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TITLE

GRAVITY FED WATER SUPPLY TO REACTOR STORAGE BASINS

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ER Astley

This document consists of
13 pages.

GRAVITY FED WATER SUPPLY TO
REACTOR STORAGE BASINS

by

J. W. Hedges, Supervisor
Plant Engineering, Mechanical B
Applied Reactor Engineering

Approved by:

ER Astley
Manager, Applied Reactor Engineering

April 1, 1963

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GRAVITY FED WATER SUPPLY TO
REACTOR STORAGE BASINS

INTRODUCTION

Document No. HW-75802 stipulated the various stabilization measures which should be taken in order to permit minimizing the consequences of enemy attack at HAPO. Included in this document was the proposal for complete reactor discharge of metal and for providing gravity flow of cooling water to the 105 storage basins by modifying portions of existing piping systems.

PURPOSE (

It is the purpose of this document to provide the scope of piping changes that are needed to supply gravity-fed water to the reactor storage basins on an unattended basis following complete reactor discharge of metal into these basins.

JUSTIFICATION

The basic justification for this work is nuclear safety through minimizing the consequences of an attack threat at the Hanford Plant.

REQUIRED FLOWS

Subsequent to issuing Document No. HW-75779, "Minimizing Consequences of an Attack Threat", C. A. Priode, more detailed studies have been made on the flow requirements for adequate cooling in the 105 storage basins. These requirements have been established by FEO and REO and are as set forth on the flow versus days after shutdown graph attached as Graph No. I to this document. These curves assume a maximum temperature change of 68°C in the storage basins. This combination of flows and temperature change provides the maximum period of gravity-fed flows while keeping the structural damage to the storage basin within tolerable limits. Document No. HWC-77276, "Technical Studies Supporting IPD Disaster Planning", May 1, 1963, provides the detailed technical basis for these flows and temperature changes.

DESCRIPTION OF PROPOSED WORK

1. 105-B (see Exhibit No. I)
 - a. Provide flow indicating equipment on $\frac{1}{2}$ and $2\frac{1}{2}$ front face headers.
 - b. Provide a 25 foot run of 6 inch pipe including flow control valve and flow indicator. Tie this piping into the 8 inch filtered water supply at floor level next to the 105-B storage basin (see Exhibit No. V).
 - c. Install pressure switches on 183-B sanitary pump and one 181-B pump.

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2. 105-C (see Exhibit No. I)

- a. Make an 8 inch tie with isolation valve between the 190 tank discharge piping and the 12 inch filtered water line.
- b. Cut into the 10 inch filtered water line supplying the 105-C storage basin and install a 6 inch line with gate valve and flow indicating device at floor level.
- c. Install pressure switches on one 183-C high lift pump and one 181-C pump.

3. 105-D (see Exhibit No. II)

- a. Provide flow indicating equipment on $\frac{1}{2}$ and $2\frac{1}{2}$ front face headers.
- b. Provide a 12 inch drain from the 105-D storage basin to the existing 1608-D drain line to the effluent system (see Exhibit No. V).
- c. Install pressure switch on 183-D sanitary pump.

4. 105-DR (see Exhibit No. II)

- a. Provide a 25 foot run of 6 inch pipe, including flow control valve and a flow indicator, on the 8 inch filtered water supply at the 105-DR storage basin.
- b. Provide flow indicating equipment on $1\frac{1}{2}$ front face header.
- c. Provide a new drain between the 105-DR storage basin and the 1608-DR to effluent line piping inter-tie (see Exhibit No. V).
- d. Install pressure switch on 181-DR pump No. 17.

5. 105-F (see Exhibit No. III)

- a. Provide flow indicating equipment for $\frac{1}{2}$ and $2\frac{1}{2}$ headers.
- b. Provide a 25 foot run of 6 inch pipe, including flow control valve, and a flow indicator, on the 8 inch filtered water supply at the 105-F storage basin.
- c. Provide plugs for 115-F tunnel drains.
- d. Remove a 20' section of one earthen dike in the existing ash pit pond.
- e. Install pressure switches on one 181-F pump and one 183-F sanitary pump.

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6. 105-H

- a. Provide flow indicating equipment for $1\frac{1}{2}$ header.
- b. Provide a 25 foot run of 8 inch pipe, including flow control valve and a flow indicator, on the 8 inch filtered water supply at the 105-H storage basin.
- c. Install pressure switches on one 181-H pump and one 183-H pump.

7. 105-KE and 105-KW (see Exhibit IV)

- a. Install 36 inch flange pairs in the 36 inch settling basin flume drains. Provide blank flanges for installation at the time of evacuation.
- b. Install 8 inch inter-ties approximately 10 feet long between the 36 inch drains and the existing 8 inch filtered water mains in the tunnel.
- c. Install flow indicating equipment in the lowest two headers.
- d. Replace the existing wood door on the flume weirs in the tunnel with stud doors designed to withstand 12 feet of internal water pressure.

DISCUSSION

The proposed piping modifications have been selected on the following basis:

1. The only control of flow settings must be made at the high flow setting just prior to evacuating the areas.
2. The water supplies from the three basic sources; that is, high tanks, 190 storage tanks, and sedimentation tanks, are so different in head characteristics that it is easier to assure flow by controlling them independently while permitting them to flow concurrently to the 105 storage basins.
3. This approach appears to match the required flow curves in the most optimum fashion.
4. Flow through reactor process tubes will disperse the coldest water over the chute liners.
5. The changes proposed provide assured protection for the minimum cost.

Flows at 105-B, C, D, F, and H are primarily obtained from the 190 storage tanks through the by-pass around one 190 steam turbine pump, and then through normal piping to the lowest crossheaders. Flow indicators, normally isolated from the system, would be provided to set the initial flow. When the reactor is set up for discharge, all caps would be left off the rear face on the lowest tube rows.

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During the period just prior to evacuation and after metal has been discharged from the reactor, check valve gates in line with this flow path should be blocked open or removed to prevent a "sticky" gate from impeding flow. See Exhibit No. II for typical valving requirements to establish this flow path.

High tank flows would be used to supplement the 190 flow during the first 11 days (14 days after shutdown) of operation. This flow would be valved and controlled through the existing high tank cooling system installed on Project CG-905 (see Exhibit No. II). Additional supplementary flow could come from the 183 sedimentation basins for 105-B, F, and H Reactors through the existing filtered water piping. A new supply line with flow indicating equipment would have to be installed at the 105 storage basins to get maximum use of available head by eliminating the high spot in the existing filtered water lines.

This same system would have to be used at 105-DR as the primary source of gravity feed. In addition, the export system would be drained through the 105-DR valve pit and reactor piping to strengthen that reactor's gravity supply.

At the K's, the steel doors installed on the flume weir openings would have to be bolted tight, and the blank flanges would have to be installed in the two 36 inch settling basin drain lines. The inter-tie between the settling basin drain lines, the filtered water system in the tunnel, the 24 inch cross-tie, the 30 inch emergency water system, and the supply lines to "C" and "D" risers would be valved in. Flow could then be established from the settling basin drains through the two lowest crossheaders and the process tubes they feed to the storage basins. Flow indicating equipment mounted on these crossheaders would enable the operators to establish the initial flow settings.

The flows available from these various arrangements are as shown on Table I.

At the old reactors, a large portion of the initial flows could be maintained for as long as electrical power was available by keeping the 190 tanks and 183 sedimentation basins "topped off" with existing pumping facilities. For the sedimentation basins, this would involve operating one 181 pump and spilling the excess water through the clear wells to process sewers. In the 183 Building, one sanitary water pump could be used to pump from the clear wells and keep the 190 tanks "topped off". In both instances, pressure switches by-passable on startup, should be installed in the attached piping to cut off these pumps when they are no longer supplied water.

Drainage from the 105 storage basins is a special problem at 105-D and 105-DR where this flow is presently pumped up through the 1608 buildings to the effluent lines. Gravity drains to the effluent lines would be required at those buildings.

The 105-F Reactor is the only building that cannot drain to the 107 basins. Exhibit No. III shows how the water can be drained from the 105-F Building to

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the existing ash disposal pit. It will be necessary to remove a section of the earthen dike in the existing ash pit pond in order to make use of the total pond area without flooding the present area access road.

Supervisor
Plant Engineering, Mechanical B
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JW Hedges/crf
4-1-63

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GRAPH NO. I
FLOW REQUIRED FOR BASIN COOLING

NOTE: Curves as furnished by P. A. Carlson - REO

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FLOW DIAGRAM, 105-B AND 105-C

FLOW DIAGRAM. 105-D AND 105-DR

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Maintain
flow to
183-DR from
some 181-D
pump supplying
183-D

CL = Valve should be left closed

J. W. HEDGES
2-17-63

HW-76690^s

EXHIBIT IV

EMERGENCY STORAGE
BASIN COOLING

33 million gallon gravity
feed to storage basin
105-KE & 105-KW

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EXHIBIT NO. V

MISCELLANEOUS PIPING
DETAILS

Gravity Drain, 105-D

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TABLE NO. I
GRAVITY FLOW TO 105 STORAGE BASINS

BUILDING TO BE SUPPLIED	GRAVITY FEED SOURCE	INITIAL HEAD (FEET)	FINAL HEAD (FEET)	INITIAL FLOW SETTING (GPM)	FLOW AT MINIMUM HEAD (GPM)	AVERAGE FLOW (GPM)	CAPACITY AVAILABLE IN M GALS.	DURATION OF FLOW DAYS
105-B	190-B Tanks	40.5	7	210	88	149	7,000	33
	187-B High Tanks	154	122	40	36	38	600	11
	183-C Sedim. Basins	22.5	18	110	98	104	5,800	38
						TOTAL	13,400	
105-C	190-C Tanks	22.5	1	360	75	217	14,800	47
	187-C High Tanks	163.5	141.5	40	36	38	600	11
						TOTAL	15,500	
105-D	190-D Tanks	43.5	5.5	320	115	218	7,000	22.2
	187-D High Tanks	155 (Av.)	123	40	36	38	600	11
						TOTAL	7,600	
105-DR	183-D & DR Sedim. Basins	14.5	5.5	200	125	163	6,000	25.4
	Export System	130	5	100	20	60	1,900	22
	105-DR High Tanks	153.5	121.5	40	36	38	600	11
						TOTAL	8,500	
105-F	190-F Tanks	41.2	5	260	90	175	7,000	30
	187-F High Tanks	153	121	40	36	38	600	11
	183-F Sedim. Basins	14.7	10.2	60	50	55	2,400	30
						TOTAL	10,000	
105-H	190-H Tanks	43	3	240	63	151	8,500	38
	187-H High Tanks	155	123	40	36	38	600	11
	183-H Sedim. Basins	4.5	1	80	38		2,800	33
						TOTAL	11,900	
105-K	183-K Sedim. Basins	20	3	900	350	625	33,000	36.5

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7/28/94

END