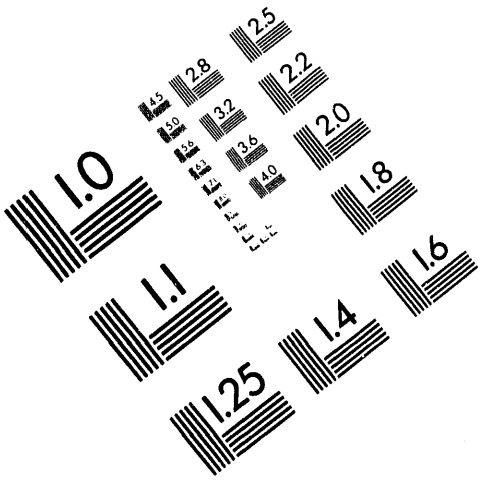

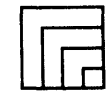

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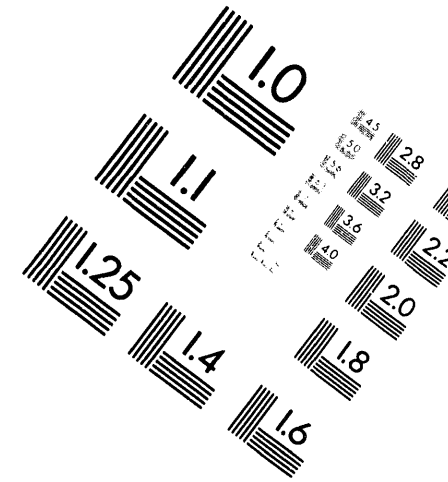

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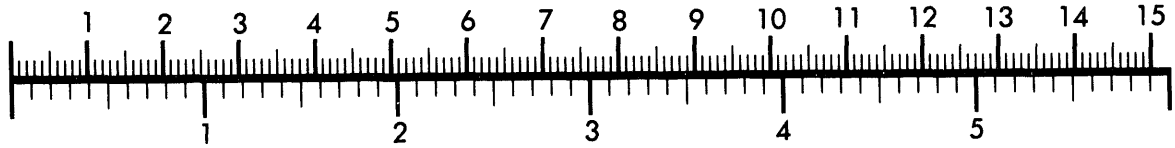

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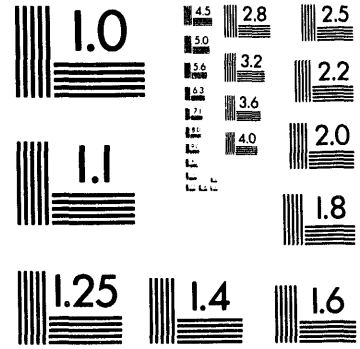

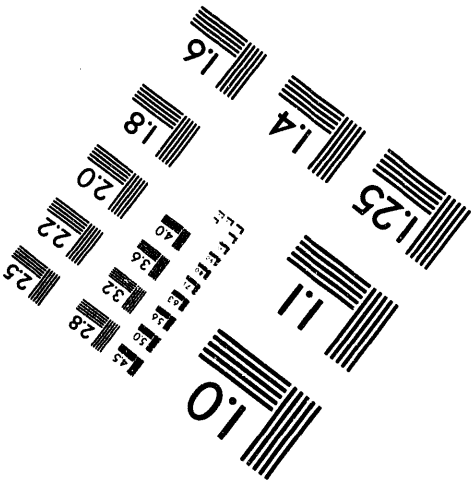

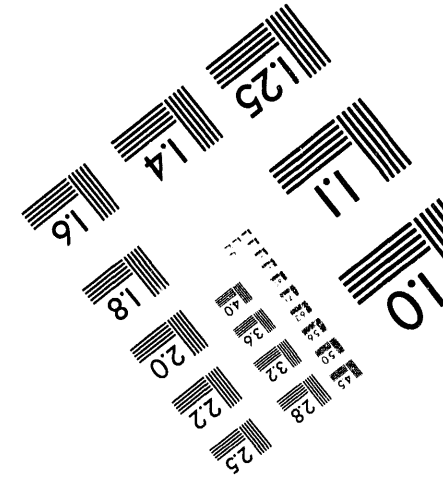

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COOLANT BACKUP DESIGN STUDY

BASIS AND OBJECTIVE

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COOLANT BACKUP DESIGN STUDY
BASIS AND OBJECTIVE

INTRODUCTION

Preliminary studies have, in general, indicated the need for modifications and improvements to the reactor last ditch coolant systems in order to provide adequate safety of operation at power levels programmed for the future. These studies have indicated the need for improved reliability as well as increased capacity for the last ditch coolant systems. A design study is being prepared by Reactor Modification Design to define the scope of the modifications required to provide adequate last ditch systems for the older areas. Adequate last ditch cooling will be provided for the 100-K Areas under Project CGI-844 which is currently in progress. The purpose of this document is to set forth the operating conditions and objectives on which the study will be based.

REACTOR OPERATING CONDITIONS

Required capacity for the last ditch systems will be based on power levels resulting from the proposed programs set forth in Document HW-62862, Plant Improvement Program, Irradiation Processing Department, Fiscal Years 1961 through 1966. Three cases will be considered: An interim case, the continuity of operation and safety case (non-expansion case) and the expansion case. Reactor operating conditions for the three cases are as follows:

Reactor Operating Conditions

Case	Required Date, FY	Flow, GPM	TORP	Bulk Outlet Temp., °C	Power Level M.W. ti=20°C
Interim (Case A)	1961	85,000 B, D, F, H, DR	545	95	1680
		95,000 - C	395	95	1880
Non-Expansion (Case B)	1963	90,000 B, D, F, H, DR	525	95	1780
	1962	100,000 - C	375	95	1980
Expansion (Case C)	1964	115,000 B, D, F, H, DR	405	95	2280
	1964	115,000 - C	345	95	2280

Modifications for the interim case (Case A) will be incorporated under a current project which is expected to be accomplished during FY-1961. These modifications would be required to provide an adequate last ditch system until about FY 1963-64 when either Case B or C conditions would be expected to exist. Modifications completed under Case A would, for the most part, be needed also for Cases B or C. - 905

LAST DITCH SYSTEM CRITERIA

The previously evolved "Reactor Cooling System Reliability Safety Criteria" will be followed. These criteria require that the last ditch cooling systems must be independent of both the primary (190 Building electrical driven pumps) and secondary (190 Building steam driven pumps) cooling systems, including piping to the reactor manifolding. It must be capable of providing adequate shutdown flow indefinitely assuming instantaneous loss of power to the primary system and concurrent failure of the secondary system to provide its rated flow. Adequate shutdown flow is defined, as a minimum, as that required to maintain the bulk outlet temperatures at or below 90°C after the initial temperature transient and to prevent boiling in all process tubes and piping.

RELIABILITY

The last ditch system must, of course, have a high degree of reliability. Several of the characteristics and components of the existing last ditch system which will be considered by the study with the view to improve reliability are listed below:

1. Natural disasters such as earthquake, windstorm, icestorm, floods, and river stoppage.

2. Corrosion in the high tanks and high tank discharge piping.

3. Leaks in mechanical joints of export system piping.

4. Excessive temperature of stored water in the high tanks.

5. Failure of export line steam driven pumps to start at the required time.

6. Pressure surges due to hydraulic transients in the export line and spurious action of the surge suppressors.

7. Indefinite control of flow to 200 Area reservoirs during an emergency period.

8. Inadequacy of export system to supply more than two reactors upon loss of primary and secondary system in more than two areas.

Of the above items the effect of earthquake is the most significant with respect to the scope of required modifications. Thus, the three cases for study will be sub-divided as follows:

Case	Earthquake Protection
Case A	No
Case B-1	No
Case B-2	Yes
Case C-1	No
Case C-2	Yes

STUDY OUTLINE

An outline of the study program and a condensed listing of the modifications which will be considered for the various cases are as follows:

Case A - Interim Case, Non-Earthquake

1. Additional high tank discharge lines - B, D, F, and H Areas
2. Cleaning high tank discharge lines
3. Cooling of high tank stored water
4. Automatic starting of export line steam driven pumps
5. Control of export flow to 200 Area during emergency
6. Hydraulic transient analysis and improvement or elimination of surge suppressors

Case B-1 - Non-Expansion Case, Non-Earthquake

1. Additional steam driven export line pump for backup spare
2. Clean and coat high tank interiors
3. Additional high tank discharge lines C and DR Areas
4. Portable river pumps.
5. Replace cast iron export line piping

Case B-2 - Non-Expansion, Earthquake Protection

1. New independent pumping station each area to replace export system
2. Brace high tank structures
3. Additional high tank discharge lines C and DR Areas
4. Replace cast iron valves and strainers; improve piping supports and anchors and provide clearance at penetrations in walls for high tank discharge lines
5. Brace 190 Building tank foundations
6. Clean and coat high tank interiors
7. Portable river pumps

Case C-1 - Expansion, Non-Earthquake

1. Additional high tank per reactor
2. Replace cast iron export line piping
3. Additional steam driven export line pump for backup spare
4. Clean and coat high tank interiors
5. Portable river pumps

Case C-2 - Expansion, Earthquake Protection

1. New independent pumping station each area to replace export system
2. Brace high tank structures
3. Additional high tank discharge lines C and DR Areas
4. Replace cast iron valves and strainers; improve piping supports and anchors and provide clearance at penetrations in walls for high tank discharge lines.
5. Brace 190 Building tank foundations
6. Clean and coat high tank interiors
7. Portable river pumps

BIBLIOGRAPHY

Considerable preliminary studies have been conducted to determine the adequacy of the last ditch system and to suggest modifications that should be made to improve the system capacity and reliability. The bibliography of significant documents written on this subject as of August 1960 is listed below:

Document No.	Title	Author	Date
HW-64996 Secret	Interim Report, Coolant Backup Study	WJ Tupper	8/1/60
HW-66153 Uncl.	Preliminary Examination of Old Reactor High Tank Flushing Requirement	A Russell	7/25/60
HW-66027 Secret	Project Proposal, Interim Modifications to High Tank and Raw Water Systems for Improved Coolant Backup, 100-B, C, D, DR, F, and H Reactors	AA Janos TH Lyons	7/22/60
HW-66334RD Secret	Preliminary Design Basis, Modifications for Improved Coolant Backup, 100-B, D, F, H, DR and C Areas	MH Schack WJ Tupper	8/12/60

Document No.	Title	Author	Date
HW-65541 Conf-Undoc.	Last Ditch Coolant Supply	HW Heacock	6/6/60
HW-64417 Secret	Review of the Status of Hanford Reactor Emergency Cooling	SS Jones	6/1/60
HW-64621 Secret	Summary of Adequacy of Coolant Supply Backup	OH Greager	4/4/60
HW-63526 Secret	FY-1962 PA&C Budget, Coolant Backup, Old Reactors, and KER	WJ Tupper DF Watson	1/15/60
HW-65931 Uncl.	Seismic Resistance Criteria	OE Adams, Jr. WD Gilbert	7/8/60

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