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INCREASED PUMPING CAPACITY AT 181-D
SCOPE AND JUSTIFICATION

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INCREASED PUMPING CAPACITY AT 181-D

By Authority of CG-PR-2 SCOPE AND JUSTIFICATION

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By J. M. Gray, 2-3-94.

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HW-65324

TABLE OF CONTENTS

	<u>PAGE</u>
I. PURPOSE	4
II. BACKGROUND	4
III. SUMMARY AND CONCLUSIONS	4
IV. DISCUSSION	4
A. Capacity of Present 181 Pumping System	4
B. Process Water Available to 105-D and DR	5
C. Proposed Work	6
D. Detailed Justification of Proposed Work	7
E. Additional Benefits	7
F. Effect on Other Projects or Proposed Work	8
G. Alternate Solution	8
V. ACKNOWLEDGMENTS	8
VI. BIBLIOGRAPHY	8
VII. APPENDICES	8
A. Study Estimate	9
B. Drawing SK-1-4169	10

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- 4 -

HW-65324

INCREASED PUMPING CAPACITY AT 181-D
SCOPE AND JUSTIFICATION

I. PURPOSE

The purpose of this report is to provide scope and justification for the installation of one new 900 HP pump in the 181-D Building and to tie the two 36" headers together in order to supply sufficient water to increase production at 105-D and 105-DR.

II. BACKGROUND

The 181-D Pump House contains nine - Fairbanks Morse 13,000 GPM - 220' head pumps, five U.S. 13,800 GPM 185' head pumps, one - 10,000 GPM - 150' head export pump, and two - 7,500 GPM steam turbines. The nine Fairbanks Morse pumps supply water to 183-D through two lines. Five pumps are tied to one 36" header and four pumps are tied to the other 36" header. The five U.S. pumps supply water to 183-DR through a 42" common header and two lines. The export pump supplies water to 182 reservoir through a separate line. A cross-tie line from 183-D to 183-DR supplies the additional water required at 183-DR for the 105-DR Reactor.

The second bay from the west end of the building is only 14'16" long and formerly housed one steam turbine. This steam turbine was replaced by a 900 HP pump, No. 16, under Project CG-558. The 14'6" bay is not large enough for two - 900 HP pumps but could accommodate one 900 HP pump and the 450 HP export pump.

III. SUMMARY AND CONCLUSIONS

One additional 900 HP pump and a tie line between the two 36" headers supplying water to the 183-D Building are required in order to achieve year round reactor flows of 172,000 GPM planned in the initial stages of the Plant Improvement Program.

The project is estimated to cost \$130,000 and the resulting production increases will pay off the project in 0.5 years.

IV. DISCUSSION

A. Capacity of Present 181 Pumping System

With 13 process pumps operating, the capacity of the 181-D pumping facilities ranges from approximately 179,000 GPM during the low river level to 186,000 GPM during the yearly expected 15' flood stage. With all 14 process pumps operating, the capacity ranges from 185,000 to 192,000 GPM. The flow is divided between the 183 Buildings as follows:

	<u>Low River</u>	<u>15 Foot Flood</u>
8 Pumps to 183-D and 182-D	108,000 GPM	112,000 GPM
5 Pumps to 183-DR	71,000 GPM	74,000 GPM
TOTAL FLOW	179,000 GPM	186,000 GPM

A. Capacity of Present 181 Pumping System (Continued)

	<u>Low River</u>	<u>15 Foot Flood</u>
9 Pumps to 183-D and 182-D	114,000 GPM	118,000 GPM
5 Pumps to 183-DR	<u>71,000 GPM</u>	<u>74,000 GPM</u>
TOTAL FLOW	185,000 GPM	192,000 GPM

B. Process Water Available to 105-D and DR

The process water available to the 105 Buildings for reactor cooling is shown below for 13 and 14 process pump operation with and without the 450 HP export pump operating.

	<u>Low River Elev. 377</u>	<u>Average River Elev. 383</u>	<u>15 Foot Flood Elev. 392</u>
13 Process Pumps to 183 and 182	179,000	182,000	186,000
Backwash and Miscellaneous Use	<u>15,000</u>	<u>18,000</u>	<u>19,000</u>
AVAILABLE TO 105	164,000	164,000	167,000
13 Process Pumps to 183 and one Export Pump to 182	185,000	188,000	192,000
Backwash and Miscellaneous Use	<u>15,000</u>	<u>18,000</u>	<u>19,000</u>
AVAILABLE TO 105	170,000	170,000	173,000
14 Process Pumps to 183 and 182	185,000	188,000	192,000
Backwash and Miscellaneous Use	<u>15,000</u>	<u>18,000</u>	<u>19,000</u>
AVAILABLE TO 105	170,000	170,000	173,000
14 Process Pumps to 183 and one Export Pump to 182	191,000	194,000	198,000
Backwash and Miscellaneous Use	<u>15,000</u>	<u>18,000</u>	<u>19,000</u>
AVAILABLE TO 105	176,000	176,000	179,000

The 183-DR effluent system and piping to 190-DR presently limit the 105-DR flow to about 85,000 GPM. The 105-D flow is estimated to be limited to 87,000 to 88,000 GPM by the 183-D pumping facilities. It is desired to obtain the maximum year round reactor flows that the 183 Buildings will permit. This is presently 172,000 to 173,000 GPM (1). A desired total reactor flow of 172,000 GPM will be considered hereafter in this report.

As can be seen from the table above, this 172,000 GPM could be achieved with 14 process pumps or 13 process pumps and the export pump only during the 15' flood level period. This flow would require all 15 existing electric pumps to be operating about nine months of the year. Past experience has shown this to be improbable. During the past 15 months five motors have been rewedged and the pumps overhauled to varying degrees. These units have been out of service from one to three weeks for these repairs. This situation was tolerable only because the total reactor flow has been in the neighborhood of 165,000 GPM. To achieve the 172,000 GPM continuously one additional pump will be necessary.

(1) HW-63263 (SECRET), "Facilities Engineering Plan Reactor Process Improvement Program CY - 1960-1961", by W. W. Windsheimer, dated April 6, 1960.

C. Proposed Work

1. Pumps and Piping

It is proposed to move the No. 17 - 450 HP export pump to the next bay along side of pump No. 16, to install a new 900 HP pump in the position vacated by pump No. 17, to revise the discharge piping on pump No. 12, and to connect the two 36" headers with a 24" tie line and gate valve between pumps No. 12 and No. 13 as shown on Drawing SK-1-4169. This arrangement of pumps would still leave the half bay space at the west end of the building free for a work area and would permit equipment to be moved in and out of the building through the west door. The proposed work would enable the anticipated reactor flows to be obtained during the entire year with one spare unit. The 24" tie line connecting the two 36" headers and the revised discharge piping on pump No. 12 would enable better distribution of the water in the lines to 183-D. This would be especially true when one of the pumps No. 8 through No. 11 were out of service, since only these four pumps are presently tied into the east header.

2. Building Modification

New concrete beams similar to those installed for Project CG-558 would be required in the end bay at the west end of the building to support the added floor loads.

3. Electrical Work

a. Relocated 450 HP Pump

Approximately 30' of new 3" conduit and 3-#4/0 single conductor 5 KV cables would be installed from the existing motor controller No. 17 to the new location of the 450 HP export pump. Equipment ground cable would also be installed.

b. New 900 HP Pump

The new 900 HP motor, to be installed in the location vacated by the 450 HP export pump, would require an additional motor controller, which would match existing equipment, to be installed at the east end of the existing bus No. 1. The new pump will add 750 KVA to the present load of 2,000 KVA making a total of 2,750 KVA on bus No. 1. The transformer capacity is 3,750/4,687 KVA and is adequate for the new load.

The work would consist of extending the 2,300 V bus, installing ammeter, time over current relay, 2-instantaneous relays, ammeter switch, and control switch with green, amber, and red lights, and relocating the small test box from the north end of the existing switchgear. Also about 100 feet of 3" conduit, 3 - 350 MCM single conductor, 5 KV shielded cables, and an equipment ground would have to be installed to the new motor.

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D. Detailed Justification of Proposed Work

Justification for this project is based primarily on increased production. Flows of 172,000 GPM through the D and DR Reactors would be possible as a result of revised reactor orifice pattern, change to I&E fuels in the fringes, and a change to 32 piece fuel charges. Since the present 181-D facilities are capable of supplying an average flow of only 170,000 GPM to the reactors, an increase in reactor flows from 170,000 to 172,000 GPM will be used as a basis for justifying this project.

1. Increased Production

Since both reactors will operate on bulk outlet limits for a major portion of the year, any increase in flow can be directly applied to increased production. The additional production from a 2,000 GPM increase in flow is estimated to be worth \$300,000 per year. (2)

2. Capital Costs

a. This project = \$130,000.

3. Increased Water Plant Operating Cost

a. Electrical

181-D - 100 KW
183-D - 100 KW
190-D - 700 KW
TOTAL - 900 KW

\$/year = 900 x \$17.50 = \$15,800

b. Chemical Treatment Costs

\$/year = $\frac{2,000 \times 1,440}{10^6} \times 0.9 \times 7.00 \times 365 = \$ 6,600$

TOTAL = \$22,400

4. Pay Off Period

Amortization Period = $\frac{\text{Capital Cost (\$)}}{\text{Production Gained (\$/year) - Increased Costs \$/year}}$
 $= \frac{130,000}{300,000 - 22,400} = .5 \text{ years}$

E. Additional Benefits

The additional benefits to be derived from the installation of a new pump are:

1. Provide increased reliability of the plant in that a spare unit would be provided.

(2) Verbal communication from R. F. Corlett.

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HW-65324

E. Additional Benefits (Continued)

2. Enable some export back-up for the 200 Areas without affecting D/DR production.
3. Make possible switching pumps during the hot months provided no unit were down for repairs.
4. Enable future additional increases in production in the event that modifications are made in the 183-D and DR Buildings and to the reactor process piping to permit greater flows through the reactors.

F. Effect on Other Projects or Proposed Work

The installation of this unit is compatible with long range Plant Improvement Program planning, and is specifically referenced in Document HW-64458, "Water Plant Modifications for Increased Production at B, C, D, DR, F, and H Reactors", by L. B. Brinkman and J. P. Corley, dated April 15, 1960.

G. Alternate Solution

An alternate solution to the problem is an additional line from the 181 Building to the 183-D Building. The new line would cost about three times as much as the proposed project. The decrease in operating costs due to the new line would not be large enough to justify the additional capital expenditure.

V. ACKNOWLEDGMENTS

The authors wish to express appreciation to D/DR Power Operation and to R. F. Corlett for their assistance in preparing this report.

VI. BIBLIOGRAPHY

- A. HW-63263 (SECRET), "Facilities Engineering Plan Reactor Process Improvement Program CY 1960-1961", by W. W. Windsheimer, dated April 6, 1960.
- B. HW-64458 (SECRET), "Water Plant Modifications for Increased Production at B, C, D, DR, F, and H Reactors", by L. B. Brinkman and J. P. Corley, dated April 15, 1960.

VII. APPENDICES

- A. Estimate Sheet.
- B. Drawing No. SK-1-4169.

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APPENDIX A

Study Estimate

<u>Feature</u>	<u>Total</u>
Structural Modifications	\$ 11,000
Equipment	43,000
Piping	14,100
Electrical	<u>9,200</u>
Sub-Total	77,300
Other Direct and Indirect Costs	<u>8,700</u>
TOTAL CONSTRUCTION COST	86,000
Construction Engineering	4,000
Contingency	16,000
General Overhead	7,000
Management Services	7,000
Design	<u>10,000</u>
TOTAL PROJECT COST	\$130,000

The estimate is based on the assumption that all work will be performed by a CPFF Contractor during a regular five-day, 40-hour week.

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A

B

C

D

E

REVISE 20" DISC
ON PUMP #12 AS

545-1380054
185 1/2" 200

UNCLA

QTY.	PT. NO.	DESCRIPTION
------	---------	-------------

HW 65324
PAGE 10

ADD NEW 900HP PUMP
& 20" DISCHARGE LINES
MOVE #17 EXPORT PUMP
TO NEW LOCATION

LARGE PIPE
SHOWN

9- F2/13000GPH
220"hd. 900HP

SCOPE

No.	DESCRIPTION	REV. BY	DATE	APP'D BY	FOR	DATE
REVISIONS						
CLASSIFICATION		CLASSIFIED BY				
NONE		AL. Hattings				
DATE 9/19/60						
DWG. NO.	SK-1-4169	SHEET NO.	1	SHEETS	1	REV. NO.
SCALE: NONE		APPROVALS				
BY		FOR				
DATE		DATE				
DRAWN KIMBRELL DATE 4-19-60		DATE 5-31-60				
CHECKED		DATE				
ISSUED		DATE				
DES. ENG.		UNIT				
INST. NO. 10089F						
PROJECT NO.						
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC I.P.D. DRAFTING						
INCREASED PUMPING 181-D PUMP HOUSE						
BLOG. NO.	181-D	INDEX NUMBER		8400		
DWG. NO.	SK-1-4169	SHT. NO.		1		
NEXT USED ON		SHEETS				

REF. NO.	DWG. NO.	DRAWING TITLE
		REFERENCE DRAWINGS
		NEXT USED ON

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8/29/94

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