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HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

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FISSION WASTE CONTAINER STORAGE FACILITIES

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AUTHOR

J. W. Barnes

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This document consists
of 7 pages.

DESIGN CRITERIA
FISSION WASTE CONTAINER STORAGE FACILITIES

By

J. W. Barnes
Process Design Engineering
Facilities Engineering
Chemical Processing Department

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By Authority of SE Gydesen
4-11-94, CG-PR-2

By J E Saneley 4-18-94
Verified By Jerri Maley,
4-18-94.

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This document has been reviewed and approved as a basis for project
action.

Submitted by:

LRM

Manager - Process Design Engineering

5-14-64
Date

Approved:

HP Shaw

Chemical Processing Department
General Electric Company

5-18-64
Date

Approved:

U. S. Atomic Energy Commission
Richland Operations Office

Date

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DESIGN CRITERIA
FISSION WASTE CONTAINER STORAGE FACILITIES

I. INTRODUCTION

An unclassified design criteria for Fission Waste Container Storage Facilities is presented in HW-81771 PT1. The purpose of this document is to present classified information not given in HW-81771 PT1. This information deals with fission waste container production rates and fission waste inventories.

II. DESIGN BASES

Container Production Rates

Hot startup of the Phase II waste packaging demonstration unit is currently scheduled for January 1, 1966. A total of six containers will be produced during the demonstration phase. This number should provide for demonstration of a container loaded with strontium, one loaded with cesium, and one loaded with a mixture of the two isotopes. It also provides for one spare container each should a second demonstration unit be required. Each container will hold approximately 500 kilocuries of isotope and yield 8,000 to 12,000 BTU/hr of heat due to isotope decay.

Full scale container production is scheduled for the latter part of 1966 following completion of the demonstration phase. An estimated 150 to 200 containers per year will be produced when full scale production rates are attained, with a possible 300 containers per year being produced during the first year if little debugging is required. A total of about one thousand 500-kilocurie containers will be produced over a five-to-seven-year period and stored in U-Plant.

Containers will be transferred from B-Plant to U-Plant by railroad cask car at the above rate. These containers will be placed in the Pool Cell, Cell 4, and held for a surveillance period of about 90 days. Visual observation will be made through a minimum water cover of 14 feet. A total of 100 containers may be accommodated in Cell 4 by stacking two layers of cans on 30-inch centers.

The containers will be transferred to final storage in the storage basin located in Cells 1 and 2. A total of 120 containers may be stored per layer by placing the cans on 30-inch by 27-inch centers. A total of six layers or 720 containers may be stacked in this way by utilizing a support grid or spacer between each layer of containers. Additional containers may be stored in Cell 4 to an ultimate capacity of 1,020 containers with

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the present design. Increased capacity may be obtained in the future by converting Cells 6, 7, and 8 into additional storage cells. A total of 200 containers could be stored in each of these cells.

Heat Exchange System

Approximately 10 million BTU/hr will be released to the storage basins by the fission waste isotopes when 1,020 containers are in storage. A closed loop cooling system has been installed in Cell 5 to remove this heat. This system is designed to circulate 500 gpm of water and cool from 120°F to 80°F. Two sets of exchangers and pumps are utilized to give two independent cooling systems so that removal of a pump or heat exchanger will still allow the storage basins to be maintained at a safe temperature. Further backup is provided by lines which allow the direct addition of demineralized or raw water from the cold side pipe gallery. Should all cooling systems fail, water temperatures within the basin would increase at no more than 12°F per hour with 1,000 containers in storage.

The Primary Coolant Heat Exchangers, E-5-2 and E-5-3 are multipass shell and tube units with approximately 1,800 ft² of heat exchange surface. Significant cost savings may be realized in procurement by selecting a standard supplier's model and modifying the flanges to fit standard Hanford remote connectors. Specifications for these units are given in the attached data sheet.

Existing 150-gpm, 7-inch, B.C. deep well pumps from U-Plant may be used initially to circulate primary coolant. Two new 250-gpm deep well pumps will be required to circulate primary coolant when the storage facility inventory exceeds 600 containers. Specifications for these pumps are given in the attached data sheets.

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EXCHANGER SPECIFICATIONS (Information Only)

PROJECT NO.		LOCATION 221-U Bldg.		NO. REQ'D. 2		ITEM NO. E-5-2 & 5-3		DATE 3-15-64		SPEC. NO.		
GENERAL	SERVICE:		☐ CONDENSER	☐ HEATER	☐ COOLER	TYPE:		☐ PACKED FLOATING HEAD	☐ FIXED TUBE SHEET			
			☒ HEAT EXCHANGER	☐ THERMOSYPHON REBOILER				☐ INTERNAL FLOATING HEAD	☒ U - BUNDLE			
P E R F O R M A N C E	ARRANGEMENT:		☐ HORIZONTAL		☐ INCLINED		SURFACE PER UNIT		SHELLS PER UNIT 1		SURFACE PER SHELL	
			☒ VERTICAL									
P E R F O R M A N C E	FLUID CIRCULATED			SHELL SIDE Raw Water				TUBE SIDE Primary Cooling Water				
	TOTAL FLUID ENTERING, #/HR			125,000				125,000				
	VAPOR, #/HR			-----				-----				
	LIQUID, #/HR			125,000				125,000				
	STEAM, #/HR			-----				-----				
	NON-CONDENSABLES, #/HR			-----				-----				
	FLUID VAPORIZED OR CONDENSED, #/HR			-----				-----				
	STEAM CONDENSED, #/HR			-----				-----				
	GRAVITY - LIQUID			1.0 @ 60 °F				1.0 @ 60 °F				
	VISCOSITY - LIQUID			CP @ °F				CP @ °F				
	MOLECULAR WEIGHT - VAPORS			-----				-----				
	SPECIFIC HEAT - LIQUIDS,			1.0 BTU/#-°F				1.0 BTU/#-°F				
	THERMAL CONDUCTIVITY,			0.35 BTU/HR-FT² (°F/FT)				0.35 BTU/HR-FT² (°F/FT)				
	SPECIFIC HEAT - VAPORS			----- BTU/#-°F				----- BTU/#-°F				
	LATENT HEAT - VAPORS			----- BTU/#				----- BTU/#				
	TEMPERATURE IN,			70 °F				120 °F				
	TEMPERATURE OUT			110 °F				80 °F				
	OPERATING PRESSURE			100 #/IN²				50 #/IN²				
	NUMBER OF PASSES											
	VELOCITY			----- FT/SEC				----- FT/SEC				
	PRESSURE DROP (Max Allow)			40 #/IN²				30 #/IN²				
	HEAT EXCHANGED, BTU/HR: 5,000,000			MTD (CORRECTED):				10 °F				
	TRANSFER RATE - SERVICE:			CLEAN:								
	DESIGN PRESSURE			150 #/IN²				120 #/IN²				
	TEST PRESSURE			ASME #/IN²				ASME #/IN²				
	DESIGN TEMPERATURE			450 °F				450 °F				
	TUBES: 304-L			NO.		OD:		BWG:		LENGTH:		
	PITCH:			SHELL:		ID:		OD:				
	THICKNESS:											
	SHELL COVER: 304-L							FLOATING HEAD COVER:		None		
CHANNEL: 304-L							CHANNEL COVER:		304-L			
TUBE SHEETS - STATIONARY:							FLOATING:					
BAFFLES-CROSS: 304-L							TYPE:		THICKNESS:			
BAFFLE - LONG: 304-L							TYPE:		THICKNESS:			
TUBE SUPPORTS: 304-L									THICKNESS:			
GASKETS:												
CONNECTIONS - SHELL -			IN: 2 - 2 inch		OUT: 1 - 3 inch		SERIES:					
CHANNEL -			IN: 3 inch		OUT: 3 inch		SERIES:					
CORROSION ALLOWANCE -			SHELL SIDE:				TUBE SIDE:					
CODE REQUIREMENTS: ASME												
WEIGHTS - EACH SHELL:					BUNDLE:				FULL OF WATER:			
REMARKS	<p>Exchanger dimensions & flange orientations as shown on Drawings SK-2-19942 & SK-2-19943.</p> <p align="center" style="font-size: 2em; font-weight: bold;">DECLASSIFIED</p>											
REF. DRAWINGS:								SPEC. BY				
SK-2-19942 & SK-2-19943								J. W. Barnes				

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FACILITIES ENGINEERING OPERATION

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PROCESS SPECIFICATION CENTRIFUGAL PUMP (Information only)

G E N E R A L

PROJECT NO.	LOCATION 221-U Bldg.	NO. REQUIRED 2	ITEM NO. P-5-1-1 & 5-1-2	DATE 3-20-64	SPEC. NO.
SERVICE Primary Coolant Pumps					

M A T E R I A L S H A N D L E D

LIQUID PUMPED <u>Primary Cooling Water</u>				PUMPING TEMPERATURE (P.T.) <u>95</u> °F	
● P.T.	SPECIFIC GRAVITY <u>1.0</u>	VISCOSITY <u>1.0</u>	CP	VAPOR PRESSURE <u>1.0</u>	PSIA
● 60° F	SPECIFIC GRAVITY <u>1.0</u>	VISCOSITY <u>1.0</u>	CP	VAPOR PRESSURE <u>1.0</u>	PSIA
SOLIDS IN LIQUID, WT. % <u>None</u>		DENSITY <u>---</u>		PARTICLE SIZE <u>---</u>	
CORROSIVE COMPOUNDS <u>None</u>					

D E S I G N D A T A

DESIGN CAPACITY <u>250</u> GPM AT		<u>35</u> PSI DIFFERENTIAL PRESSURE	
MAXIMUM SUCTION PRESSURE <u>5</u> PSIG	DIFFERENTIAL PRESSURE <u>35</u> PSI		
MINIMUM SUCTION PRESSURE <u>0</u> PSIG	DIFFERENTIAL HEAD <u>81</u> FT.		
NET POSITIVE SUCTION HEAD <u>20</u> FT	MAXIMUM DISCHARGE PRESSURE <u> </u> PSIG		
MAXIMUM DIFFERENTIAL PRESSURE AT SHUT OFF <u> </u> PSI			
BRAKE HORSEPOWER AT <u> </u>		% EFFICIENCY <u> </u>	
MATERIALS OF CONSTRUCTION <u>Stainless Steel - 304-L</u>			
PUMP TO BE	INSULATED	TRACED	WITH <u> </u> PSIG STEAM
SHAFT SEAL COMMENTS 			
FLUSHING REQUIREMENTS	MATERIAL <u> </u>		MAXIMUM FLOW <u> </u> GPM
	TEMPERATURE <u> </u> °F		PRESSURE <u> </u> PSIG
IMPELLER	OPEN	CLOSED	SEMI-ENCLOSED

C O N N E C T I O N S

SUCTION SIZE	SERIES	FACING	DISCHARGE SIZE <u>3" Remote Nozzle</u>	SERIES	FACING
--------------	--------	--------	---	--------	--------

M O T O R

<u>440</u> VOLTS	<u>3</u> PHASE	CYCLES	HP	RPM	<u>TEFC</u> TYPE
NON-OVERLOADING FOR FULL RANGE OF THE PUMP					

C A N Y O N P U M P S

REMOTE FLANGE	23" O.D.	I.D.	SETTING HEIGHT <u>14' 2"</u>	STD. GROUP NO.
REMARKS: <u>Multistage, deep well, vertical centrifugal pumps to fit existing 8' diameter, 14' deep remote tanks per Drawing H-2-40474.</u>				
REFERENCES: <u>BPF 3362 & BPF 3369</u>			SPEC. BY: <u>J. W. Barnes</u>	

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7/18/94

END