8, 1960
(FILL = 265.8 INCHES)

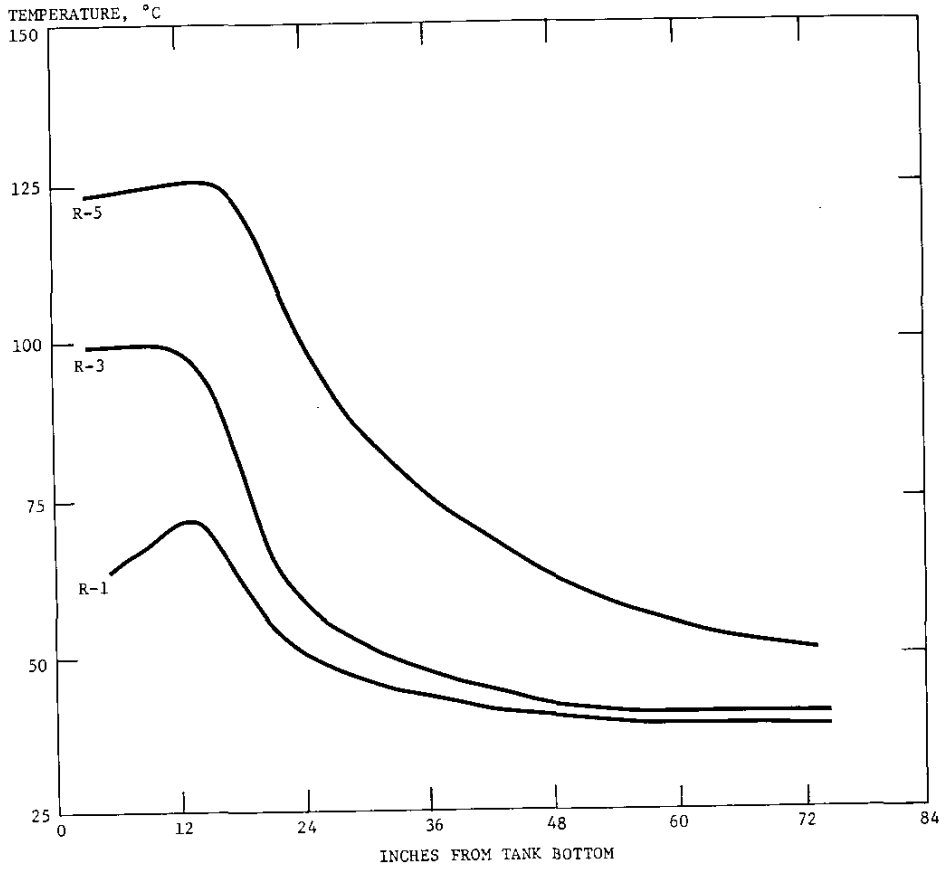

FIGURE 6. TEMPERATURE GRADIENT, TANK 5; APRIL 1968

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