DUN-2564

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, 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. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Cover Sheet for a Hanford Historical Document Released for Public Availability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

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DT

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

(CLASSIFICATION)

DECLASSIFIED

DOCUMENT NO.

DUN-2564

SERIES AND COPY NO.

DATE

June 9, 1967

DOUGLAS UNITED NUCLEAR, INC.

RICHLAND, WASHINGTON

TITLE

B & D POWER AND WATER PLANT MODIFICATIONS
AND OPERATION AFTER DEACTIVATION OF D REACTOR

THIS DOCUMENT CONTAINS REPRODUCTION OF INFORMATION CONTAINED IN THE ATOMIC ENERGY ACT OF 1954. NO PERSON IS PROHIBITED.

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 TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

AUTHOR

L. B. Brinkman

ISSUING FILE

THIS DOCUMENT MUST NOT BE LEFT UNATTENDED OR IN THE HANDS OF AN UNAUTHORIZED PERSON. IT MUST BE STORED IN AN APPROVED LOCKED REPOSITORY OR IN A GUARDED AREA. WHILE IT IS IN YOUR POSSESSION, YOU ARE RESPONSIBLE TO KEEP IT IN ITS CONTAINER WITHIN THE LIMITS OF THIS PROJECT AND FROM AN UNAUTHORIZED PERSON. ITS TRANSMITTAL TO, AND STORAGE IN, YOUR PLACE OF RESIDENCE IS PROHIBITED. IT IS NOT TO BE DUPLICATED. IF ADDITIONAL COPIES ARE REQUIRED, OBTAIN THEM FROM THE RELATED ISSUING FILE. ALL PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

ROUTE TO:

PAYROLL NO.

LOCATION

FILES ROUTE DATE

SIGNATURE AND DATE

R. Lloyd

30074

3201, 300 Area

300 Area

JUL 20 1967

DECLASSIFIED

DOUGLAS UNITED NUCLEAR, INC.

RICHLAND, WASHINGTON

NOTICE

THIS REPORT WAS PREPARED FOR USE WITHIN DOUGLAS UNITED NUCLEAR, INC. IN THE COURSE OF WORK UNDER ATOMIC ENERGY COMMISSION CONTRACT AT(45-1) - 1857, AND ANY VIEWS OR OPINIONS EXPRESSED IN THE REPORT ARE THOSE OF THE AUTHOR ONLY. THIS REPORT IS SUBJECT TO REVISION UPON COLLECTION OF ADDITIONAL DATA.

LEGAL NOTICE

THIS REPORT WAS PREPARED AS AN ACCOUNT OF GOVERNMENT SPONSORED WORK. NEITHER THE UNITED STATES, NOR THE COMMISSION, NOR ANY PERSON ACTING ON BEHALF OF THE COMMISSION:

A. MAKES ANY WARRANTY OR REPRESENTATION, EXPRESSED OR IMPLIED, WITH RESPECT TO THE ACCURACY, COMPLETENESS, OR USEFULNESS OF THE INFORMATION CONTAINED IN THIS REPORT, OR THAT THE USE OF ANY INFORMATION, APPARATUS, METHOD, OR PROCESS DISCLOSED IN THIS REPORT MAY NOT INFRINGE PRIVATELY OWNED RIGHTS; OR

B. ASSUMES ANY LIABILITIES WITH RESPECT TO THE USE OF, OR FOR DAMAGES RESULTING FROM THE USE OF ANY INFORMATION, APPARATUS, METHOD, OR PROCESS DISCLOSED IN THIS REPORT.

AS USED IN THE ABOVE, "PERSON ACTING ON BEHALF OF THE COMMISSION" INCLUDES ANY EMPLOYEE OR CONTRACTOR OF THE COMMISSION, OR EMPLOYEE OF SUCH CONTRACTOR, TO THE EXTENT THAT SUCH EMPLOYEE OR CONTRACTOR OF THE COMMISSION, OR EMPLOYEE OF SUCH CONTRACTOR PREPARES, DISSEMINATES, OR PROVIDES ACCESS TO, ANY INFORMATION PURSUANT TO HIS EMPLOYMENT OR CONTRACT WITH THE COMMISSION, OR HIS EMPLOYMENT WITH SUCH CONTRACTOR.

DECLASSIFIED

-1-

DUN-2564

Hanford Code: C44c

This document consists
of 14 pages.

B & D POWER AND WATER PLANT MODIFICATIONS
AND OPERATION AFTER DEACTIVATION OF D REACTORS

June 9, 1967

By

L. B. Brinkman

Plant Design

Development Engineering & Process Design Subsection

Facilities Engineering Section

MASTER

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of CG-NMP-1,

DS Lewis, 8-16-94.

By Gerri Mally, 10-4-94.

Verified By J.E. Savely 10-5-94

B & D POWER AND WATER PLANT MODIFICATIONS
AND OPERATION AFTER DEACTIVATION OF D REACTORS

DISTRIBUTION

RL-AEC

1.-3. RL Plum

BNW

4.-5. JL Boyd

ISOCHEM, INC.

6.-7. HP Shaw

DUN

8. TW Ambrose
 9. RS Bell
 10. LB Brinkman
 11. PA Carlson
 12. DM Diediker
 13. RE Dunn
 14. ML Faught
 15. LP Forby
 16. JW Green

17. CN Gross
 18. RE Hall
 19. AK Hardin
 20. CE Harkins
 21. HW Heacock
 22. RT Jessen
 23. SS Jones
 24. CW Kuhlman
 25. CE Lange
 26. TH Lyons
 27. AR Maguire
 28. EJ O'Black
 29. RS Peterson
 30. WW Porter
 31. RW Reid
 32. RL Roske
 33. OC Schroeder
 34. W. Seeburger
 35. EA Smith
 36. AP Vinther
 37. WW Windsheimer
 38. DUN File
 39. DUN Record

B & D POWER AND WATER PLANT MODIFICATIONS
AND OPERATION AFTER DEACTIVATION OF D REACTOR

TABLE OF CONTENTS

	<u>Page No.</u>
I. Introduction	4
II. Background	4
III. Summary and Conclusions	4
IV. Discussion	5
A. D Area Steam Facilities	5
B. D Area Filtered Water Modifications	6
C. Fire & Sanitary Water	7
D. Emergency Water to 200 Areas	8
E. Diesel Engine at 181-B River Pumphouse	8
V. Appendices	
A. SK-1-6702, Diesel Engine at 181-B	11
B. Figure 1, B Reactor Last-Ditch Flow Characteristics	12
C. Figure 2, C Reactor Last-Ditch Flow Characteristics	13
D. Table I, Pumping Equipment	14

B & D POWER AND WATER PLANT MODIFICATIONS
AND OPERATION AFTER DEACTIVATION OF D REACTOR

I. INTRODUCTION

Pursuant to the decision of the Atomic Energy Commission to deactivate a fourth Hanford production reactor, engineering studies were initiated in regard to the water supply and distribution systems of the smaller production reactor complex. It was the intent of these studies to effect optimization of the water supply and distribution system which would result in a more effective operation and would continue to meet existing standards and requirements. It is the purpose of this report to document the results of the engineering studies and to describe the functional requirements of the overall water supply and distribution systems.

II. BACKGROUND

Prior to deactivation of D Reactor, the 100-D water plant facilities, in addition to providing D Reactor coolant requirements, provided water for 108 and 185-189 Building experiments and laboratory testing, fire and sanitary water for 100-D Area and previously deactivated F and H Areas, and were capable of providing emergency water to the 200 Areas and emergency coolant backup to replenish the water in 182-B reservoir. Subsequent to D Reactor deactivation, the above services will still be required with the exception of coolant supply to D Reactor. Methods of supplying these services were investigated and the existing or modified systems are described herein.

III. SUMMARY AND CONCLUSIONS

After deactivation of D Reactor, the steam requirement in D Area will be supplied from one of the existing coal-fired boilers in 184-D powerhouse. The main steam lines will be blanked or capped as required, in order to minimize the amount of steam line remaining in service.

The filtered water and fire and sanitary water requirements of D Area will be supplied by operating a portion of the existing water plant facilities in D Area. In order to improve the reliability and capability of the water plant remaining in service after D Reactor is deactivated, an additional electric pump will be installed for the filtered water system and a new chlorine analyzer and controller will be installed for the fire and sanitary water system.

The capability to replenish the 182-B reservoir water that is used for last-ditch coolant to B and C Reactors will be provided by a diesel-driven pump at 181-B river pumphouse. One of the two steam-turbine drives for the 7500 gpm steam-driven pumps will be replaced with a diesel engine.

The diesel engine will provide a power source that is independent of the primary and secondary systems and a backup system to replenish the 182-B reservoir that is essentially independent of the export system.

The export system will continue to be used as primary source of water to Isochem, Inc. as is currently the case. The 200 Areas water requirements will be supplied normally from 182-B, and in the event of an emergency in which electrical power (BPA) is lost, steam-turbine driven pumps at 182-B will provide the required water. In the event of an emergency in which steam power is lost in 100-B Area as well as electrical power, steam-turbine driven pumps at 182-D will be available to supply the required water through the D leg of the export system to Isochem.

In the event of an emergency consisting of loss of electrical power and loss of steam power at 100-B at a time when the 181-B diesel is out of service for maintenance, the 182-B reservoir must be replenished from 182-D through the export system. During such an emergency, supply of water to the 200 Areas will also be provided through the export system as is currently done. Water must be supplied to the 182-B reservoir at a rate equal to the coolant requirements of those reactors.

IV. DISCUSSION

A. D Area Steam Facilities

After D Reactor is deactivated, steam will still be required in D Area to provide heat for all occupied buildings, for laboratory test programs conducted in 108, 185-189 Buildings, and for supplying emergency water to the 200 Areas.

The existing 184-D powerhouse will remain in operation to supply D Area steam requirements. One coal-fired boiler will be in operation continuously with a second boiler ready to be fired at any time. Three of the five boilers will be in lay away status. The powerhouse will tentatively be manned by two operators round the clock seven days a week. If operating experience proves that the powerhouse can be operated safely with less than two operators at certain shifts and seasons of the year, personnel coverage may be reduced accordingly.

The main steam lines and laterals to facilities not requiring steam after deactivation of D Area will be blanked or capped so that only the minimum amount of steam line will remain in service. The entire south loop of the existing steam line will be deactivated. The 185-189 Building process and heating steam requirements will be supplied directly from the 16-inch, 225 psig steam main so that all steam facilities in 190-D can be completely deactivated. The PRV station currently located at the north end of the 190-D Building will be re-located to the 40 foot level of the 185 Building and connected to the low pressure steam loop. A new line will be installed from the 16-inch

main north of 190-D to the 185 Building and will be connected to the existing 225 psig line and the relocated PRV station. The existing 14-inch line to the north end of 190-D will be blanked at the valve to shut off all steam to the 190-D Building.

The installation of an oil-fired package boiler having a steam capacity of approximately 40,000#/hour to supply the D Area steam requirements after D Reactor deactivation will be studied and considered independently on the basis of savings in operating and maintenance costs versus the capital expenditure of a new facility. Currently it is estimated that the annual operating cost for a package boiler will be approximately \$116,000 less than the cost of operating the existing boilers.

B. D Area Filtered Water Modifications

After D Reactor is deactivated, filtered water still will be required in the 185-189-D Building, 105-D and 105-DR Storage basins, and in the 184-D powerhouse to supply feedwater to the boiler. Both filtered and raw water are currently used in 185-189-D Building by DUN, BNW, and GE. Filtered water is supplied by the filtered water pump in 183-D and raw water is supplied from the 182-D reservoir by a condenser water pump located in the 182-D pump room. Rather than maintain separate pumping sources for filtered and raw water after deactivation, all water supplied to 185-189 facilities will be filtered water. The total water demand at 185-189 Building is expected to be normally 1200 to 1400 gpm but may reach 5000 gpm on occasions during certain tests and experiments.

The filtered water to be used in D Area at 185-189 facilities and for fire and sanitary use will be supplied from the existing 183-D filter plant. Four of the present 16 filters will be used to provide the required filtered water. The remaining 12 filters will be placed in a lay away condition. Operation of one or two filters and one pump at 181-D will be limited to the day shift two or three days a week to refill the two clearwells having a total capacity of 11,000,000 gallons. The remaining time the filters will be closed off and no water will be pumped from 181-D river pumphouse. One operator will be on duty during the day shift only, five days a week.

In order to assure continued filtered water to 185-189-D facilities, 105-D and DR Storage basins, and the 184-D boiler, the following water plant modifications are proposed:

1. Filtered Water Line - Condenser Water Line Connection

Raw water is currently supplied to the 185-189 facilities through the condenser water line which makes a loop through the 190 tank room and 185-189 Building.

The filtered water line and the condenser water line are adjacent to each other for several hundred feet underground. A cross connection between the filtered water main and the 16-inch condenser water line going to the 190 Building will be provided which will permit filtered water to be supplied from 183-D pump room to the 185-189 facilities currently using raw water.

2. Electric Filtered Water Pumping Capacity at 183-D

Water is currently supplied to the filtered water system by one 6000 gpm, 240-foot head electric-driven pump in 183-D pump room. A 1450 gpm, 150-foot head ash sluice pump from 184-H will be installed in 183-D to serve as backup for the existing filtered water pump and to supply the normal 1200 to 1400 gpm of filtered water to the 185-189 facilities. Space for the new pumping facility will be provided by removing one of the three existing steam-driven emergency filtered water pumps.

The additional electric-driven pump provides the filtered water system with one 6000 gpm, 250-foot head electric-driven pump, one 1450 gpm, 150-foot head electric pump, and two 4000 gpm, 250-foot head steam-driven pumps. One 1000 gpm, 175-foot head electric pump and one 1000 gpm, 175-foot head steam-driven pump provide the feedwater to the boilers in 184-D powerhouse. Normally the small 1450 gpm pump will be capable of supplying the filtered water demands to 185-189 Building. During the occasions when the demand exceeds the capacity of the small pump, the 6000 gpm pump will be operated. In the event of an electric failure in D Area, one 4000 gpm steam-driven pump and the 1000 gpm steam-driven powerhouse pump will start automatically.

C. Fire and Sanitary Water

Fire and sanitary water will continue to be supplied to F and H Areas from D Area through the 30-inch export line. The fire and sanitary system at D Area will remain in service with certain laterals to unused buildings being blanked off. Also a new chlorinator, chlorine analyzer and controller will be installed in 183-D Building to assure the proper chlorine residual in the drinking water. Since the present chlorine equipment is very old and requires constant maintenance and since it is planned to have an operator in the D Area water plant only during the day shift five days a week, new automatic chlorine addition equipment will save operating and maintenance costs and provide better quality of water to the 400-500 people stationed in D, F, and H Areas.

The existing fire and sanitary pumps in 183-D pump room, consisting of one 1000 gpm, 175-foot head electric pump, one 450 gpm, 175-foot head electric pump, and two 600 gpm, 175-foot head steam-driven pumps will remain in service after deactivation of D Reactor. Also the high tank at D and F Area will be a part of the system.

The two steam-driven fire and sanitary pumps are required for fire protection backup and will be manually started in the event of an electric failure in D Area.

D. Emergency Water to 200 Areas

In the event of a power failure in B and D Areas, water will be supplied to the 200 Areas through the export system from steam turbine driven pumps at 182-B. In the event of such an electrical power failure and a simultaneous loss of steam power in B Area, water will be supplied to the 200 Areas through the export system from steam-turbine driven pumps at 182-D.

Document, HW-81747 - "Design Criteria for Coolant Backup, Three Remaining Smaller Reactors", states that in the event that B Area has lost primary and secondary power sources, the 182-D export facilities shall supply 3600 gpm to the 200 Areas within 21 hours after the start of the emergency. One additional steam-turbine driven 6000 gpm export pump was installed at 182-D as a part of the F, N, and DR Reactor deactivation modifications so that one steam turbine pump would always be available to supply the emergency water to the 200 Areas and to replenish the 182-B reservoir. The 200 Area emergency water requirements have not changed in the past three years except that 2200 gpm are required within four hours after the start of an emergency and 3000 gpm are required indefinitely after 24 hours.

In the event of an emergency requiring 200 Area cooling water to be supplied from D Area, one 182-D steam-driven export pump and one 181-D steam-driven pump can be started within one hour. By replenishing the 182-D reservoir water with the 181-D steam-driven pump, emergency water can be supplied to the 200 Areas indefinitely from D Area facilities.

Since the 182-D Building export system will continue to be a part of the overall export system, the two surge suppressors in 182-D will continue to remain in operation. Sufficient steam heat will be provided in 182-D pump room to assure operation of the surge suppressors during cold weather.

The electric export pumps will also remain in service so that any number of the four pumps can be operated to help supply the normal export water from the 182-D reservoir to the 200 Areas in the event that their assistance is required as it has been so many times in the past years.

E. Diesel Engine at 181-B River Pumphouse

Last-ditch coolant for B and C Reactors is currently supplied by four diesel-driven pumps in 182-B pump room from the 25,000,000 gallon 182-B reservoir. Three pumps and the high tanks are required to supply the initial reactor coolant requirements for both B and C Reactors in the event that primary and secondary power sources are lost in B Area. The fourth unit is a spare. The 25,000,000 gallon reservoir has a capacity to supply both B and C Reactor emergency last-ditch coolant for about three days. After that time no coolant would be available if the 182-B reservoir were not replenished.

DECLASSIFIED

-9-

DUN-2564

The capability to replenish the 182-B reservoir in the event of a primary and secondary power failure in B Area currently exists in D Area. Water can be supplied from the 182-D reservoir through the export system into the 182-B reservoir. Both electrical and steam-driven export pumps are available in 182-D pump room to supply water to the export system.

After D Reactor is deactivated, the present ability to replenish the water in the 182-B reservoir will still be maintained in D Area except that only one boiler will be operating instead of two. In the event that only one steam-driven export pump in 182-D were available to supply the emergency water to the 200 Areas and B Area, the adequacy of the one pump would be marginal and the regulation to provide the proper flow split between 200 Area and B Area would be difficult.

In order to assure adequate water to replenish the 182-B reservoir, one of the two steam-turbine drives of the two 7500 gpm, 150-foot head steam-driven pumps at 181-B will be replaced with a diesel engine as shown on Drawing SK-1-6702 so that a power source independent of both electric and steam will be available at all times to pump water to the 182-B reservoir. The diesel-driven pump has sufficient capacity to supply the reservoir with the cooling water required for both B and C Reactors. The diesel engine will be started and stopped manually in the river pump house, but will have the provision for future installation of remote start control from 183-C control room.

In the event that the last-ditch system pumps in 182-B are required to supply coolant to B and C Reactors, the diesel-driven pump at 181-B will be manually started within one hour after the start of the emergency to replenish the water being pumped from the 182-B reservoir. It will continue to operate and supply the required water to the reservoir as long as the last-ditch pumps in 182-B are supplying coolant to the reactors.

The installation of the diesel engine in the river pump house will make the last-ditch system for B and C Reactors completely independent of the primary and secondary system and essentially independent of the export system. The diesel system to replenish the 182-B reservoir is compatible with the budget item submitted for fiscal year 1969 for upgrading the nuclear safety system for earthquake protection. By eliminating the use of the export line from D Area to B Area for replenishing the 182-B reservoir, the portion of the last-ditch system most vulnerable to earthquake damage has been eliminated from the system.

The diesel engine will provide a last-ditch system that complies with all requirements of the last-ditch criteria with the exception of redundancy. There will be no spare diesel-driven pump at 181-B. If the 182-B reservoir should require replenishing when the diesel-driven pump is out of service for maintenance purposes, the export system would supply water from 182-D to refill the reservoir.

DECLASSIFIED

DUN-2564

-10-

The need for the 182-B reservoir water to be replenished so that coolant can be supplied to B and C Reactors for a period longer than the 3 days that the 25,000,000 gallon reservoir would provide has been established and reported in document, DUN-1050 - "Unattended Cooling for Hanford Production Reactors," dated June 10, 1966.

Figures 1 and 2 show the reactor coolant that will be provided to B and C Reactors by the last-ditch system and the minimum reactor coolant requirements in order to prevent the melting of fuel elements and possible reactor meltdown with a release of fission products to the atmosphere. The melting of fuel elements due to insufficient coolant can occur well beyond the three-day period that the 25,000,000 gallon 182-B reservoir can supply coolant to the reactor. Consequently, the 182-B reservoir must be replenished with Columbia River water in order to insure continued reactor safety.

Table I shows the pumping capacities that will be available in D and B Area after deactivation of D Reactor for the purpose of supplying filtered water to the operating facilities in D Area, fire & sanitary water to D, F, & H Area, emergency water to the 200 Areas, and last-ditch coolant to B & C Reactors.

L. B. Brinkman

Senior Engineer
Plant Design

LBB:lek

A

DIESEL LOC.

DIESEL

DIESEL
FUEL
STORAGE
TANK

PARTIAL PLAN

C

D

E

SECTION

	E 2-D.						
1	REMOVED INTAKE FILTER	CHANGE 2-2-67	S.B.B	F.E.S	#240	REV. NO.	
NO.	DESCRIPTION	REV. BY DATE	APP'D BY	FOR	DATE		
	REVISIONS						REV.

MUFFLER

ROOF HATCH

DAY TANK

EXIST. PUMP WITH NEW GEAR DRIVE

EXIST. 18" DISCHARGE LINE

1ST SUCTION

LOCATION KEY PLAN

SK-1-6702

DESIGN	REV.
1	1

PRELIMINARY ENGINEERING DRAWING

A-A

D. NO. DRAWING TITLE

REFERENCE DRAWINGS

ED ON

CHECK PRINT 5/13/63		COMMENT PRINT 5/13/63		APPROVED FOR CONST. SY PER DATE REV.		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC	
APPROVED FOR PURCHASE SY PER DATE		APPROVED FOR DESIGN SY PER DATE		I.P.D. DRAFTING		COOLANT BACKUP DIESEL ENGINES AT 181-B BLDG.	
SCALE NONE		DRAWN F.H. Myers 5/1/63		CHECKED J.P. Seltzer 5/1/63		DESIGNED J.P. Seltzer 5/1/63	
DATE 5-10-63		DATE 5-10-63		DATE 5-10-63		DATE 5-10-63	
PROJECT 104-74-F		CLASSIFICATION NONE		CLASSIFICATION NONE		CLASSIFICATION NONE	
D. NO. 181-B		D. NO. 9901.01		D. NO. SK-1-6702		D. NO. 111	

UNCLASSIFIED

DECLASSIFIED

TIME AFTER REACT

DECLASSIFIED

TABLE IPUMPING EQUIPMENT

<u>STATION</u>	<u>EQUIPMENT</u>	<u>CAPACITY</u>	<u>USAGE</u>
183-D	1 electric pump	6000 gpm	Supply filtered water to 100-D Facilities.
	1 electric pump	1450 gpm	
	1 steam pump	4000 gpm	
	2 steam pumps (spares)		
	1 electric pump	1000 gpm	Supply fire & sanitary water to deactivated areas.
	1 electric pump	450 gpm	
	2 steam pumps	1200 gpm	
	1 electric pump	1000 gpm	Supply feed water to boilers.
	1 steam pump	1000 gpm	
182-D	2 electric pumps	12000 gpm	Assist in supplying normal export water to 200 Areas.
	2 electric pumps	6000 gpm	
	1 steam pump	6800 gpm	Supply emergency water to export system.
	1 steam pump (spare)		
181-D	1 electric pump	14000 gpm	Supply raw water to filter plant.
	2 electric pumps (spares)		
	1 steam pump	7500 gpm	Refill the 182-D Reservoir.
	1 steam pump (spare)		
182-B	3 diesel pumps	13000 gpm	Supply last-ditch coolant to B and C Reactors.
	1 diesel pump (spare)		
	1 steam pump	6800 gpm	Supply emergency water to 200 Areas.
	1 steam pump (spare)		
181-B	1 diesel pump	7500 gpm	Replenish 182-B Reservoir.
	1 steam pump	7500 gpm	