AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

**Cover Sheet for a Hanford
Historical Document
Released for Public Availability**

Released 1994

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

DISCLAIMER

This is a **historical document** that is being released for public availability. This was made from the best available copy. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

(CLASSIFICATION)
GENERAL ELECTRIC

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DECLASSIFIED

DOCUMENT NO.

HW-6634 RD

SERIES AND COPY NO.

DATE

August 12, 1960

☒

THIS DOCUMENT CONTAINS RESTRICTED DATA
DEFINED BY THE ENERGY ACT OF 1974
WHICH TRANSMITTING THE DISCLOSURE OF ITS
CONTENTS IN ANY MANNER TO AN UNAUTHORIZED
PERSON IS PROHIBITED.

TITLE

PRELIMINARY DESIGN BASIS
MODIFICATIONS FOR IMPROVED COOLANT BACKUP
100-B, D, F, H, DR, and C AREAS

☐

OTHER OFFICIAL CLASSIFIED INFORMATION

THIS MATERIAL CONTAINS INFORMATION AFFECTING
THE NATIONAL DEFENSE OF THE UNITED STATES
WITHIN THE MEANING OF THE ESPIONAGE LAWS,
TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANS-
MISSION OR REVELATION OF WHICH IN ANY MANNER
TO AN UNAUTHORIZED PERSON IS PROHIBITED BY
Indefinite Retention

AUTHOR

M. H. Schack
W. J. Tupper

ISSUING OFFICE
CIRCULATING COPY
RECEIVED 700 AREA
AUG 18 1960
RETURN TO

Authority DOCUMENT MUST BE KEPT UNATTENDED WHERE AN UNAUTHORIZED PERSON MAY HAVE ACCESS
TO IT. WHEN NOT IN USE, IT MUST BE STORED IN AN APPROVED LOCKED REPOSITORY WITHIN AN APPROVED
GUARDED AREA. WHILE IT IS YOUR RESPONSIBILITY AND UNTIL YOU HAVE RECEIVED A SIGNED RECEIPT
CLASSIFIED FILES, IT IS YOUR RESPONSIBILITY TO KEEP IT IN YOUR POSSESSION WITHIN THE SCOPE OF
PROJECT AND FROM AN UNAUTHORIZED PERSON. IT IS ESSENTIAL TO, AND STORED IN YOUR PLACE
RESIDENCE IS PROHIBITED. IT IS NOT TO BE REPRODUCED. IF ADDITIONAL COPIES ARE REQUIRED,
OBTAIN THEM FROM THE RELATED ISSUING OFFICE. PERSONS READING THIS DOCUMENT ARE REQUESTED
TO SIGN IN THE SPACE PROVIDED BELOW.

ROUTE TO:	CONTROL NO.	LOCATION	FILES ROUTE DATE	SIGNATURE AND DATE

Indefinite Retention

Authority

JUL 2 1965

(CLASSIFICATION)

DECLASSIFIED

DECLASSIFIED HW-66334 RD

-1-

PRELIMINARY DESIGN BASIS
MODIFICATIONS FOR IMPROVED COOLANT BACKUP
100-B, D, F, H, IR, and C AREAS

§ 1.2-60

by

M. H. Schack
W. J. Tupper
Reactor Modification Design
FACILITIES ENGINEERING SECTION

DISTRIBUTION

1. S. M. Graves
2. A. K. Hardin
3. H. W. Heacock
4. S. S. Jones
5. J. W. Nageley
6. R. W. Reid
7. G. J. Rogers
8. M. H. Schack
9. D. E. Sebade
10. R. E. Trumble
11. W. J. Tupper

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of WA Snyder

CGPR-2, 1-25-94

By J. E. Savely 2-2-94

Verified By J. M. Miller 2-11-94

This document contains restricted information as defined in the Atomic Energy Act of 1954. Its transmission or the disclosure of its contents in any manner to unauthorized persons is prohibited.

This document consists of
14 pages. No. 2 of
11 copies.

MASTER

DECLASSIFIED

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DECLASSIFIED

HW-66334 RD

TABLE OF CONTENTS

	<u>Page</u>
I INTRODUCTION	3
II BASIC DESIGN REQUIREMENTS	3
III DESCRIPTION OF BASIC DESIGN	4
IV REFERENCE CODES, STANDARDS, AND BIBLIOGRAPHY	6
V DRAWINGS	7

DECLASSIFIED

HW-66334 RD

PRELIMINARY DESIGN BASIS
MODIFICATIONS FOR IMPROVED COOLANT BACKUP
100-B, D, F, H, DR, and C AREAS

I. INTRODUCTION

The purpose of this document is to establish the design scope for the proposed modifications to the reactor "last ditch" cooling systems in the 100-B, D, F, H, DR, and C Areas.

The objective in making these modifications is to provide adequate "last-ditch" reactor coolant flows for safety of operation at power levels currently programmed for the period to CY-1964 when additional "last-ditch" cooling facilities are planned in connection with major plant modifications. Additional interim modifications may be required for the last ditch system at the 100-C and DR Areas and for the export water system prior to major plant modifications during CY 1964-65.

II. BASIC DESIGN REQUIREMENTS

The last ditch cooling system for the 100-B, D, F, H, DR, and C Areas consists of two 300,000 gallon capacity high tanks at each reactor and an export water system. Upon loss of both the primary (190 Building electrical driven pumps) and the secondary (190 Building steam driven pumps) coolant supplies, the last ditch system must automatically supply sufficient coolant flow to prevent reactor damage.

Present and required last ditch system capabilities are as presented in Document HW-64417⁽¹⁾, and are used as a basis for the following design requirements:

1. The minimum high tank flow rates to the reactor during the critical period two to seven minutes after shutdown shall be as listed below:

<u>Area</u>	<u>High Tank Flow Rate</u>
100-B, D, F, and H	15,000 gpm
100-C	12,900 gpm
100-DR	13,700 gpm

2. The temperature of the stored water in the high tanks shall not exceed 30 degrees centigrade.
3. The high tank water supply shall be extended to last approximately one hour.
4. The flow available from the export system shall exceed the minimum required reactor flow rates at the time of depletion of the high tanks. The water temperature of the export system shall be taken as 30 degrees centigrade.

DECLASSIFIED

III. DESCRIPTION OF BASIC DESIGN

General

Increased high tank discharge rates will be required at 100-B, D, F, and H Area. No increase in high tank discharge rates is required at 100-DR and C Areas at the present time. The increased flow rates shall be obtained by installing new additional discharge lines from the high tanks to the reactor piping. Provisions shall be made in all areas to cool the high tank water and to detect its temperature. Modifications shall be made to the export system operation in order to increase its supply capacity to individual reactors and to decrease the time required to bring it into service during an emergency. These modifications will result in last ditch coolant flow rates as typified by Figures 1 and 2.

High Tank Discharge Piping

1. A new 18 inch discharge line shall be added in parallel with the existing 12 inch discharge line from each high tank in the 100-B, D, and F Areas. A new 16 inch discharge line shall be added in parallel with the existing 16 inch discharge line from each high tank in the 100-H Area. The new piping is sized to obtain the required high tank flow rates while operating in parallel with the existing high tank discharge lines. The flow capability of the existing high tank discharge lines was based on results of actual flow tests as reported in Document HW-64417⁽²⁾.
2. The new piping shall have valves and strainers similar to that of the existing piping.
3. Provisions shall be made in each new line for the future installation of an orifice for use in either flow restriction or flow measurement.
4. The new lines shall be protected from freezing by adequate earth coverage or by supplementary heating.
5. The material for piping, valves, and strainers shall be of steel, where possible, for earthquake resistance. Piping connections shall be anchored to resist transmission of earthquake induced reactions to cast iron valves or strainers. Clearance holes with resilient sealing shall be provided for piping penetrations through concrete walls and foundations. Piping supports in tunnels and valve pits shall be designed to resist earthquake induced forces.

Steel used in piping, valves, and fittings must have a V notch Charpy impact strength of 15 ft-lbs. or greater at 10°F.

The design of all piping and supports shall be in accordance with the recommended earthquake criteria detailed in Document HW-65931⁽⁵⁾. As an integral part of the last ditch coolant system this installation must be considered as critical to the safety of a nuclear process, and the appropriate provisions of the earthquake criteria will apply.

DECLASSIFIED

HW-66334 RD

6. In order to extend the duration of the high tank supply, the discharge flow rate shall be modulated by interconnecting the existing high tank discharge line and the existing 12 inch fill line inside the high tank riser. The fill line shall be terminated below the normal high tank water level so that flow through the existing discharge line will be stopped after about 15 minutes of emergency operation.
7. Typical piping arrangements are shown by drawings SK-1-4244, SK-1-4249, SK-1-4250, and SK-1-4255.

High Tank Water Temperature Control

Water temperature sensing elements shall be installed in each high tank and connected to recorders in the 105 control rooms. A new orificed drain line shall be provided to bleed about 200 gpm from each tank. This water will be replaced with colder water through the existing four-inch fill line. A continuous bleed of 200 gpm during hot weather should maintain high tank water temperatures below 30°C. Typical arrangements for the installation of the temperature sensing elements are shown by drawings SK-1-4263 and SK-1-4264. This is the only modification required at DR and C at this time.

Export System Modifications

1. At each reactor where high tank discharge piping modifications are made, the Groves Flex-Flo valve shall be opened to supply export water to the reactor about five minutes after the high tanks start to drain. This will be accomplished by extending each Groves valve sensing line to a higher point in the tank. This change is required to extend the high tank water supply until the export system can supply the required reactor coolant flow alone.
2. Larger orifices shall be installed in the export system at each reactor where additional high tank piping is to be installed. Since the increased high tank flow rates will empty the high tanks sooner than previously, higher flow rates will be required from the export system.
3. Automatic closure shall be provided for the 12 inch cone valves in the export system supply to the 282-E and 282-W reservoirs. An orificed bypass at each cone valve will provide a minimum export flow of about 2700 gpm to 200-E and about 850 gpm at 200-W. This change will insure that sufficient water is available to a stricken reactor if only steam pumping is available in other areas to supply the export system. The cone valves shall close off slowly to prevent pressure surges. Normal positioning of the valve for control purposes shall be by manual operation as at present. An alarm and indicating light shall be provided to the appropriate 200 Area Control Room to show valve position.
4. All four export system steam turbine driven pumps shall be controlled by the existing Copes regulators to assume the export system pumping load upon loss of water pressure. The export system shall be capable of augmenting the high tank flow rates during the initial period of emergency operation. Automatic acceleration of the steam turbine driven pumps will insure adequate export system pressure upon loss of the electric driven pumps.

DECLASSIFIED

HW-66334 RD

IV. REFERENCE CODES, STANDARDS, AND BIBLIOGRAPHY

Codes and Standards

Unless otherwise stated, the design, the material used, and the work to be performed shall adhere to the requirements set forth in the latest edition of the Hanford Works Standards and the applicable codes approved by these standards.

Bibliography as of August 1, 1960

	<u>Document No.</u>	<u>Classification</u>	<u>Title</u>	<u>Author</u>	<u>Date</u>
(1)	HW-65541	Conf-Undoc.	Last Ditch Coolant Supply	HW Heacock	6/6/60
(2)	HW-64417	Secret	Review of the Status of Hanford Reac. Emer. Cooling	SS Jones	6/1/60
(3)	HW-64621	Secret	Summary of Adequacy of Coolant Supply Backup	OH Greager	4/4/60
(4)	HW-63526	Secret	FY-1962 PA&C Budget, Coolant Backup, Old Reac- tors and KER	WJ Tupper DF Watson	1/15/60
(5)	HW-65931	Secret	Seismic Resistance Criteria	OE Adams WD Gilbert	7/8/60

DECLASSIFIED

HW-66334 RD

FIGURE 1

MODIFIED HIGH TANK AND EXPORT SYSTEM FLOWS

105-B, High Tank Water Level 3' Below Full at Start
105-D and 105-F, Similar

REACTOR FLOW
GPM

Groves Valve Opens

Flow Stops through Existing 12" Lines

Modified High Tanks Only

High Tanks Empty
Export System Only

Required Flow
1720 Mw
308 Water

TIME AFTER POWER FAILURE - MINUTES

24,000

20,000

16,000

12,000

8,000

4,000

0

10

20

30

40

50

60

70

80

90

DECLASSIFIED

FIGURE 2
MODIFIED HIGH TANK AND EXPORT SYSTEM FLOWS
105-H
High Tank Water Level 3' Below Full at Start

P L O T
SCALE 1" = 30'

HW-66334

- 9 -

STUDY

FOR
COMMENTS
NOT FOR CONSTRUCTION

- 10 SK-1-4250 PROC. WAT. PIP. - HIGH TANK VALVE PIT ARCT.
- 9 W-1-12520 PROC. WAT. PIP. - HIGH TANK VALVE PIT
- 8 PROK3750 OUTSIDE LINES - OVERHD. PIPING
- 7 W-71823 PLOT PLAN 105-B
- 6 W-71824 PLOT PLAN 105-B & 115-B
- 5 W-1-26010 PLOT PLAN 190-B ANNEX
- 4 M-1904-B SH-5 OUTSIDE LINES SEWERS
- 3 M-1904-B SH-5 OUTSIDE LINES UNDERGR. WAT.
- 2 M-1800-B SH-5 OVERHEAD PIPING UNDERGR. STM.
- 1 M-1600-B SH-5 TOPOGRAPHIC MAP 100-B AREA

DESCRIPTION		REV. BY	APP'D BY	FOR	DATE
REVISIONS					
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 4/2/66			
DRAWING NO. SK-1-4244		DESIGN NO.	CHECKED BY	REV. NO.	
SCALE: AS SHOWN		APPROVALS			
DRAWING DATE 6-1-66		BY	FOR	DATE	
ISSUED BY					
REV. NO. 12311					
PROJECT NO.					
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
UNDERGROUND PROCESS WATER PIPING HIGH TANKS TO REACTOR PLOT PLAN					
LAST DITCH COOLANT SYSTEM					
DRAWING NO. 105-B		DESIGN NO. 0305			
REV. NO. SK-1-4244		REV. NO.			

2nd issue
6-23-60

[illegible]

SECRET B-B

QTY.	PR.	DESCRIPTION
------	-----	-------------

GENERAL NOTES

1. ALL MATERIAL SHALL BE AS SPECIFIED OR APPROVED EQUAL.
2. FIELD TO CHECK DIMENSIONS BEFORE FABRICATING COMPONENT PARTS.
3. PIPING MATERIAL SHALL CONFORM TO ASTM A-53-58.4T
4. FLANGE MATERIAL SHALL CONFORM TO ASTM A-105-58T AND DIMENSIONS PER ATA B-16.3
5. PIPE FITTINGS SHALL BE IN ACCORDANCE WITH ATA B-16.3 FROM MATERIAL PER ASTM A-234-58.4T GRADE WPB
6. GASKETS TO BE FLEXITALLIC, STYLE 'C-6' WITH COATED CARBON STEEL BACKING RINGS, TYPE 304 STAINLESS STEEL WINDINGS AND CANADIAN ASBESTOS FILLER WITH NEOPRENE BINDER.
7. ALL PIPE AND STEEL SUPPORTS SHALL BE PAINTED WITH ONE COAT OF GENERAL PAINT CO. N-2483 ZINC CHROMATE PRIMER AND TWO COATS OF GENERAL PAINT CO. ALUMINUM FLAKE FINISH ALUMINUM. BEFORE PAINTING, ALL STEEL SURFACES SHALL BE WIRE BRUSHED TO REMOVE RUST, SCALE AND DIRT. GREASE AND OIL SHALL BE REMOVED WITH A SUITABLE VOLATILE CLEANER.

STUDY

**FOR
COMMENTS**
NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	11-18-108	PROCESS WATER VALVE PIT ARR'G'T.
2	SK-1-4251	PROCESS WATER VALVE PIT EXCT. 8-18-108
3	SK-1-4249	PROCESS WATER HIGH TANK VALVE PIT
4	SK-4246	PROCESS WATER HIGH TANK TO REACTOR

NO.	DESCRIPTION	REV. BY	APP'D. BY	FOR	DATE
REVISIONS					
CLASSIFICATION					
NONE					
DATE 6/15/60					
SK-1-4250					
SCALE: AS NOTED					
DRAWN: DOWNEY DATE 6-17-60					
CHECKED: [Signature] DATE 7-5-60					
DES. ENG. HILL UNIT 204					
NO. 10577					
PROJECT NO. 10577					
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
PROCESS WATER PIPING HIGH TANK TO REACTOR 105 VALVE PIT ARR'G'T.					
LAST DITCH COOLANT SYSTEM					
NO. 105-A					
REV. 8403					
SK-1-4250					

6/16/60

FOR
COMMENTS

Y FOR CONSTRUCTION

UDY

TS WATER PIPING TUNNEL PLAN & DET.
ARRO-T VALVE PIT TO PROCESS AREA
SS WATER TUNNEL BETWEEN TUNNEL
SS WATER VALVE PIT SECT 8 DET.
SS WATER HIGH TANK TO REACTOR

DRAWING TITLE
REFERENCE DRAWINGS
3356

NO.		DESCRIPTION		REV DATE	APP'D BY	FOR	DATE
REVISIONS		CLASSIFICATION		DESIGNED BY <i>DR. [Signature]</i> DATE 6-18-60			
CLASSIFICATION		NONE		DATE 6-18-60			
SK-1-4255		-		-		-	
SCALE: 1" = 10'		APPROVALS					
DRAWN BY <i>David</i> DATE 6-17-60		CHECKED		DATE		DESIGNED BY	
ISSUED BY <i>MOND/TUNT</i> P10		10577		PROJECT NO. 00-1860			
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC							
PROCESS WATER PIPING HIGH TANK TO REACTOR 105 VALVE PIT ARR'G'T. LAST DITCH COOLANT SYSTEM							
105H		8403		REV. NO.		DATE	
SK-1-4255		-		-		-	

NOT FOR CONSTRUCTION

STUDY

PROCESS WATER PIPING
HIGH TANK TO REACTOR
105 VALVE PIT ARR'G'T.

LAST DITCH COOLANT SYSTEM

SK-1-4255

End issue 11
7-6-60

④ 1st reference
7-6-60

-14-

100 66334

NAME PLATE LEGEND
X-X NEAR AND FAR HIGH TANK TEMP

QTY.	PT. NO.	DESCRIPTION	
	X 1	PANEL ARRGT. 105 B, D & F	
	X 2	PANEL ARRGT. 105 DR	
	X 3	PANEL ARRGT. 105 H	
X		PANEL ARRGT. 105 G	
1	1	RECORDER	
1	1	NAME PLATE 1/2" x 3" x 3/8" LETTERS	REF. 9

ARRANGEMENT
5-DR)

INSTALL TO
MATCH TOP EDGE
OF EXIST INSTR

ARRANGEMENT
5, 7 & 8 (105-H)

9	J-27	HANFORD STANDARD INSTR.
8	H-1997C	PANEL MODIFICATION (PROJ 791)
7	P-4875	(PROJ 558)
6	P-3186	INLET WATER PANEL ARRGT.
5	H-8018 DR	INLET WATER MISC INSTR. PANEL ARRGT.
4	P-8007	MISC INSTR. PANEL ARRGT.
3	H-19977	MODIFICATION
2	SK-1-4263	HIGH TANK PROBE INSTLN. INSTR.
1	H-111820	CONTR ROOM PANEL ARRGT. 105 B (S&L)
REFERENCE DRAWINGS		

**FOR
COMMENTS**
NOT FOR CONSTRUCTION

NO.	DESCRIPTION	REVISED BY	DATE	APPROVED BY	DATE
	REVISIONS				
	CLASSIFICATION				
	NONE				
SK-1-4264					
SCALE: AS NOTED					
DRAWN BY: [Signature]					
CHECKED BY: [Signature]					
DATE: 7-6-60					
U.S. ATOMIC ENERGY COMMISSION					
HANFORD ATOMIC PRODUCTS OPERATION					
GENERAL ELECTRIC					
INSTRUMENTATION					
HIGH TANK WATER TEMP.					
CONTROL ROOM PANEL					
MODIFICATION					
105 B, D & F H&C					
390211					
SK-1-4264					

1st copy
7-6-60

DATE

FILMED

6/22/94

END