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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards revised FSAR pages from Section 9.2.5(ultimate heat sink).Pages will be incorporated into Amend 23 of facility FSAR.

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Washington Public Power Supply System
P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

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Docket No. 50-397

Mr. A. Schwencer, Director
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
REVISED FSAR PAGES TO SECTION 9.2.5

Enclosed are sixty (60) copies of revised FSAR pages from Section 9.2.5, Ultimate Heat Sink. These pages will be incorporated into Amendment 23 of the WNP-2 FSAR.

Very truly yours,

G D Bouchey

G. D. Bouchey
Deputy Director, Safety and Security

CDT/jca
Enclosures

cc: R Auluck - NRC
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[illegible]

charge header of the pumps stops the jockey pump and starts one of the two main pumps on an increase in demand of system flow. Upon a further increase in flow demand, above 140 gpm, the flow meter automatically starts the second pump. When the flow demand decreases below 140 gpm, the second main pump stops. If flow demand continues to decrease to below 50 gpm, the jockey pump starts and the main pump stops.

During the starting sequence if one pump fails to start, the sequence automatically continues to the next pump and a local alarm and light indicate pump failure. Upon indication of low potable water storage tank level, all pumps stop.

The reactor building potable water booster pumps are automatically cycled on and off by a pressure switch in the pressurizing tanks on the pump discharge in order to maintain header pressure between 20 and 50 psig.

All electric water heaters are thermostatically controlled to maintain the tank at the desired setpoint. The hot water circulating pumps in the service building and radwaste building are cycled by a thermostat with sensor in the hot water recirculation line set to maintain the loop at a minimum setpoint.

9.2.5 ULTIMATE HEAT SINK

9.2.5.1 Design Bases

a. The ultimate heat sink, a spray pond system, supplies cooling water to remove heat from all nuclear plant equipment which is essential for a safe and orderly shutdown of the reactor and to maintain it in a safe condition.

b. The ultimate heat sink is capable of accomplishing its safety function for a normal cooldown or an emergency cooldown following a loss of coolant accident without the availability of off-site power. The sink provides this cooling capability for a period of 30 days without outside makeup. Provisions are made for replenishment of the sink to allow continued cooling capability beyond the initial 30-day period. The sink will accomplish its safety function despite the occurrançe of the most severe site related natural events including earthquake, tornado, flood or drought.

c. The ultimate heat sink is designed to satisfy the regulatory requirements of Regulatory Guide 1.27 (Rev. 1). See Appendix C and 2.3.1.2.3.

9.2.5.2 System Description

During all normal operating conditions, including startups and normal shutdown, waste heat from the reactor auxiliaries is transferred to the circulating water system. Heat from this system is in turn rejected to the atmosphere by the normal plant cooling tower system.

Following any event that would prevent the use of the plant cooling towers, the heat rejection duties are transferred to the spray ponds. The ultimate heat sink consists of two concrete ponds with redundant pumping and spray facilities. The pond and pumphouse arrangements are shown on Figure 9.2-11. The ponds and pumphouses are designed to Seismic Category I requirements. Standby service water (SW) loop A draws water from pond A, cools the Division I equipment required for safe shutdown, and discharges through the spray ring in pond B for heat dissipation. Similarly, SW loop B draws water from pond B, cools Division II equipment, and discharges through the spray ring in pond A. The HPCS SW system draws water from pond A, cools Division III and discharges without spray into pond A. A syphon between the ponds allows for water flow from one pond to the other.

The spray system illustrated in Figure 9.2-11 consists of two annuli of spray trees -- one for each of the concrete ponds. Each annulus is 140.0 feet in diameter and contains 32 spray trees equally spaced (13.75 feet between vertical centerlines) on the circumference. The vertical trees are serviced by the annulus water pipe, 20 inches in diameter, mounted above the water level. The annulus pipe is fed by the main header from each respective pumphouse. Each spray tree consists of a vertical riser pipe or trunk 8 inches in diameter and 7 horizontal limbs of 1-1/2 inch pipe. The limbs are attached to the riser at 2'8" intervals of heights and are rotated at 90° subsequent angles from each other so that the arms resemble a counter-clockwise helix with increasing height. The arms radial to the annulus are 4'6-7/16" long. The lowermost arm is a tangent arm. The arms tangent to the annulus pipe are 3'6" long. Spray nozzles are located at the end of each arm and are connected by fittings. The orientation of every nozzle is radially inward with an angle of 55° upward from horizontal. The nozzles are 1-1/2-CX-27-55 Whirljet nozzles supplied by Spraying Systems Company. Since each

tree nozzle is located at a different elevation, each nozzle pressure is different. The uppermost nozzle water pressure is 17.0 psig, and the total water flow from a tree is approximately 300 gpm.

The HPCS SSW flow, 1192 gpm, is treated as a straight heat dump in the thermal analyses.

The combined water volume of the spray ponds is adequate to provide cooling water for 30 days without makeup. Although the pond is not used for cooling during normal operation, some small losses are to be expected due to normal evaporation from the surface and occasional blowdown needed to maintain water chemistry. A gravity makeup line is provided from the circulating water pumphouse to the spray ponds to automatically maintain the pond water at the required level. The ponds can also be supplied directly from the plant makeup water pumps (see 10.4.5). Design parameters for the spray pond are given in Tables 9.2-1 and 9.2-2.

A standby service water pump is located in each spray pond pumphouse along with its associated equipment so that an accident, such as a fire or pipe break associated with one pump would not affect the operation of the redundant pump.

The bottom of the pump sump is depressed below the pond bottom. This ensures that there is still sufficient submergence for the pumps at the lowest possible water level in the pond. A sand trap, and screen precede the pump sump to prevent heavy debris from entering the pump sump area. A skimmer wall and fixed screen prevent floating debris from entering the pumps.

A spray ring bypass is provided so that the water temperature may be controlled during cold weather operation. When the pond temperature drops below approximately 60°F, the spray ring may be bypassed by opening the dump valve returning water directly to the pond.

To prevent adverse operation during freezing weather, all SSW piping and components are either below the frost line, within the heated pump houses, heat traced, or, in the case of the spray rings, kept drained by the return header dump when not in operation.

9.2.5.3 Safety Evaluation

An oriented spray cooling system (OSCS) is utilized for cooling the water inventory of the ultimate heat sink. OSCS has been developed as a result of intensive analytical studies and experimental verification over a period of more than six years. Details of the OSCS experimental and analytical developmental efforts are described in Topical Report, Oriented Spray Cooling System(OSCS) for Ultimate Heat Sink Application (UHS), I-R 100 which has been submitted for Nuclear Regulatory Commission staff review.

The thermal performance model is based on the correlation of the Canadys test data described in Section 3.1 of Topical Report, I-R 100. The resulting KAV/L for this application is 2.66. This includes a 10% derate of the KAV/L to cover conservatively the data scatter experienced at Canadys. Since the KAV/L represents the performance of the specified geometry and nozzle pressure, the KAV/L combined with the meteorological data are sufficient to determine the system cooling performance.

The system model for both the thermal performance analysis and the mass loss analysis was based on the following assumptions:

a. The pond contains total inventory upon onset of LOCA less 0.5 feet for sedimentation of the pond basin.

b. Water losses result only from drift, evaporation of the sprayed droplets, and evaporation due to heat rejection on the pond surface.

c. All the heat transfer is accomplished by evaporation, none of the heat transfer is accomplished by sensible heat transfer.

d. The first three days of the thermal performance analysis assume the worst single day of record conditions (Table 9.2-4 Page 1 of 3). It was found that repeating the worst day conditions for three days resulted in the maximum peak. The fourth through thirtieth days are the average meteorological conditions of the worst 30 day period of record (Table 9.2-4 Page 2 of 3). For conservatism, the average wind speed during each period is used rather than the diurnal variation.
RMS

The performance predicted by this model is modified as shown below to better correlate with the test data given in Reference A.

$$CR = (-.761 + .009\,TWB) + (0.2677 + 0.004029\,TWB)CP + (.001179 - 7.14 \cdot 10^{-6}\,TW\ldots \times CP^2$$

CR = cooling range
TWB = wet bulb temperature
CP = cooling potential

e. The first through thirty days of the mass loss analysis are the average meteorological conditions of the worst 30 day period of record (See 2.3.1.2.3 and Table 9.2-4 Page 3 of 3). ~~The analysis assumes a mass loss due to drift of .57% of the spray flow. The spray flow is based on continuous operation of one spray ring.~~ The analysis assumes a mass loss due to drift of 1.02% of the spray flow. This value is an upper bound obtained from test results performed on the spray ponds.

f. The spray flow is continuous for one spray ring for the first three days, with one standby service water pump in operation. For the mass loss case evaluation, the sprays are cycled on and off for the fourth through thirtieth day depending on pond temperature. The sprays are turned on when the standby service water temperature reaches 85°F and are turned off when the temperature drops below 80°F. This method of operation resulted in one cycle on and off per day.

~~f~~g. Off-site power is lost and Division 2 diesel fails to start, resulting in a loss of the pond A spray header. (Division I heat loads are slightly higher).

~~g~~h. The major heat loads considered are reactor core decay heat, sensible heat from both the coolant and the reactor, fuel pool decay heat, pump work, and the heat removed from the station auxiliaries. These heat loads are detailed in Table 9.2-8 and Figures 9.2-7~~b~~c, -7~~c~~d and -7~~d~~e. No credit was taken for heat sinks in the primary containment other than the suppression pool volume.

The ~~actual~~ RMS average wind speed during the 6.91 selected thirty day period for the mass loss analysis was ~~5.5~~ mph. ~~However, for conservatism, the drift loss assumed in the analysis was based on five times the calculated drift value at the highest daily average wind speed of 10.2 mph.~~ The drift loss was based on the calculated drift value at the RMS wind speed. The mass loss analysis thus demonstrates that the spray ponds contain sufficient water inventory to meet drift losses significantly higher than expected.

The analyses assume an initial temperature of 77°F. This is approximately the highest monthly average temperature expected if the sprays are not operated. To maintain the pond temperature below this limit, the spray headers will be operated and/or river water make-up to the cooling towers will be diverted through the spray ponds. Analyses have been performed which demonstrate that the above operations can maintain the spray pond below 77°F.

An analysis was conducted which verified failure of Division 1 or Division 2 power results in the most severe service water transient. If the failure was postulated in Division 3 (HPCS) instead of Division 1 or 2, the peak pond temperature is lower. The HPCS SW flow is a straight heat dump; therefore, inasmuch as the spray pond is concerned, it raises rather than lowers the temperature transient.

The resulting peak spray pond temperature, 88.6°F, predicted by the "worst case" analysis is considerably below the 95°F service water temperature assumed in the analysis performed in 6.2.1 for containment heat removal, adding further conservatism to the containment temperature and pressure transients therein presented. The service water temperature, however, exceeds the design basis temperature, 85°F, ~~at the emergency reactor building and control room HVAC equipment~~ for ~~a~~ short periods of time as shown in Figure 9.2-7a. This results in a predicted peak temperature for some of the electrical equipment rooms served by emergency HVAC equipment of, at most, 3°F higher than the continuous operating temperature limit ~~the nominal lifetime rating~~ for the equipment. ~~This has been assessed as not being deleterious to the equipment operation.~~ Provisions are being made to assure that the small temperature difference will have no significant deleterious effect on equipment functional performance.

A sensitivity study was performed to determine the effect of the RHR heat exchanger effectiveness on the suppression pool and spray pond temperature transients. The RHR heat exchanger effectiveness varies with the amount of fouling and with the flow rates. RHR heat exchanger flows different from the rated values in Table 6.2-2 are anticipated only if the operator delays or fails to close the RHR heat exchanger shellside bypass valve as discussed in 6.2.2.3. Anticipated variations in flow and fouling were determined to have essentially no affect on the spray pond temperature transient following a design basis LOCA, but were determined to have an impact on the suppression pool temperature transient. The most severe postulated suppression pool transient results from assuming a fully fouled RHR heat exchanger and no operator action to close the shellside bypass valve. This suppression pool transient, presented in Figure 9.2-7b, is slightly less severe than the suppression pool transient presented in 6.2.1 which assumed a steady 95°F service water temperature and that the operator closed the RHR heat exchanger bypass valves.

The results of the mass loss analysis assuming an unfouled heat exchanger is shown in Figure 9.2-8 and is tabulated in Table 9.2-3. ~~The mass loss assuming a fouled heat exchanger is less severe, but only by approximately 2,000 gallons.~~

Drift losses following loss of makeup to the ponds are controlled during two spray ring operation by bypassing the spray header on one pond whenever spray pond temperatures drop below approximately 80°F. Continuous, simultaneous operation of both spray rings is not required after a LOCA. Since the two SW loops are redundant to each other, the operators will be able to secure any redundant safe shutdown equipment when they determine that the peak temperatures have been past. In addition, the difference between assumed and calculated drift losses for continuous operation

of one spray ring, is more than adequate to account for drift losses from the operation of the second spray ring for several days after the accident.

Table 9.2-7 lists the available sources of makeup water to provide continued cooling beyond the initial 30-day period. This table assumes that off-site power is restored within the 30 days. No credit is taken for the water stored in the cooling tower basins. However, it is expected that this water will not be instantaneously lost and will flow to the pond for the same period of time. Table 9.2-7 also summarizes the effects of natural phenomena and of a LOCA on the water supplies to the spray pond.

The possibility of a tornado passing over the spray pond and removing a significant amount of water is considered a credible event. For this reason, the makeup water pumphouse is designed to be tornado proof, with all piping and electrical power supply between the plant and the pumphouse

underground. Since it is not credible to assume an earthquake coincident with a tornado, this system need not be Seismic Category I. Two 12,500 gpm plant makeup water pumps are provided, one powered from each emergency diesel generator. Should pond water be lost due to a tornado, one of these pumps will be started to provide makeup. Valves are provided in the makeup water line to isolate the flow to the cooling tower and to ensure that it goes to the spray pond.

9.2.5.4 Testing and Inspection Requirements

After completion of the spray pond, an inspection and test program has been established to ensure that the spray system will accomplish its safety function as discussed in 14.2.

All valves and piping in the system have been hydrostatically tested in the shop per ASME Section III, Class 3. After installation the system is hydrostatically tested and visually inspected. During plant operation the system is periodically tested.

Preservice and inservice inspections for the spray system will be in accordance with 6.6.

9.2.5.5 Instrumentation Requirements

The spray pond is equipped with redundant level and temperature sensors which are alarmed and indicated in the main control room as well as locally.

In the event that the spray pond level falls below the minimum level required for 30 days of cooling, an alarm is sounded and makeup automatically is provided directly from the plant makeup water line to the spray pond.

High and low temperature alarms are provided. In the event that the pond water temperature approaches the design limit, the spray system is initiated to lower the temperature. Upon low water temperature signal, return water is dumped directly into the ponds to prevent spray trees and spray headers from icing.

Reference A: "1979 Ultimate Heat Sink Spray System Test Results," Washington Public Power Supply System Nuclear Project No. 2 report (WPPSS-EN-81-01)

TABLE 9.2-2

DESIGN PARAMETERS FOR THE SPRAY SYSTEM

Number of systems	2
Number of trees per system	32
Diameter of the ring headers	140'-0"
Circumferential spacing between trees	13'-9"
Number of horizontal arms per riser	7
Pressure at top nozzle	17 psig
Pressure at interface (flange)	24.5 psig
Flow rate per tree at design pressure	303.9 gpm
Total flow rate per system	9,725 gpm
Nozzle type	Spraying Systems Company 1-1/2-CX-27-55
Height of vertical riser	17'-9"
Spacing between arms	32"
Height of bottom nozzle elevation from system interface (flange) riser pipe diameter	6-11/16"
Riser pipe	8", Schedule 80
Horizontal branch arm pipe	1-1/2", Schedule 80

TABLE 9.2-3

TOTAL SPRAY POND WATER LOSSES AND CONTENT 30 DAYS AFTER LOCA EVENT

Drift losses	~~2,488,867~~ gal	2,835,952
Spray evaporation	~~6,152,171~~ gal	4,986,676
Surface evaporation	~~478,683~~ gal	876,842
Total	~~9,119,721~~ gal	8,871,620
Remaining inventory	~~3,380,279~~ gal	3,761,661
H_2 Recombiner	172,510 gal	

TABLE 9.2-4 (Continued)

DIURNAL VARIATION IN METEOROLOGICAL DATA (FOR DAY 1 THRU 30 USED TO ANALYZE MASS LOSS FOLLOWING LOCA)

Hour	Dry Bulb (°F)	Dew Point (°F)	Wet Bulb (°F)	Wind* Speed (mph)	Solar Radiation ($\frac{BTU}{hr}$)
Noon	96.40	42.50	64.70	10.30 6.91	290.81
1:00 p.m.	98.00	43.50	65.40	10.30	282.71
2:00	98.50	43.50	65.60	10.30	261.30
3:00	98.00	43.50	65.40	10.30	226.27
4:00	96.40	42.50	64.70	10.30	180.98
5:00	93.90	42.00	63.70	10.30	127.56
6:00	90.70	42.00	62.30	10.30	70.89
7:00	86.90	40.50	60.70	10.30	16.86
8:00	82.90	40.00	59.00	10.30	0.00
9:00	78.90	40.00	57.30	10.30	0.00
10:00	75.10	39.00	55.70	10.30	0.00
11:00	71.90	39.00	54.30	10.30	0.00
Midnight	69.40	39.00	53.30	10.30	0.00
1:00 p.m.	67.80	39.00	52.60	10.30	0.00
2:00	67.30	39.00	52.40	10.30	0.00
3:00	67.80	39.00	52.60	10.30	0.00
4:00	69.40	39.00	53.30	10.30	0.00
5:00	71.90	39.50	54.30	10.30	16.86
6:00	75.10	39.00	55.70	10.30	70.89
7:00	78.90	40.00	57.30	10.30	127.56
8:00	82.90	40.00	59.00	10.30	180.98
9:00	86.90	40.70	60.70	10.30	226.27
10:00	90.70	42.00	62.30	10.30	261.30
11:00	93.90	42.20	63.70	10.30	282.71

Data based upon average values for the period 2 July - 1 August 1960.

* Wind speed is the ~~highest daily~~ RMS average wind speed for the period.

TABLE 9.2-7

SOURCE OF SPRAY POND MAKEUP WATER

Water Source	Design Basis Earthquake	Probable Maximum Flood	River Blockage or Drought	Tornado	LOCA
Plant makeup water pumps	NA	NA	NA	A	A
Cooling tower basin by gravity	NA	A	A	A	A
Tank truck or rail	A	A	A	A	A

NA = not available

A = available

TABLE 9.2-8

HEAT LOADS RATES USED IN UHS ANALYSIS

I. Core Decay Heat Load(1)

See Table 6.2-11

II. Reactor Coolant Sensible Heat Load(1)

The energy (414×10^6 BTU referenced to 32°F) of the reactor coolant is accounted for by starting the suppression pool at 150°F.

III. Reactor Vessel, Piping, and Core Sensible Heat Load(1)

Time (hours)	Rate (10^6 BTU/hr)
$t \leq 24$	8.14
$t > 24$	negligible

IV. Metal-Water Reaction Heat Load(1)

Time (hours)	Rate (10^6 BTU/hr)
$t \leq 1$	.47
$t \geq 1$ (remove)	negligible

V. ECCS Pump Work Load(1)(2)(3)

Time (hours)	Rate (10^6 BTU/hr)
$t \leq 8$	~~12.35~~ 13.168
$t > 8$	~~5.49~~ 5.534

VI. HPCS (Div. 3) Service Water System Heat Load(3)(4)

Time (hours)	Rate (10^6 BTU/hr)
$t \leq 8$	~~8.73~~ 9.17
$t > 8$	0

TABLE 9.2-8 (Continued)

VII. Constant Div. 1 Service Water System Heat Load (5) (6)

Time (hours)	Rate (10^6 BTU/hr)
t ≥ 0	~~18.18~~ 19.202

VIII. Fuel Pool Heat Load (7)

Time (hours)	Rate ($x10^6$ BTU/hr)
~~0 ≤ t ≤ 10~~	~~0~~
~~10 < t ≤ 20~~	~~.5~~
~~20~~	~~.54~~
~~22~~	~~.76~~
~~24~~	~~1.09~~
~~26~~	~~1.41~~
~~28~~	~~1.74~~
~~30~~	~~1.96~~
~~32~~	~~2.39~~
~~34~~	~~2.61~~
~~36~~	~~2.82~~
~~38~~	~~3.04~~
~~40~~	~~3.26~~
~~42~~	~~3.48~~
~~44~~	~~3.69~~
~~46~~	~~3.86~~
~~48~~	~~4.02~~
~~50~~	~~4.07~~
~~t ≥ 52~~	~~4.13~~
t ≥ 0	5.0

TABLE 9.2-8 (Continued)

Notes:

(1) Rejected initially to the suppression pool and subsequently transferred by the RHR heat exchangers to the UHS.

(2) RHR pump ~~1.93×10^6~~ BTU/hr $1.972 \cdot 10^6$
LPCS pump ~~3.56×10^6~~ BTU/hr $3.5623 \cdot 10^6$
HPCS pump ~~6.86×10^6~~ BTU/hr $7.6335 \cdot 10^6$

(3) HPCS system and HPCS SW system shut down after 8 hours. LPCS system and RHR loop A maintain long-term cooling.

(4) HPCS service water pump work ~~$.13 \times 10^6$~~ BTU/hr $.132314 \cdot 10^6$
HPCS diesel coolers 7.40×10^6 BTU/hr
HPCS coolers (Table 9.2-5) 1.20×10^6 BTU/hr
} $9.0377 \cdot 10^6$

(5) Div. I Service water pump work ~~3.82~~ $\times 10^6$ BTU/hr 3.91853
Div. I Diesel Generator 11.69×10^6 BTU/hr
Coolers and misc.equip. (Table 9.2-5) 2.67×10^6 BTU/hr
} $15.2834 \cdot 10^6$

(6) Excludes fuel pool and RHR heat exchanger heat loads

(7) Added to the RHR service water system

TABLE 9.2

INTEGRATED HEAT DATA - WNP-2 UHS RE-ANALYSIS

Time After LOCA Min.	Q Decay (1)	Q Sens (2)	Q Aux 1 (3)	Q Aux 2 (4)	Q Aux 3 (5)	Q Total (6)	Q SW (7)(8)
	10^7 BTU						
0	0	0	0	0	0	0	0
1	~~3.51~~ 3.26	.014	~~.020~~ .022	~~.030~~ .040	.015	~~3.59~~ 3.35	~~.174~~ .150
2	~~4.28~~ 4.03	.027	~~.041~~ .044	~~.061~~ .081	~~.029~~ .031	~~4.44~~ 4.19	~~.355~~ .304
4	~~5.57~~ 5.38	~~.054~~ .054	~~.083~~ .088	~~.121~~ .161	~~.058~~ .061	~~5.89~~ 5.74	~~.719~~ .615
10	8.72 8.77	.136	~~.205~~ .219	~~.303~~ .403	~~.146~~ .153	~~9.51~~ 9.69	~~1.83~~ 1.58
20	13.02 13.81	.271	~~.413~~ .439	~~.606~~ .804	~~.291~~ .306	~~14.62~~ 15.20	~~3.75~~ 3.41
40	~~20.26~~ 20.92	.543	~~.823~~ .878	~~1.21~~ 1.61	~~.582~~ .635	~~23.45~~ 24.60	~~7.80~~ 6.90
90	~~35.16~~ 36.43	1.22	~~1.85~~ 1.97	~~2.73~~ 3.63	~~1.31~~ 1.38	~~42.32~~ 44.67	~~18.69~~ 16.17
120(2H)	~~43.03~~ 44.59	1.63	~~2.48~~ 2.63	~~3.64~~ 4.84	~~1.75~~ 1.83	~~52.57~~ 55.57	~~25.57~~ 21.75
240(4H)	~~70.65~~ 72.67	3.26	~~4.94~~ 5.27	~~7.27~~ 9.68	~~3.49~~ 3.67	~~89.66~~ 94.59	~~54.51~~ 45.22
360(6H)	~~94.84~~ 97.01	4.88	~~7.41~~ 7.90	~~10.91~~ 14.52	~~5.24~~ 5.50	~~123.3~~ 129.9	~~84.37~~ 69.74
480(8H)	~~117.8~~ 119.5	6.51	~~9.88~~ 10.53	~~14.54~~ 19.36	~~6.98~~ 7.34	~~155.0~~ 163.3	~~114.3~~ 94.80
720(12H)	~~157.6~~ 160.1	9.77	~~12.08~~ 12.75	~~21.92~~ 29.04	~~6.98~~ 7.34	~~208.4~~ 219.1	~~172.4~~ 143.60
960(16H)	~~194.9~~ 197.3	~~13.02~~ 13.02	~~14.27~~ 14.96	~~29.39~~ 38.72	~~6.98~~ 7.34	~~258.6~~ 271.4	~~227.3~~ 194.40
1200(20H)	~~229.9~~ 232.2	~~16.28~~ 16.28	~~16.47~~ 17.18	~~36.86~~ 48.40	~~6.98~~ 7.34	~~306.5~~ 321.5	~~279.3~~ 242.1
1440(1D)	~~263.1~~ 265.4	~~19.54~~ 19.54	~~18.66~~ 19.39	~~44.45~~ 53.10	~~6.98~~ 7.34	~~352.8~~ 369.8	~~328.6~~ 285.1
2160(1-1/2D)	~~354.5~~ 356.2	~~19.54~~ 19.56	~~25.25~~ 26.03	~~68.67~~ 87.13	~~6.98~~ 7.34	~~475.0~~ 496.3	~~461.1~~ 417.7
2880(2D)	~~435.3~~ 435.5	~~19.54~~ 19.56	~~31.84~~ 32.67	~~94.64~~ 116.2	6.98 7.34	~~588.3~~ 611.3	~~581.1~~ 549.2
4320(3D)	~~577.2~~ 570.4	~~19.54~~ 19.56	~~45.02~~ 45.96	~~148.2~~ 174.2	~~6.98~~ 7.34	~~796.9~~ 817.6	~~796.6~~ 803.6
5760(4D)	~~702.3~~ 686.1	~~19.54~~ 19.56	~~58.19~~ 59.43	~~201.7~~ 232.3	~~6.98~~ 7.34	~~988.8~~ 1004.6	~~995.4~~ 1010.1
7200(5D)	~~816.2~~ 792.3	~~19.54~~ 19.56	~~71.37~~ 72.52	~~255.3~~ 290.4	~~6.98~~ 7.34	~~1169~~ 1182	~~1182~~ 1190.0
8640(6D)	~~922.0~~ 891.9	~~19.54~~ 19.56	~~84.54~~ 85.80	~~308.8~~ 348.5	~~6.98~~ 7.34	~~1342~~ 1353	~~1358~~ 1371
11520(8D)	~~1116~~ 1073	~~19.54~~ 19.56	~~110.9~~ 112.4	~~415.9~~ 464.7	6.98 7.34	~~1669~~ 1677	1689 1711
14400(10D)	~~1292~~ 1238	~~19.54~~ 19.56	~~137.2~~ 138.9	~~523.0~~ 580.8	~~6.98~~ 7.34	~~1979~~ 1984	2001 2032
17280(12D)	~~1456~~ 1391	~~19.54~~ 19.56	~~163.6~~ 165.5	~~630.1~~ 697.0	~~6.98~~ 7.34	2276 2280	2300 2341
23040(16D)	~~1756~~ 1683	~~19.54~~ 19.56	~~216.3~~ 218.6	~~844.2~~ 929.4	~~6.98~~ 7.34	~~2843~~ 2848	2870 2894
28800(20D)	2029 1931	~~19.54~~ 19.56	~~269.0~~ 271.8	1058 1162	~~6.98~~ 7.34	3383 3392	3412 3454
34560(24D)	~~2282~~ 2174	~~19.54~~ 19.56	~~321.7~~ 324.9	~~1273~~ 1394	~~6.98~~ 7.34	3903 3919.5	3935 4004
43200(30D)	2635 2518	~~19.54~~ 19.56	400.8 404.6	~~1594~~ 1742	~~6.98~~ 7.34	4656 4692	4689 4816

TABLE 9.2-9 (Continued)

Notes:

(1)	Q Decay	Integrated core decay heat suppression pool.
(2)	Q Sensible	Integrated sensible heat rejected by the reactor vessel, piping, and core to the suppression pool.
(3)	Q Auxiliary 1	Integrated heat from ECCS pump work rejected to the suppression pool.
(4)	Q Auxiliary 2	Integrated heat from auxiliary systems rejected to Division 1 service water system. This heat includes all sources of heat into Division 1 SW system except for the RHR heat exchanger. The RHR heat exchanger transfers heat from the suppression pool to Division 1 SW system.
(5)	Q Auxiliary 3	Integrated heat from HPCS service water system. This heat is a straight heat dump into spray pond A.
(6)	Q Total	Sum of Q Decay, Q Sensible, Q Auxiliary 1, Q Auxiliary 2, and Q Auxiliary 3.
(7)	Q Service	Sum of Q Auxiliary 2 and the heat rejected Water by the RHR heat exchanger into Division 1 service water system, i.e., the sum of the heat rejected through the spray nozzles.
(8)		The RHR heat exchangers provide suppression pool cooling from 10 minutes through to the end of an accident (30 days). No heat exchanger cooling is assumed for the first 10 minutes of an accident. See 6.2.2.2 and 6.3.2.8 for further information on containment cooling.

TEMPERATURE RESPONSE FOLLOWING
DESIGN BASE LOCA (STANDBY SERVICE WATER)

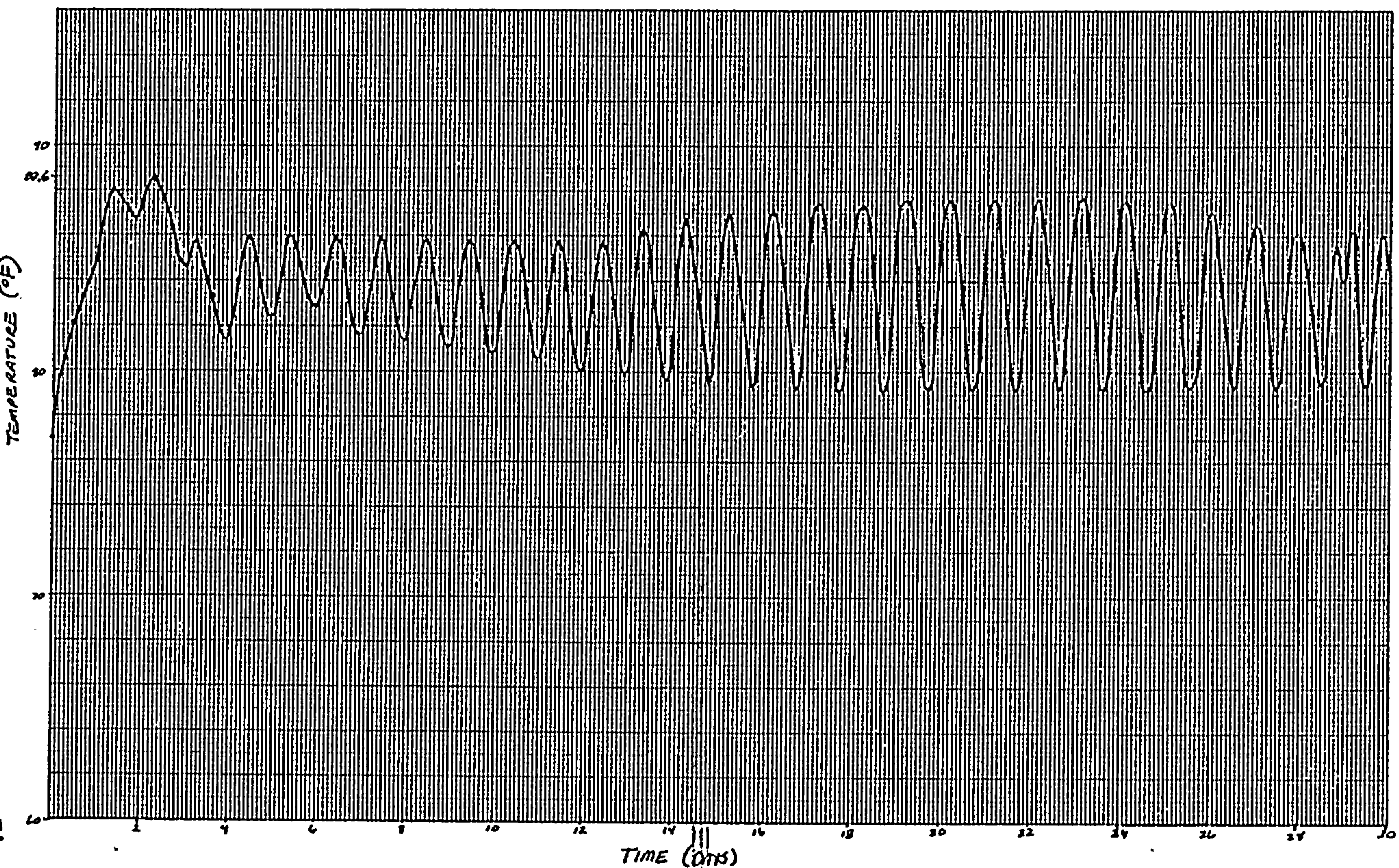

Figure 9.2-7a

TEMPERATURE RESPONSE
FOLLOWING A DESIGN BASIS LOCA (SUPPRESSION POOL)

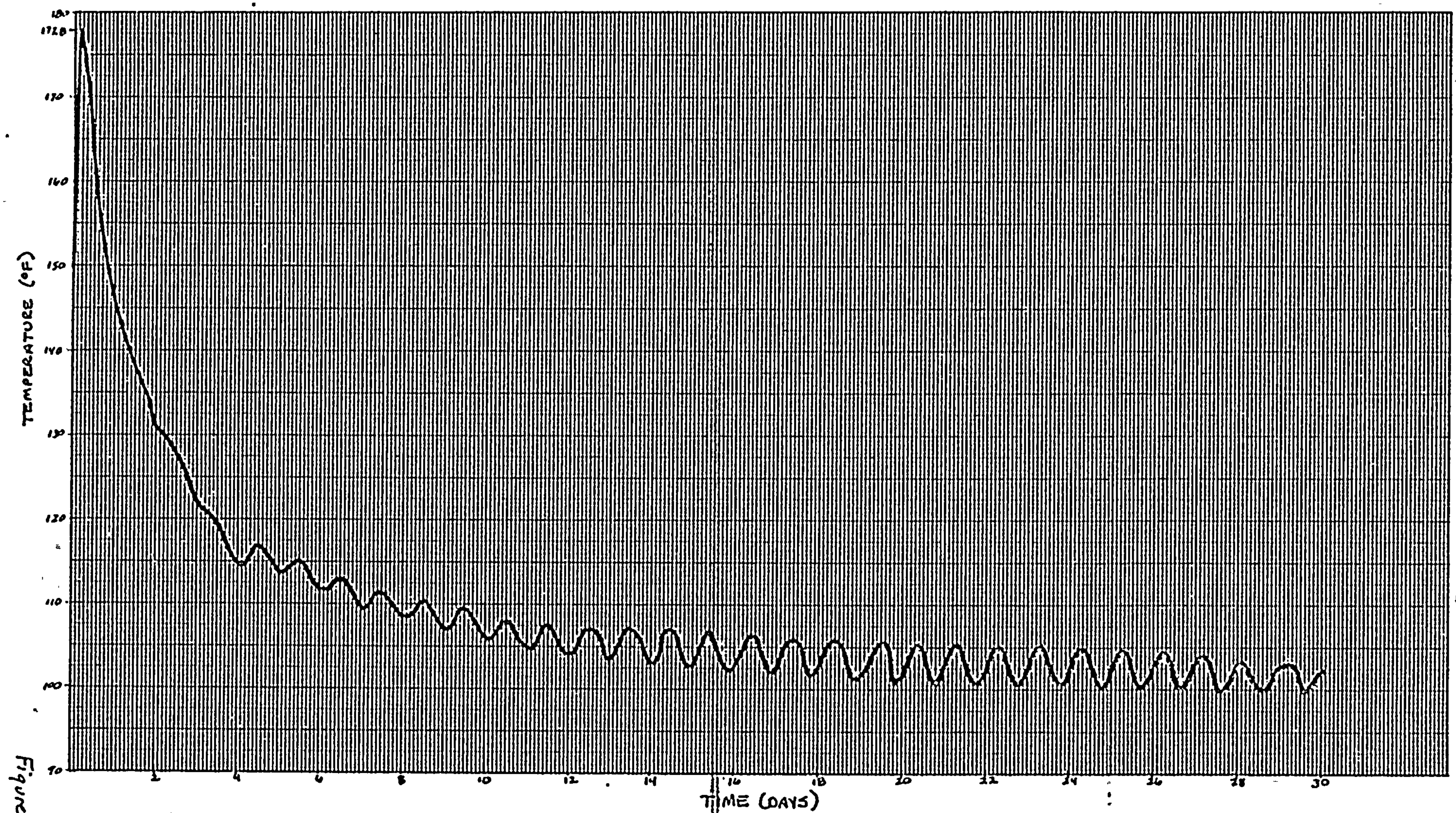

Figure 9.2-7b

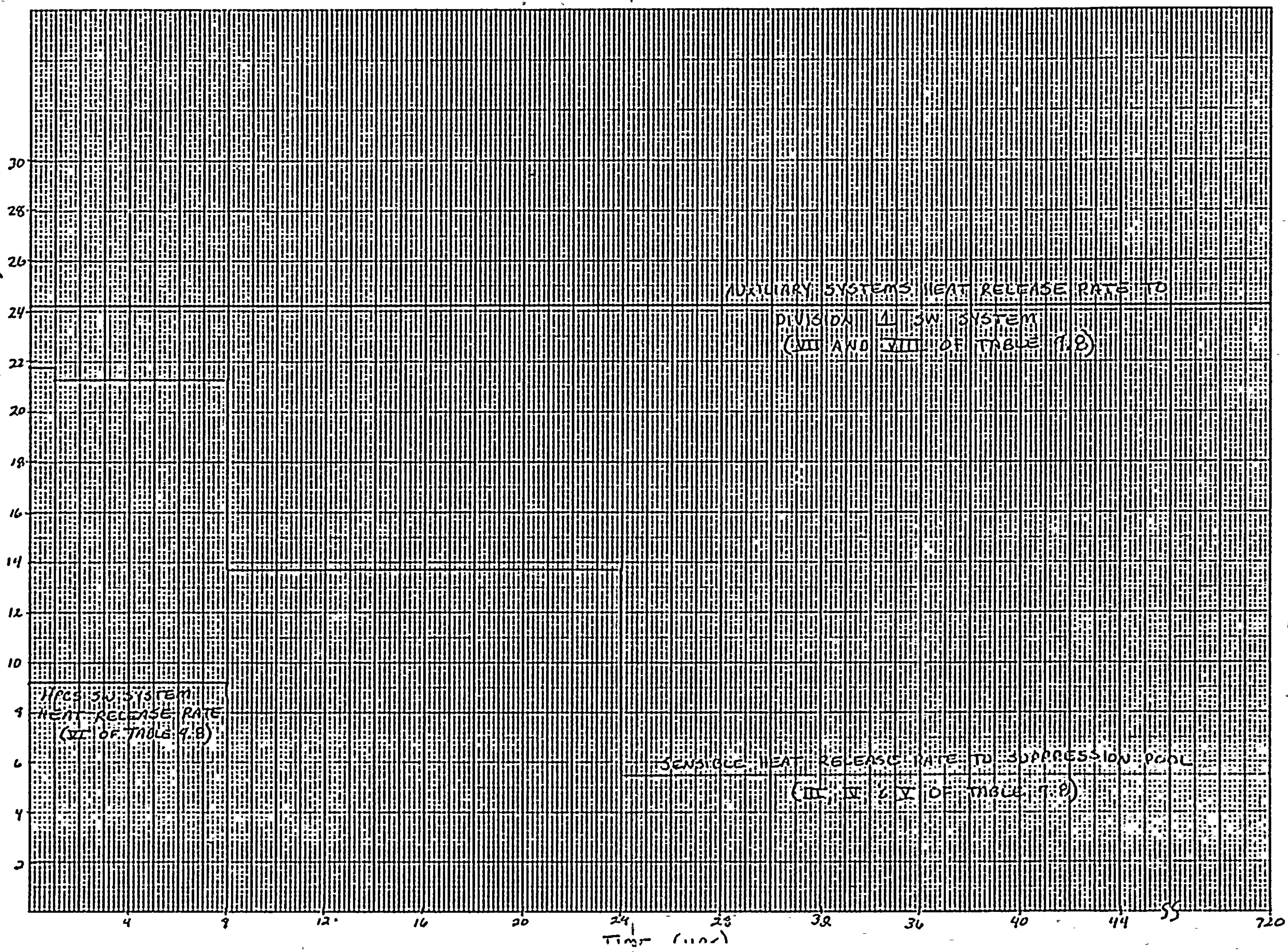
AUXILIARY SYSTEMS HEAT RELEASE RATE TO
DIVISION II SW SYSTEM
(VII AND VIII OF TABLE 7.8)
HPCS SW SYSTEM
HEAT RELEASE RATE
(VI OF TABLE 7.8)
SENSIBLE HEAT RELEASE RATE TO SUPPRESSION POOL
(III, IV & V OF TABLE 7.8)
HEAT RELEASE RATE (10⁶ BTU/HR)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
4
8
12
16
20
24
28
32
36
40
44
720
TIME (HRS)

Figure 9.

INTEGRATED HEAT LOADS
FOLLOWING LOCA

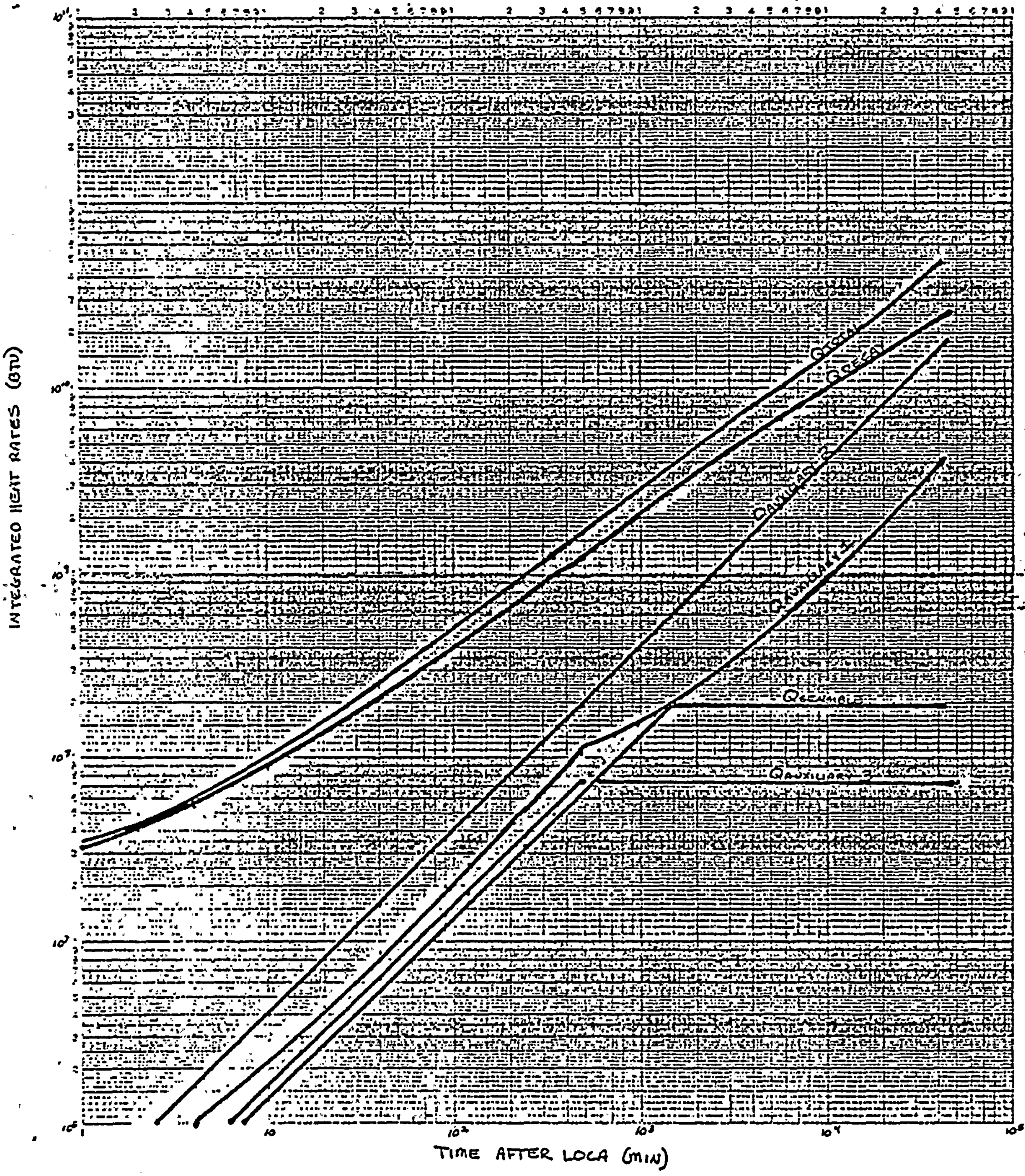

Figure 9.2-7d

INTEGRATED HEAT LOADS
REJECTED TO UHS

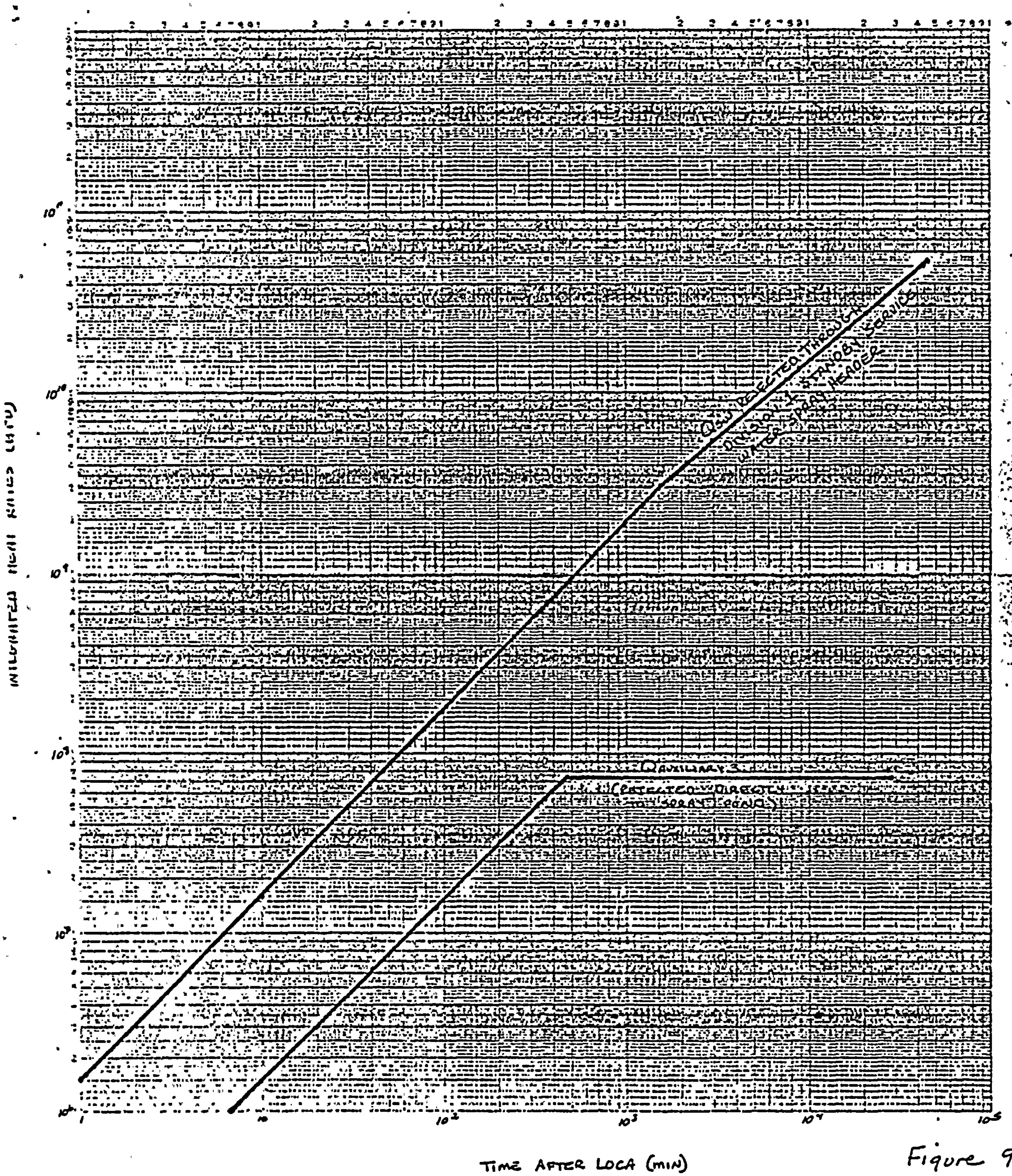

Figure 9.2-7e

WATER INVENTORY IN UHS
FOLLOWING DESIGN BASIS LOCA

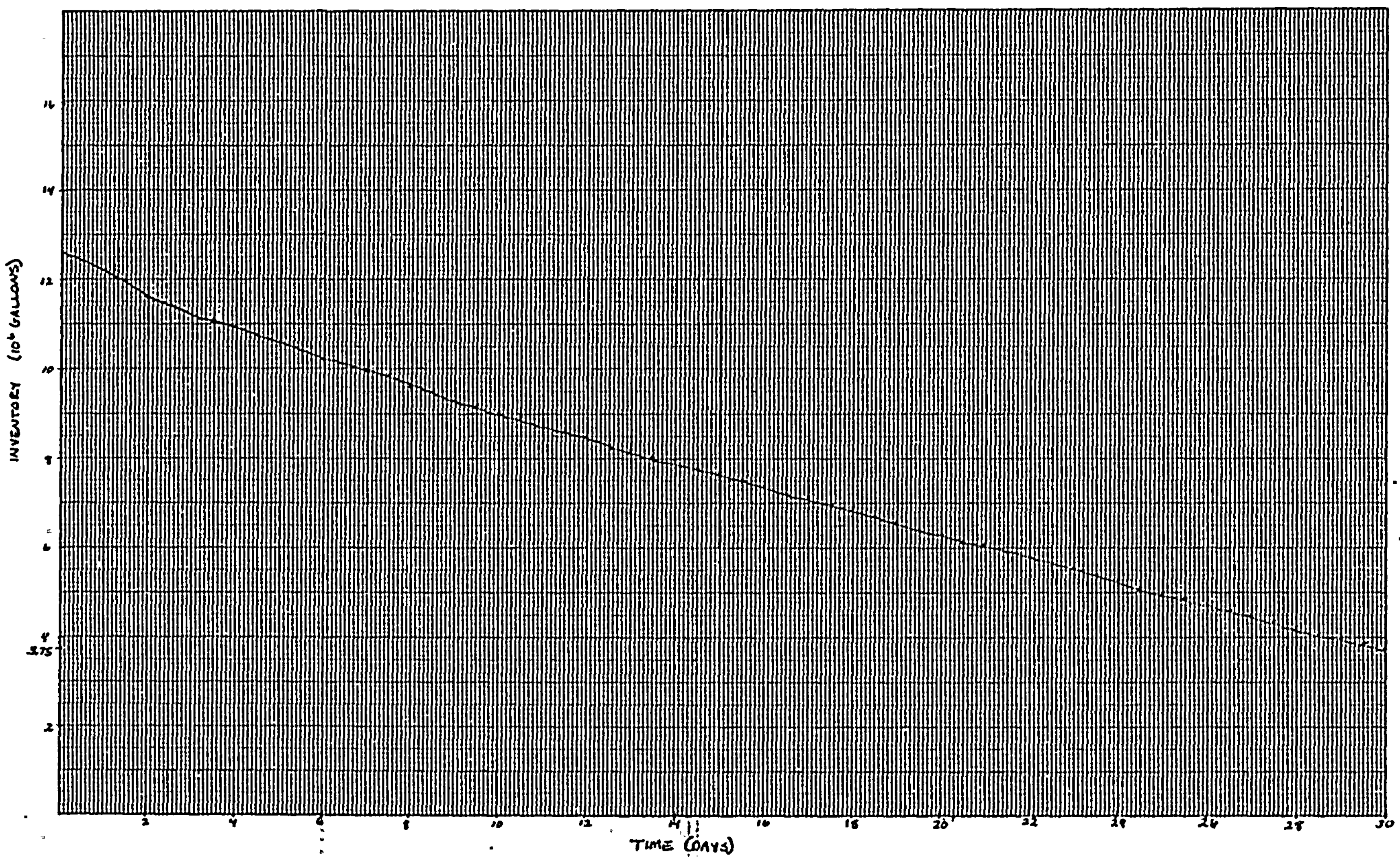

Figure 9.2-5

[illegible]