IRRADIATION PROCESSING DEPARTMENT
MONTHLY RECORD REPORT
FEBRUARY, 1960

Compiled By
IPD Personnel

March 22, 1960

RICHLAND, WASHINGTON

Work performed under Contract No. AT (45-1)-1350 between the Atomic Energy Commission and the General Electric Company.

<table>
<thead>
<tr>
<th>Route To:</th>
<th>P.R. No.</th>
<th>Location</th>
<th>Files Route Date</th>
<th>Signature and Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. E. Lewis</td>
<td></td>
<td>713</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CLASSIFICATION REM. FOR DECLASSIFICATION MUST LEFT UNCHANGED

Compiled By
IPD Personnel

March 22, 1960

RICHLAND, WASHINGTON

Work performed under Contract No. AT (45-1)-1350 between the Atomic Energy Commission and the General Electric Company.
<table>
<thead>
<tr>
<th>Copy Number</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W. E. Johnson</td>
</tr>
<tr>
<td>2</td>
<td>O. C. Schroeder</td>
</tr>
<tr>
<td>3</td>
<td>A. B. Greninger</td>
</tr>
<tr>
<td>4</td>
<td>H. M. Parker</td>
</tr>
<tr>
<td>5</td>
<td>APD, F. E. Crever</td>
</tr>
<tr>
<td>6-7-8-9</td>
<td>ABC-HOO, J. E. Travis</td>
</tr>
<tr>
<td>10-11</td>
<td>ABC Production Division, G. F. Quinn</td>
</tr>
<tr>
<td>12</td>
<td>ABC-SROO, R. C. Blair</td>
</tr>
<tr>
<td>13</td>
<td>300 Area File</td>
</tr>
<tr>
<td>14</td>
<td>Records Center</td>
</tr>
</tbody>
</table>

**DECLASSIFIED**
# TABLE OF CONTENTS

## GENERAL SUMMARY
A-1 through A-4

## RESEARCH AND ENGINEERING OPERATION
B-1 through B-32
- Process and Reactor Development Operation B-2 through B-11
- Process Technology Operation B-12 through B-17
- Operational Physics Operation B-18 through B-22
- Testing Operation B-23 through B-32

## MANUFACTURING OPERATION
C-1 through C-43
- Production and Reactor Operations C-3 through C-7
- Reactor Operations Statistics C-8 through C-12
- B-C Reactors Operation C-13 through C-17
- D-IR Reactors Operation C-18 through C-23
- F Reactor Operation C-24 through C-30
- H Reactor Operation C-31 through C-36
- KE-KW Reactors Operation C-37 through C-43

## FACILITIES ENGINEERING OPERATION
D-1 through D-20

## RELATIONS PRACTICES OPERATION
E-1 through E-2

## FINANCIAL OPERATION
F-1 through F-2

## NPR PROJECT OPERATION
G-1 through G-16
RESEARCH AND ENGINEERING OPERATION

The four tubes of self-supported fuel elements charged into B Reactor on PT-IP-247-A were discharged at exposures above 850 MWD/T. The four control columns of standard fuel were discharged in December because of failures. Statistical evaluation of the test indicates a factor of improvement in rupture resistance of 30 at a 95 per cent confidence level. Visual examination of the test elements showed no hot spot flow patterns as compared with 13 observed on the control elements discharged in December.

Seven additional zirconium tubes were installed in C Reactor. A review of the hazards associated with the use of zirconium tubes in the old reactors was completed. It was concluded that they, in themselves, will not worsen the safety status of the reactors and will, in some cases, result in improvement.

Traverses of the top center process tubes at B and F Reactors showed significant increases in the elevation of inlet and outlet humps. No reason for this unexpected behavior has been discovered; similar traverses at D and DR Reactors showed only a slight increase which is expected.

Non-equilibrium losses at the K Reactors, normally one or more effective days per startup, have been halved by use of splines. Significant reductions, 25 to 35 per cent, were also realized at H and DR Reactors by relocation and addition of PCCF columns.

The primary limit to all reactor power levels was based on fuel element failure control at the goal exposure currently in effect.

Pilot contracts for NPR zirconium process tubes were renegotiated with Allegheny-Ludlum Steel Corporation and Chase Brass Copper Company.

An initial draft of the technical specifications for the NPR core graphite was completed, and with necessary revisions, will provide support for procurement.

The MKCR-II test irradiation charged in the DR-1 Loop was completed, discharged and shipped to General Atomic.

MANUFACTURING OPERATION

Reactor input production was 0.7 per cent above forecast; 4.3 per cent below at the six old reactors and 8.2 per cent above at the K Reactors.

Over-all time operated efficiency was 76.5 per cent (82 per cent forecast); 75.3 per cent at the six old reactors and 80.4 at the K Reactors. Efficiency was low due largely to ruptures and small increases in outage time caused by water leaks and production tests.
The combined reactor instantaneous power level was not increased. Record levels at the individual reactors were increased 40 megawatts at B (1685 to 1725), 5 at C (2065 to 2070), 55 at D (1710 to 1765), 70 at DR (1710 to 1780), 10 at F (1815 to 1825), 65 at H (1825 to 1890), 70 at KE (3730 to 3800), and 30 at KW (3810 to 3840).

Twenty-one ruptures, seventeen I and E regular, three solid regular and one I and E-E, were removed from the reactors. Five of the I and E Regular metal ruptures were at C, five at H, three at KW, two at B, one at KE and one at F. Two of the solid regular metal ruptures were at KE and one at H. The I and E-E rupture was at KE. A cluster fuel element failure was removed from KER-1, February 7.

FACILITIES ENGINEERING OPERATION

Installation of improved rear face nozzle cap handling equipment at KE and KW is complete.

One process tube channel was successfully overbored 200 mils in DR Reactor.

An installation of seven zirconium tubes at C Reactor, using new flanging and trimming tools was successful. Design modifications to C Reactor's charging machine for self-supported fuel elements were completed and results indicate a reduction in charging rate.

A poison spline coil was demonstrated at 105-KW.

The seismic vulnerability study of the production reactor facilities as originally outlined has been completed; however, arrangements have been made to extend the study to include an investigation of the seismic vulnerability of the graphite stack and shielding at 105-B, C, and H Reactors.

Scope design for Project CG-775 is 76 per cent complete. Ten scope drawings were approved by the Design Council. Three drawings were issued for comment.

The over-all design for Project CG-791 is 76 per cent complete. Design completion percentages retrogressed during the month due to the addition of new drawings to the schedule. Thirty-two scope drawings and the installation of two banks of high efficiency filters in series were approved by the Design Council. Phase IIA was completed on February 18, 1960. Phase IIB is approximately 12 per cent complete.

Electrical loads for pumps required by Project CGI-839 were transferred to the B-E buses to equalize loading on the emergency generators.

Project CGI-883 was initiated with the approval of the preliminary project proposal. Requisitions have been placed for all engineered items.

RELATIONS PRACTICES OPERATION

Nine BS/MS candidates were interviewed with four offers extended. Two exempt employees transferred into the department from other HAP components. There were two resignations and one exempt transfer to another GE department. IPD's
1960 salary review was completed with all sections and the department operating within prescribed guide ratios. Three IPD employees retired during February. Three security violations were investigated. Safety conditions at 100-N construction site were inspected by the AEC and IPD safety representatives.

FINANCIAL OPERATION

IPD FY 1961 and FY 1962 forecasts of office, photographic and radiation monitoring equipment were transmitted to the responsible custodians in Contract and Accounting Operation and HLO.

IPD's allocation of PA and C funds for miscellaneous capital work orders has been entirely committed. No additional work orders will be processed during the balance of this fiscal year.

A maintenance force breakdown for IPD at December 31, 1959 to show the comparison of effective maintenance personnel between reactor plants after allowing for assignments to other than reactor maintenance work, was prepared.

Absenceism for February was 2.6 per cent of available hours and represented a decrease from 2.7 per cent for January, 1960. Total overtime hours worked by the department during February was 12,782 or 3.6 per cent of total hours available. The same statistics for January were 10,403 overtime hours worked or 3.0 per cent of total hours available.

Tuition refunds amounting to $495 were refunded to thirty-three (33) department employees who had successfully completed graduate courses in the University of Washington Center for Graduate Study.

NPR PROJECT OPERATION

The bid package for the first phase of the 105-N and 190-N process piping fabrication and erection was completed on schedule.

A final review of the moderator design to evaluate potential methods of accommodating graphite contraction in excess of the design basis was completed. Stack redesign was initiated on the basis of providing increased process channel articulation as well as maximum latitude for channel conditioning late in the life of the reactor.

Approval was obtained and authorization given to AFED to perform an engineering review or audit of the NPR design.

Construction was resumed on the 1704-N Administration Building and work was started on the 1734-N Storage Building. Temporary construction activities continued with several 20 foot X 40 foot army buildings being relocated at the 100-N site and three sections of the 1101 Building being moved from the 1100 Area to 100-N. The 181-N River Pumphouse excavation was brought down to grade and placement of concrete was started.

Deliveries of process tubes have been received from all three vendors producing pilot orders. Price redetermination negotiations were completed with two of the pilot order vendors.
Top and bottom reflector graphite was being produced on schedule by both vendors of this material.

Design review and issuance of drawings and specifications continued at a high level of activity.

IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT OF INVENTIONS OR DISCOVERIES

FEBRUARY, 1960

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

O.H. Braeger
Acting General Manager
RESEARCH AND ENGINEERING OPERATION
FEBRUARY 1960

VISITORS AND BUSINESS TRIPS

A. W. Mosen, General Dynamics, General Atomic Division, San Diego, Calif., visited HAPO to consult on gas chromatograph performance, 2/1-2/60.

R. E. Smith, Westinghouse Electric Corp., MTR Site Operation, Idaho Falls, Idaho, visited HAPO to discuss the water chemistry program for the WAPD 120-5b test, 2/4-5/60.


H. C. Hopkins and B. E. Kotts, General Dynamics, General Atomic Division, San Diego, Calif., visited HAPO to observe discharge of test elements in DR Gas Loop, 2/20-21/60.

F. E. Dearing visited Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa., to observe loading for WAPD-120-5b test, 2/1-5/60.


A. K. Hardin and N. T. Hildreth attended the Nuclear Instrumentation Symposium at General Electric, APED, San Jose, Calif., 2/10-12/60.

T. W. Evans attended the American Society for Metals Committee Meeting in Cleveland, O., 2/11-13/60.

O. H. Greager, 2/13-20/60, R. E. Trumble, 2/16-21/60, and G. J. Rogers, 2/16-19/60, discussed the NPR confinement system at the ACRS Subcommittee Meeting, Washington, D.C. Mr. Greager also discussed NPR fuel element manufacturing with the AEC and inspected the NS Savannah Installation at Camden, N.J.


W. K. Kratzer visited Argonne National Laboratory, Lemont, Ill., to discuss irradiated fuel element behavior, and also attended the annual ANE Meeting in New York, N.Y., 2/13-21/60.
RESEARCH AND ENGINEERING OPERATION

FEBRUARY 1960

VISITORS AND BUSINESS TRIPS

A. W. Mosen, General Dynamics, General Atomic Division, San Diego, Calif., visited HAPO to consult on gas chromatograph performance, 2/1-2/60.

R. E. Smith, Westinghouse Electric Corp., MTR Site Operation, Idaho Falls, Idaho, visited HAPO to discuss the water chemistry program for the WAPD 120-3B test, 2/4-5/60.


H. C. Hopkins and B. E. Kotts, General Dynamics, General Atomic Division, San Diego, Calif., visited HAPO to observe discharge of test elements in DR Gas Loop, 2/20-21/60.

F. E. Dearing visited Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa., to observe loading for WAPD-120-3B test, 2/1-5/60.


A. K. Hardin and N. T. Hildreth attended the Nuclear Instrumentation Symposium at General Electric, APED, San Jose, Calif., 2/10-12/60.

T. W. Evans attended the American Society for Metals Committee Meeting in Cleveland, O., 2/11-13/60.

O. H. Greager, 2/13-20/60, R. E. Trumble, 2/16-21/60, and G. J. Rogers, 2/16-19/60, discussed the NPR confinement system at the ACRS Subcommittee Meeting, Washington, D.C. Mr. Greager also discussed NPR fuel element manufacturing with the AEC and inspected the NS Savannah Installation at Camden, N.J.


W. K. Kratzer visited Argonne National Laboratory, Lemont, Ill., to discuss irradiated fuel element behavior, and also attended the annual AIME Meeting in New York, N.Y., 2/13-21/60.
PROCESS AND REACTOR DEVELOPMENT OPERATION

Reactor Fuels

Present Reactor Technology

Projection Fuel Testing

PT-IP-247-A was charged into B Reactor at the end of November and was designed
to demonstrate relative performance of ribbed and self-supported fuel under
identical irradiated conditions. On December 23 and December 30 control column
failures were sustained, and on December 30, the remaining two control columns
were discharged. The test material remained in-reactor until its discharge on
February 9, without a failure. Statistical evaluation of the test indicated
that a factor of improvement in rupture resistance of 30 had been demonstrated
at the confidence level of 95%. At the 50% confidence level the factor of
improvement was 100. Visual examination of the elements showed no hot spot flow
patterns as compared with 13 observed (in addition to the two failures) on the
control elements. Operating conditions for both test and control material
included specific power above 100 kw/ft., calculated surface temperatures up to
150 C and for the test material exposures above 850 MWD/T.

Seven additional zirconium tubes were installed in C reactor during the February
5 outage. The tubes were charged with CIVN fuel, with only minor difficulties.
Downstream thermocouple trains are complete and will be installed when the
reactor shuts down. Difficulty was encountered in charging one tube which was
discharged for examination; only a slight amount of rib damage was found.

E-H Irradiation

The few remaining central zone "striped" columns under irradiation at H reactor
are scheduled for discharge during the next outage, total number of tubes
remaining in pile is 20.

Advanced Reactor Fuels

Development Work at NMI

NMI is working on two specific problems in connection with the NPR fuel program.
The first of these efforts is to fabricate 50 ft. of NPR inner tubing size for
use in irradiation testing at Hanford. The material is scheduled for extrusion
on about March 11 and is expected to arrive at Hanford approximately 10 days
thereafter. The second problem involves the development of a process for
making Zr-Be alloy required for the brazed closure. Previous efforts involved
remelting small button, casting these to small billets and extruding to 1/8"
wire. Work is proceeding in an attempt to make larger billets by consumable
electrode arc melting Zr-Be composite electrodes. The first such billet has
been produced and extruded to a 1 1/2" rod which will serve as the electrode
for remelting. It is hoped that successive melting and extruding will produce
a homogeneous material with uniform melting point. The final extrusion would
then be in tubular form from which rings can be cut for use in brazing coextruded
fuel elements.
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Type Metal</th>
<th>Tubes</th>
<th>Reactor</th>
<th>Goal Exposure</th>
<th>Current Exposure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-56-A</td>
<td>Low Hydrogen Dingot U</td>
<td>13</td>
<td>D</td>
<td>Variable</td>
<td></td>
<td>Semi-production scale testing of low hydrogen dipot uranium fuel, solid. Test is discontinued but will not be terminated until material discharged.</td>
</tr>
<tr>
<td></td>
<td>Elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP-84-A</td>
<td>Projection Self-Supported</td>
<td>13</td>
<td>B</td>
<td>900 MWD/T</td>
<td></td>
<td>Preliminary evaluation of self-supported fuel elements. Routine charging to continue until tubes are replaced. Ultrasonically attached supports currently being used.</td>
</tr>
<tr>
<td></td>
<td>fuel in ribless aluminum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>tubes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP-171-A</td>
<td>Solid M 388 &amp; C64-F</td>
<td>1</td>
<td>B,DR,F</td>
<td>Variable</td>
<td>600 MWD/T</td>
<td>Provide for evaluation of alternate aluminum component vendors. Control columns are only ones carried special. Rest are lot charged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500 MWD/T</td>
<td></td>
</tr>
<tr>
<td>IP-216-A</td>
<td>Normal Prod. Nat. OII, KII</td>
<td>82</td>
<td>All</td>
<td>Normal</td>
<td></td>
<td>Provides for monitoring the performance of a sample of all Natural Uranium Lots to assist in development of a Quality Index for Production use. Test is continuous.</td>
</tr>
<tr>
<td></td>
<td>and KIII fuel elements</td>
<td></td>
<td></td>
<td>Variable Goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP-219-A</td>
<td>OIIN cores SORT tested</td>
<td>18</td>
<td>DR</td>
<td>800 MWD/T</td>
<td>400 MWD/T</td>
<td>Provides for monitored irradiation of fuel cores categorized by the Sonic Orientation tests to evaluate its ability to isolate dimensionally unstable pieces prior to irradiation.</td>
</tr>
<tr>
<td></td>
<td>7-rod cluster elements</td>
<td></td>
<td></td>
<td>discharge</td>
<td>discharge exposure</td>
<td></td>
</tr>
<tr>
<td>IP-227-A</td>
<td>Enriched Uranium samples</td>
<td>2</td>
<td>D</td>
<td>1500 MWD/T</td>
<td>2100 MWD/T</td>
<td>Test charged in 105-D on September 18, 1959. One tube was discharged on Nov. 24 at 865 MWD/T because of reactor maintenance difficulties; one was discharged at goal on Jan. 5, 1959, and the final tube discharged Jan. 25, 1960, at 2100 MWD/T.</td>
</tr>
<tr>
<td></td>
<td>in aluminum capsules</td>
<td></td>
<td></td>
<td>discharge</td>
<td>discharge exposure on test column</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>exposure on</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>test column</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test No.</td>
<td>Type Metal</td>
<td>Tubes</td>
<td>Reactor</td>
<td>Goal Exposure</td>
<td>Current Exposure</td>
<td>Remarks</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>IP-247-A</td>
<td>1.4% Enriched I&amp;E Self-Supported</td>
<td>0</td>
<td>B</td>
<td>To two ruptures</td>
<td>850 MWD/T</td>
<td>Provides for rupture comparison of self-supported and rib-supported fuel. Control elements were charged and failed during December. Test elements discharged in February without failure.</td>
</tr>
<tr>
<td>IP-255-A</td>
<td>Solid Black Mint</td>
<td>7</td>
<td>H</td>
<td>2 years except for 3 columns scheduled for special extraction at approximately 3 Mo.</td>
<td>5 Mo.</td>
<td>Provides for long term irradiation of solid black mint for conversion ratio, and fuel performance determination. Control columns discharged.</td>
</tr>
<tr>
<td>OII &amp; I&amp;E Black Mint</td>
<td>20</td>
<td>H</td>
<td>Six columns to be irradiated to 800 MWD/T, rest till one rupture is sustained.</td>
<td></td>
<td>Provides for irradiation of the &quot;striped&quot; portion of the load to determine conversion ratio data, physics parameters, and fuel performance. Monitor columns discharged.</td>
<td></td>
</tr>
<tr>
<td>IP-272-A</td>
<td>CIVN Geometry I&amp;E self-supported fuel</td>
<td>9</td>
<td>C</td>
<td>Variable</td>
<td>375 MWD/T</td>
<td>Provides for testing of CIVN geometry fuel in C Reactor ribless zirconium process tubes. Seven additional tubes charged.</td>
</tr>
<tr>
<td>IP-288-A</td>
<td>Seven Zr-2 jacketed Nat. U 7-rod cluster elements with hot headed end closures.</td>
<td>1</td>
<td>KE</td>
<td>2000 MWD/T</td>
<td>1190 MWD/T</td>
<td>Charged in KER Loop 3 on October 29, 1959.</td>
</tr>
<tr>
<td>IP-280-A</td>
<td>OIIIN alloyed Dingot</td>
<td>12</td>
<td>D</td>
<td>400 and 800 MWD/T</td>
<td>250 MWD/T</td>
<td>Provides for evaluation of the stability and performance of cores having 100-200 ppm Si and Fe additives as grain refiners.</td>
</tr>
</tbody>
</table>
KER Loop Irradiations

On February 7, 1960, a failure occurred in the 1.6% enriched Zircaloy-2 jacketed cluster elements being irradiated at a coolant temperature of about 230 °C in KER Loop 1. The exposure at failure was 2520 MWD/T. Cause of failure has not yet been determined.

On February 21, three enriched Zircaloy clad tube-and-tube elements were charged in KER Loop 4. Two of the elements were 1.6% enriched 2 w/o Zr alloy. The other element contained unalloyed uranium.

Irradiation of Swelling Capsules

The third tube of uranium swelling capsules was discharged from D reactor on February 25, at an exposure of about 2100 MWD/T.

IBM Fuel Analysis Program

The statistical analysis program was used to study the effects of fuel element dimensional tolerances to include variations in pressure drop losses in tube connectors, fittings, dummy trains, etc. Several trials have been run with various sets of tolerance specifications. Results are under study at the present time. Further explorations are planned to locate a range of tolerances which result in acceptable in-reactor behavior.

Reactor Physics

Present Reactor Technology

Zirconium Tube Hazards Review

A review of the possible hazards associated with the use of zirconium tubes in the old reactors has been completed. The results of the study, which will be documented immediately, are that the zirconium process tubes in themselves will not worsen the safety status of the Hanford Reactors. In some cases, instead, improvement can result. Higher melting point process tubing will contain fuel elements subjected to inadequate cooling for a longer period of time. Also the thinner process tube wall allows a greater latitude in fuel element sizing and in some cases results in a lattice configuration less over moderated than at present.

Speed of Control

In support of analysis being carried out for the expansion studies, additional analog runs were made to determine the effect of partial acceleration of the VSR's in the old reactors. For a 3000 MWe EDF reactor and an assumed extreme limit on water loss reactivity gain, the excursion following coolant loss was effectively contained with approximately a quarter of the rods accelerated.
Advanced Reactor Technology

NPR Transients

Data were obtained for NPR analog simulation on power and outlet temperature variations during the scram and startup conditions and during assumed excursions. This type of result will ultimately be used as a basis for water requirements during scrams, and to assist in reactivity transients calculations for different power level variations.

Efforts continue to develop an analytical model to treat the dynamics of a reactor system with an internal reactivity feedback loop via water and metal temperature changes. Comparisons which were made with previous analog computer results indicate that at least two groups of delayed neutrons are required. Analytical methods seem to suffice for reactivity disturbances arising external to the loop, for example a control rod motion. However, for inlet water disturbances, the equation becomes too complex for solution short of analog means.

IBM Programs

The Monte-Carlo program describing neutron slowing down in graphite uranium lattices continues in the debugging stage. The Monte-Carlo program describing neutron behavior in the thermo region and just above is very near completion. Work will continue on both programs.

Reactor Engineering

Present Reactor Technology

Earthquake Studies

Work being performed by Holmes and Narver for the older reactors is nearly completed. Interim reports have been received and a final report will be issued by Holmes and Narver on approximately June 15.

Zirconium Process Tubing

Three of the four contracts for Zr-2 ribbed process tubes in RDF geometry have been cancelled.

Seven additional smooth bore process tubes were installed in C reactor early in February and a total of nine are now in place in the reactor. Thirteen more are in storage at Hanford and 24 are on route from Bridgeport Brass Co.

Water Plant Testing

A test was conducted at D-DR reactor on February 22, which was designed to determine the adequacy of the "last-ditch" cooling system for these reactors. Analysis of the data received is underway.
Graphite Distortion

Traverses of the top center process tubes at B and F reactors indicated an increase of 0.15 to 0.3 inches in the elevation of inlet and outlet humps and of the center depression since readings taken approximately three months ago. The behavior expected would have included little or no change in the elevation of the humps and decreases of about 0.1 inches in the elevation of the center depressions. A repeat traverse was made at B reactor and indicated that the measurement was not a mistake. Recent traverses of center tubes in D-DR Reactor showed the expected behavior. The reason for the changes in behavior of the graphite at B and F reactor is being sought. Traverses of the top center tube will be repeated at about one month intervals (rather than the usual three months) to monitor the course of graphite distortion.

Oxidation of Graphite Samples - C Reactor

Graphite burnout monitoring samples were discharged from channel 1960 C in mid-January. Samples in the graphite boat which had been at midpoint of the channel were found to have suffered severe oxidation. The graphite boat itself was also severely oxidized. The process channel was borescoped and about half of the channel surface between 13 and 24 feet showed pitted areas which looked similar to the oxidized samples. Operating data are being studied to see if there is possibly a correlation between water leaks and this observed burnout.

Advanced Reactor Technology

Zirconium Tubes

Research and Engineering personnel participated from a technical standpoint in the renegotiation of the pilot contracts for NPR process tubes with Allegheny Ludlum Steel Corp. and Chase Brass and Copper Co. Assistance will also be rendered in the similar action with Harvey Aluminum.

Three KER tubes were received from Harvey Aluminum on February 16 and are being inspected.

NPR Graphite

An initial draft for the technical specifications for the NPR core graphite has been completed. Revisions as needed will be made during the next two weeks in support of graphite procurement.

The Great Lakes Carbon Corp. has completed detailed design of a special full size 6" x 6" extrusion die. The die will be used in trial runs with the aim of achieving a significantly higher degree of preferred orientation in a massive graphite bar. Design and schedule for this effort was reviewed with Great Lakes at Niagara Falls on February 19. Four to six weeks will be required for fabrication of the die and processed graphite bars from extrusions using the die may be available in August, 1960.
NPR Confinement

The NPR confinement system was discussed with a sub-committee of the ACRS in Washington, D.C. on February 19, 1960.

Radiological Engineering

Radiation Control Experience

The following table summarizes the radiation exposure experienced of critical IPD classifications for the first 4 weeks of the 1960 badge year:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Total Dose</th>
<th>No. of Employees</th>
<th>Average Dose/Employee</th>
<th>Extrapolated Year End</th>
<th>Extrapolated Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Monitors</td>
<td>16397 mr</td>
<td>76</td>
<td>216 mr</td>
<td>2805 mr</td>
<td>35</td>
</tr>
<tr>
<td>Processing Operators</td>
<td>42823 mr</td>
<td>251</td>
<td>171 mr</td>
<td>2221 mr</td>
<td>57</td>
</tr>
<tr>
<td>Pipefitters</td>
<td>14826 mr</td>
<td>97</td>
<td>153 mr</td>
<td>1987 mr</td>
<td>23</td>
</tr>
<tr>
<td>Millwrights</td>
<td>10857 mr</td>
<td>77</td>
<td>141 mr</td>
<td>1831 mr</td>
<td>16</td>
</tr>
</tbody>
</table>

Lapse of Control

The following table summarizes the February Lapses of control experienced in IPD.

<table>
<thead>
<tr>
<th>Lapse of Radiation Control Distribution by Reactor and Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Proc</td>
</tr>
<tr>
<td>Maint</td>
</tr>
<tr>
<td>Supp</td>
</tr>
<tr>
<td>ResE</td>
</tr>
<tr>
<td>FacE</td>
</tr>
<tr>
<td>Cent</td>
</tr>
<tr>
<td>React</td>
</tr>
<tr>
<td>Assigned Totals</td>
</tr>
<tr>
<td>IPD General</td>
</tr>
</tbody>
</table>

Vertical columns do not necessarily add up to the indicated totals, because in some cases, a Lapse of Control may be chargeable to more than one component.

Average Reactor Effluent Activity Output

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>107-B</td>
<td>19,000 uc/sec.</td>
<td>31,000 uc/sec.</td>
<td>27,000 uc/sec.</td>
</tr>
<tr>
<td>107-C</td>
<td>15,000</td>
<td>15,000</td>
<td>29,000</td>
</tr>
<tr>
<td>107-KW</td>
<td>36,000</td>
<td>61,000</td>
<td>58,000</td>
</tr>
<tr>
<td>107-KE</td>
<td>36,000</td>
<td>28,000</td>
<td>50,000</td>
</tr>
<tr>
<td>107-D</td>
<td>23,000</td>
<td>16,000</td>
<td>26,000</td>
</tr>
<tr>
<td>107-DR</td>
<td>22,000</td>
<td>15,000</td>
<td>18,000</td>
</tr>
<tr>
<td>107-H</td>
<td>32,000</td>
<td>22,000</td>
<td>20,000</td>
</tr>
<tr>
<td>107-F</td>
<td>15,000</td>
<td>17,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Total</td>
<td>155,000 uc/sec</td>
<td>305,000 uc/sec</td>
<td>254,000 uc/sec</td>
</tr>
</tbody>
</table>
N Reactor Instrumentation

A complete review of the locations to be monitored in N reactor was completed. The review resulted in a reduction in the number of monitoring points to 85 stations. Monitoring for gamma radiation at this number of stations is considered adequate from a health physics standpoint.

Reactor Effluent Water Monitoring

The automatic effluent water monitor at 100-F Area was activated early in the month. The monitor is a prototype model developed in HLO for selective monitoring of the concentration of specific isotopes in effluent water. Although a number of minor operational difficulties were encountered in support equipment, the instrumentation was successfully operated through several cycles.

Effluent Water Studies

Preliminary data on the effect of increased iron concentrations in water to a single tube at NE reactor were obtained. Although it was anticipated that the activity densities of many of the isotopes in the effluent would increase sharply with increased iron concentration, no appreciable increase was observed. The test is not yet completed and will be continued.
PROCESS TECHNOLOGY OPERATION

REACTOR POWER LEVEL LIMITATIONS

The primary limit to all reactor power levels at the end of the report period was based on fuel element failure control at the goal exposure currently in effect.

WATER TREATMENT

Raw Water Conditions

The raw water has been easy to treat in February.

PROCESS STANDARDS

HW-46000 B, Process Standards - Reactor

Four revised Standards were issued during the month. These were:

Process Standard C-060 - "Vertical Rod Withdrawal"

Process Standard C-070 - "Horizontal Rod Withdrawal, Power Increase"

Process Standard C-090 - "Number of Inoperable Rods and Ball 3K Hoppers During Reactor Operation"

Process Standard C-120 - "Poison Splines"

The changes made to the above Standards involve conversion from inhour units of reactivity to c-sec units. No other changes were made.

HW-46000 D, Process Standards - Reactor

One new Standard was issued during the month. This was:

Process Standard D-070 - "Reactor Confinement - Fog Spray System"

This new Standard requires manual operation of the new Fog Spray System, under certain conditions, to confine radioactivity particulate matter to the reactor discharge area.

HW-46000 F, HW-46000 H, Process Standards - Reactor

Five revised Standards were issued during the month for the above manuals. These were:

Process Standard C-060 - "Vertical Rod Withdrawal"

Process Standard C-070 - "Horizontal Rod Withdrawal - Power Increase"
Process Standard C-090 - "Number of Inoperable Rods and Ball 3X Hoppers During Reactor Operation"

Process Standard C-110 - "Ball 3X System"

Process Standard C-120 - "Poison Splines"

The revisions are identical to those issued for HW-46000 B, above.

HW-46000 K, Process Standards - Reactor

Five revised and one new Standard was issued during the month. These were:

Process Standard C-060 - "Vertical Rod Withdrawal"

Process Standard C-070 - "Horizontal Rod Withdrawal - Power Increase"

Process Standard C-090 - "Number of Inoperable Rods and Ball 3X Hoppers During Reactor Operation"

Process Standard C-110 - "Ball 3X System"

Process Standard C-120 - "Poison Splines"

The revisions are identical to those issued for HW-46000 B, above.

Process Standard D-070 - "Reactor Confinement - Fog Spray System"

This new Standard is identical to that issued for HW-46000 D, above.

PROCESS CHANGE AUTHORIZATIONS

Seven Process Change Authorizations were issued during the month to permit temporary deviation from Process Standards - Reactor, HW-46000; three were issued to permit temporary deviation from Process Equipment Standards, HW-41000; and two were issued to permit temporary deviation from Process Standards - Water Plant, HW-27155 Revl. These were:

PCA #0-1 - "C Elevator Photocell Interlock - D-BR Reactors"

Authorization to operate C Elevator during operation without the use of the normal photocell was granted due to the unreliability of the photocell to provide the desired protection. Individual charge machine interlocks were substituted in the elevator circuit, to prevent elevator operation when the machines were attached to the reactor.

PCA #0-2 - "Crosstie Flushing - KW Reactor"

High pressure crosstie line flushing must be completed within two hours at a shutdown reactor to minimize the time the adjacent area operates without back-up from the emergency coolant crosstie system. The time was extended by one hour to permit investigation of a malfunction of the V-73 valve electrical control circuit.
PCA #0-3 - "Use of Cast Uncanned Tubular Al-Si-Cd Dummies, B Reactor"

The PCA authorized the use of 26000 aluminum-silicon-cadmium poison pieces remaining from Production Test IP-174-1T. This poison material was tested and proven a satisfactory substitute for the canned lead-cadmium alloy normally used. Due to manufacturing difficulties associated with Al-Si-Cd alloy, further procurement of this material will be discontinued.

PCA #0-4 - "Throttling of Panellit Gauge Sensing Line - H Reactor"

Use of the one-way Boke valve on the Panellit gauge board to throttle gauge oscillation is not normally permitted since excessive throttling which could escape detection is possible. Due to failure of the valve normally throttled, authorization was given to throttle the Boke valve on one sensing line to dampen a 30 psi gauge oscillation. Restrictions imposed were one-half hour observations and not less than six psi oscillation of the gauge involved.

PCA #0-5 - "Raw Water Screens - H Reactor"

The mesh dimensions of raw water screens at H Reactor do not conform with requirements of Standards. The presently installed screens, although not subject to severe plugging under credible circumstances, are not considered optimum for protection against such plugging. The PCA permitted continued operation of H Reactor with the present screens for six weeks, at which time they will be replaced with screens of the optimum size.

PCA #0-6 - "High Tank Requirements - B Reactor"

Provisions of Process Standard A-080 require that reactor operation be discontinued if either high tank level drops more than three feet.

Because of a frozen make-up line to one tank, the level dropped five feet before being detected.

The PCA permitted operation with one high tank five feet low, based on the fact that the water in the tank was 15°C below maximum experienced in summer weather, and on inspections which indicated all other process water and backup coolant systems were reliable.

PCA #0-7 - "Panellit Gauge Trip Span Calibration - H Reactor"

Provisions of Process Equipment Standard A-020 require that gauges with 10 psi and 90 psi trips must have a span between trips of 77 ± 3 psi to be acceptable for process tube flow monitoring. Calibration of Panellit gauges over a wide pressure range is not entirely linear. Twenty-five gauges on non-fissionable material were used in pressure ranges which caused them to exceed the specified span by 3 to 5 psi. The PCA permitted operation for the remainder of the period.

PCA #0-8 - "Panellit Coordinate Trip Identification System - K Reactors"

The Panellit Coordinate Trip Identification system at the K Reactors was de-
activated in February 1959, when it was discovered that because of this
circuitry sections of the Panellit system could be inadvertently by-passed
by a particular sequence of operation. Since many unnecessary scrams have
been caused by faulty Panellit gauges, it was desired to utilize the co-
dordinate system for identifying the offending gauge.

A temporary procedural method for avoiding inadvertent by-pass was authorized
by the PCA to permit use of the coordinate system until a permanent revision
could be designed and installed.

PCA #0-9 - "V-72 Guard Valve Closure Pressure Setting - K Reactors"

During a recent trip-out test, the V-72 guard valve automatically closed
at a time when it should normally have remained open. Closure of the valve
is controlled by a pressure switch which is actuated by lower pressure in
the crosstie line. The PCA permitted a 10 psi decrease in the pressure
switch setting to minimize undesired closure due to pressure surges in the
crosstie line.

PCA #0-10 - "Rear Pigtail Failure - C Reactor"

The PCA allowed continued operation and hot startups on failure of a rear
pigtail, provided Panellit gauge minimum low trip pressure and minimum tube
power requirements, which were specified in the PCA, could be met.

PCA #0-11 - "Rear Pigtail Failure - K Reactors"

Same as PCA #0-10 above.

PCA #0-12 - "Raw Water Screen at 105-3"

Last-ditch water screens are required to be of heavy coarse mesh construction.
One of the two screens at F Reactor was found to have 33 per cent smaller
mesh than normally specified. Operation was permitted under this PCA until
fabrication of an optimum size new screen could be completed

PROCESS ASSISTANCE

Double Pole, Single Throw Panellit Gauge Switch Bottles

An investigation of a proposed change in Panellit gauge switch bottles from
SPDT to DPST switches was conducted by Process Standards Unit. Conclusions
were that with appropriate testing of the new switch, upgrading the Panellit
circuitry, and operation of the new switch on a one reactor basis in co-
dordinate lighting only, an acceptable basis for switch replacement could
be established.

Auditing

One engineer audited conformance to Process Standards by making 19 inspections
at each reactor during the report period.
Graphics

Graphic services prepared 50 charts, graphs, and visual aids for various IPD and HLO components.

**RUPTURE EXPERIENCE:**

<table>
<thead>
<tr>
<th>Failure Date</th>
<th>Tube Number</th>
<th>Lot Number</th>
<th>Type Metal</th>
<th>Exposure</th>
<th>Failure Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/4/60</td>
<td>2875-C</td>
<td>KJ-193-C</td>
<td>8&quot; IAE Natural</td>
<td>316</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/5/60</td>
<td>3890-KW</td>
<td>KR-128-D</td>
<td>8&quot; IAE Natural</td>
<td>394</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/6/60</td>
<td>2276-C(1)</td>
<td>KJ-190-D</td>
<td>8&quot; IAE Natural</td>
<td>344</td>
<td>Side Other Spot</td>
</tr>
<tr>
<td>2/7/60</td>
<td>3160-KE</td>
<td>1T-226-A</td>
<td>13&quot; 7-Rod Cluster(3)</td>
<td>2520</td>
<td>Jacket Split</td>
</tr>
<tr>
<td>2/8/60</td>
<td>0775-H</td>
<td>KA-287-A</td>
<td>8&quot; Solid Natural</td>
<td>427</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/8/60</td>
<td>0770-H</td>
<td>KL-329-D(2)</td>
<td>8&quot; IAE Natural</td>
<td>275</td>
<td>Side Other Spot</td>
</tr>
<tr>
<td>2/10/60</td>
<td>1478-C</td>
<td>KL-186-C(2)</td>
<td>8&quot; IAE Natural</td>
<td>343</td>
<td>Unknown Spot</td>
</tr>
<tr>
<td>2/10/60</td>
<td>3880-B</td>
<td>KL-356-D(2)</td>
<td>8&quot; IAE Natural</td>
<td>423</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/11/60</td>
<td>3661-H</td>
<td>KL-364-C</td>
<td>8&quot; IAE Natural</td>
<td>519</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/13/60</td>
<td>0884-H</td>
<td>KL-366-C(2)</td>
<td>8&quot; IAE Natural</td>
<td>532</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/14/60</td>
<td>0765-C</td>
<td>KL-186-C(2)</td>
<td>8&quot; IAE Natural</td>
<td>416</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/16/60</td>
<td>2978-H</td>
<td>KL-366-C(2)</td>
<td>8&quot; IAE Natural</td>
<td>561</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/21/60</td>
<td>5556-KE</td>
<td>KA-274-A(2)</td>
<td>8&quot; Solid Natural</td>
<td>478</td>
<td>Split-Long Spot</td>
</tr>
<tr>
<td>2/22/60</td>
<td>2673-H</td>
<td>KL-340-C</td>
<td>8&quot; IAE Natural</td>
<td>569</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/22/60</td>
<td>4645-KE</td>
<td>KA-274-A(2)</td>
<td>8&quot; Solid Natural</td>
<td>500</td>
<td>Split-Long Hole</td>
</tr>
<tr>
<td>2/23/60</td>
<td>2459-KW</td>
<td>KR-119-D</td>
<td>8&quot; IAE Natural</td>
<td>689</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/23/60</td>
<td>4651-KE</td>
<td>KR-149-D</td>
<td>8&quot; IAE Natural</td>
<td>563</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/25/60</td>
<td>1985-F</td>
<td>KL-360-C</td>
<td>8&quot; IAE Natural</td>
<td>529</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/26/60</td>
<td>2483-KW</td>
<td>KR-108-D</td>
<td>8&quot; IAE Natural</td>
<td>531</td>
<td>Side-Other Spot</td>
</tr>
<tr>
<td>2/26/60</td>
<td>3284-B</td>
<td>KL-343-D</td>
<td>8&quot; IAE Natural</td>
<td>728</td>
<td>Unknown Spot</td>
</tr>
<tr>
<td>2/26/60</td>
<td>1151-KE</td>
<td>KS-117-F</td>
<td>8&quot; IAE Enriched (4)</td>
<td>363</td>
<td>Side Hot Spot</td>
</tr>
<tr>
<td>2/29/60</td>
<td>3087-C</td>
<td>KJ-179-C(2)</td>
<td>8&quot; IAE Natural</td>
<td>715</td>
<td>Side Hot Spot</td>
</tr>
</tbody>
</table>

(1) KER Loop #1
(2) Multiple Failure Lot
(3) 1.6 per cent U-235
(4) .94 per cent U-235

**Legend:** Side Hot Spot - Failure probably caused by accelerated corrosion of the external can wall in a localized region of high temperature.
Side Other - Failure probably caused by corrosion or water penetration of the external can wall or other unknown mechanism.

Split-Long - Failure caused by uranium cleavage along the axis of the core.

Unknown - Failed piece could not be located or had not been examined at the time of writing.

Hole - Failure on the internal surface of an I & E piece probably caused by water penetration through a weld or other unknown mechanism.
PILE PHYSICS ASSISTANCE

Non-equilibrium loss reductions in excess of 50 per cent were achieved during several startups at the two K Reactors through large scale use of splines for transient control. Significant startup efficiency improvements at DR and H Reactors were made following additions to and relocation of PCCF columns. The average flattening efficiency as measured by the total ECT reached a record high of nearly 77.5 per cent of all reactor tubes with most reactors at a relatively high point in flattening; KE Reactor achieved an ECT value of 80.5 per cent of the total reactor tubes.

**SUMMARY OF OPERATING DATA OF PHYSICS INTEREST**

**FOR THE MONTH OF FEBRUARY, 1960**

<table>
<thead>
<tr>
<th>Reactor</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>DR</th>
<th>F</th>
<th>H</th>
<th>KE</th>
<th>KW</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECT in Feb. (1)</td>
<td>1445</td>
<td>1655</td>
<td>1490</td>
<td>1530</td>
<td>1460</td>
<td>1630</td>
<td>2585</td>
<td>2475</td>
</tr>
<tr>
<td>12 Mo. Avg. ECT</td>
<td>1435</td>
<td>1645</td>
<td>1475</td>
<td>1510</td>
<td>1445</td>
<td>1600</td>
<td>2450</td>
<td>2455</td>
</tr>
<tr>
<td>Equil. Scram Time (2)</td>
<td>13-17</td>
<td>26-30</td>
<td>14-18</td>
<td>30-40</td>
<td>14-20</td>
<td>20-25</td>
<td>18-22*</td>
<td>18-22*</td>
</tr>
<tr>
<td>No. of Scrams and Recoveries (3)</td>
<td>2/2</td>
<td>1/1</td>
<td>0/0</td>
<td>2/2</td>
<td>2/2</td>
<td>5/5</td>
<td>1/1</td>
<td>0/0</td>
</tr>
<tr>
<td>No. of Non-Scram Outages (4)</td>
<td>1/0</td>
<td>0/0</td>
<td>0/0</td>
<td>4/4</td>
<td>0/0</td>
<td>2/2</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Record Period - From:</td>
<td>1/25</td>
<td>1/22</td>
<td>1/25</td>
<td>1/23</td>
<td>1/25</td>
<td>1/26</td>
<td>1/25</td>
<td>1/27</td>
</tr>
<tr>
<td>To:</td>
<td>2/23</td>
<td>2/22</td>
<td>2/23</td>
<td>2/23</td>
<td>2/22</td>
<td>2/23</td>
<td>2/24</td>
<td>2/22</td>
</tr>
</tbody>
</table>

* Equilibrium scram recoveries aren't attempted at the K Reactors.

(1) Effective Central Tubes: This value is defined as pile power level divided by the average of the ten most productive tubes in the reactor.

(2) This is defined as the maximum time available in minutes between scram and first indication of startup.

(3) The first pair of numbers shows the number of brief outages from which secondary cold startups would be made and the number of successful startups. The second pair shows the number of brief outages from which hot startups would be made and the number of successful recoveries.

(4) The first number shows the number of ordinary outages (including those initiated by scrams followed by unsuccessful recovery attempts), and the second shows the number of additional outages to discharge temporary poison.

**B REACTOR - W. R. SMIT**

Operation has been continuous for the last half of the report period with a higher than average flattening efficiency; however, continuity was interrupted by three outages during the first half of the report period. Of these, two were caused by ruptures, and one was caused by a Panellit scram of unknown origin. Procurement and analysis of axial flux distribution data did not disclose any variations in the front-to-rear specific power distribution for the past several months, indicating that a changing flux distortion was not a factor in the increased rupture experience.
C REACTOR - R. A. CHITWOOD

The recent increase in rupture rate, particularly in a central region of the reactor containing about 300 tubes, prompted a thorough examination of the front-to-rear flux distribution. The flux distribution in this region of the reactor indicated by traverses from irradiated fuel and dummy columns was found to be sharply depressed at about the sixth fuel element from the front and peaked about 20 per cent above the normal chopped cosine distribution at about the fourth fuel element downstream of the center. The flux distribution appeared normal in the remainder of the reactor. Although this localized distortion had existed to a lesser extent for several years it became more severe following the concurrent events of test ball 3X drops and the addition of centered spike enrichment charges (to provide the necessary reactivity to operate at the new higher levels) during November and December, 1959. Rechecks of ball losses following drops showed significant amounts of balls remained in several front vertical channels, and subsequent borescoping of one of these channels confirmed that large numbers of balls had lodged in the region of depressed flux. Compensation for this distortion with off-center enrichment charges will depend on the results of scheduled ball removal attempts. During the interim period lower local tube power limits have been specified, enrichment charges in the distorted region have been displaced upstream, and the rod configuration has been altered to reduce distortion. Due to the changes to reduce rupture potential in the flux distortion region the flattening efficiency has decreased by about four per cent.

Spline usage at C has been delayed pending equipment modification. During the report period, there were five shutdowns for ruptures (one causing a Panellit scram) and two temporary poison discharge outages.

D REACTOR - W. L. STIEDE

Subcritical monitor and power rate of rise instrumentation installation were completed during the outage of 2-22-60. Flattening efficiency has been exceptionally good, especially during the last part of the period when an ECT value of over 1500 was maintained. Operation was interrupted by three shutdowns: one scheduled, one to remove debris from process piping, and one due to exceeding graphite temperature limits when corrective action was hindered by a stuck charge in the PCCF and by temporary reactor gas composition control problems. Spline usage for startup and turnaround control has become relatively routine with significant startup efficiency being realized. A new high power level for D Reactor was achieved during the report period.

IR REACTOR - D. I. MONNIE AND D. G. MONTAGUE

Discharge of all the regular uranium charged in the central zone of the reactor at one time (PITA-294-C - Unit Flattened Zone Discharge) was completed. To compensate for the low residual concentration and the large samarium transient, 75 additional enrichment columns were charged. The high residual exposure immediately prior to the central discharge and reactor gas composition control problems resulted in some bothersome but manageable distributional flux cycling. The reactor was shut down twice to replace venturis, four times by Panellit scrams, once for a stuck charge in the PCCF, once for a spurious high temperature, and once due to a trip of the "SN" relay.
F REACTOR - G. F. BATLEY

A new high power level was achieved with operational continuity being interrupted by only one major outage. Two additional shutdowns were required following startup due to insufficient control at turnaround. One of these shutdowns was caused by failure to charge sufficient poison after startup; the other was the result of delayed timing of the power cut-back normally made prior to turnaround.

The Operational Physics tests of the Sub Critical Monitor (PT-IP-188-C) were successfully completed during the report period.

H REACTOR - A. J. KOSMATA

Despite a large number of shutdowns, a new high power level for H Reactor was achieved and equilibrium flattening efficiency was maintained at a high level. Operating continuity was interrupted by four shutdowns for ruptures (including two which resulted in tube leaks), five Panellit scarms following startups, one shutdown to test for water leaks, and one shutdown to correct the annunciator panel.

Both channels of the subcritical monitor have been installed and are functioning satisfactorily; the Power Rate-of-Rise Meter has been out of service due to malfunction. An eight-point tube temperature deviation recorder will soon replace the present four-point recorder. Proper utilization of this instrument should improve flux distributional stability markedly. During one outage five PCCF columns were inadvertently charged with bismuth rather than with the required lead-cadmium. The resulting non-conservative prediction error (250 c-mk) was well within the error anticipated by startup procedures; however, startup efficiency was adversely affected.

KE REACTOR - F. C. FRANKLIN

The successful incorporation of operating techniques utilizing increased spline usage for startup and turnaround control resulted in non-equilibrium losses being reduced by more than 60 per cent for minimum outages (to less than 0.4 effective day of lost production). A high flattening efficiency, nearly three per cent higher than the previous record, was maintained due to efficient spline usage, discharge during shutdown of potentially limiting tubes, and a slightly extended flattened zone in the corners of the reactor; a record power level resulted. An estimated 9000 MWD production increase, equivalent to nearly three operating days or roughly eight to ten per cent of operating time, resulted from efficient use of the 170 splines used during the report period. The reactor shut down twice for TSR, once for a water leak, once by a flux monitor scram, and twice for solid uranium ruptures in the fringe. The slightly higher peripheral tube power could have been a contributing factor in these ruptures; tubes in these zones currently are being recharged with I & E fuel elements.

KW REACTOR - A. D. VAUGHN

Although flattening efficiency was slightly restricted for a portion of the operating period by a non-optimum rod configuration used to stop a distributional flux cycle, the average ECT for the month was above average. The first
KW REACTOR (Continued)

large scale spline usage for startup resulted in a non-equilibrium loss of only 0.5 day's production, more than 50 per cent lower than had been previously achieved. Two distributional flux cycles were successfully controlled and stopped. The only outage at KW was due to a rupture.

PROCESS PHYSICS STUDIES

Safety Control Studies

The subcritical monitor experience test (PT-IP-188-C) was carried out at the F pile with good results. An interim report giving the results of the B and F tests, which were in good agreement with predictions, will be published shortly. Experience tests will be carried out at each of the other reactors as their scheduling permits. A series of discussions on startup instrumentation and total control was initiated in conjunction with the reactor specialist classes.

The document recommending use of the "square pile" concept for evaluating total control capacities and for outlining application procedure is now on Multilith and ready for appropriate approval signatures. Differences in control capacity caused by charge length show up more clearly by this method than by previous weighting approximations.

Control Efficiency Studies

Non-equilibrium losses, normally one or more effective days per startup at the K's, have been halved by recent use of splines. The spline coiler, a device for winding the spline on a reel, was used successfully at KW on the last startup. KE has continued to use the whole spline drop method of discharge in which a pit of water is used for shielding under the front elevator.

H and DR losses, normally 0.5 to 0.6 effective days per startup, have been reduced 25 to 35 per cent by relocation and addition of PCCF columns.

The poison spline displacement column prototype equipment is again on plant; if all goes well it is planned to have one winch mounted at KW by April 1, and to add the other five on one or more subsequent shutdowns.

DR pile carried out the first full flattened zone discharge under PITA-IP-294-C, during the extended outage of February 18 to 24. Initial operation following the startup was promisingly consistent with reactivity and flattening predictions.

Shielding Studies

Preparation of a status report on the old pile shield attenuation properties is under way. The B, D, and DR side shields which normally have had maximum temperatures in the range of 100 to 110 C show no noticeable increase in flux leakage. The F and H pile side shields whose normal maximum temperatures have
Shielding Studies (Continued)

reached 120 to 130°C, show a slight increase in neutron leakage over the past two years, though less than predicted by out-of-pile masonite deterioration data.

Reactor Fundamentals Training

Over 300 trainee hours were provided in Reactor Fundamentals classes during the month - approximately 130 and 120 respectively for scheduled Specialist and Utility Operator classes, and approximately 90 for two "one-shot" classes for Instrument Trainees.

Thirty-six of forty Utility Operator questionnaires were returned. Consistent answers of "about right" complexity, and "too short" length of course indicate that the Utility Operators felt the classes have been worth while. Essentially all of the Utility Operators will have had this class by the time the current group finishes this spring.
IRRADIATION TESTING

DR-1 Loop

The DR-1 Loop was operated continuously during the report period with the exception of reactor outage periods. The MCR-II test was completed with a total of 99.4 hours irradiation time at reference conditions (1500°F surface temperature). The fuel element was discharged without incident and the element assembly was prepared for shipment to General Atomic for post-irradiation evaluation. Shipment was made February 23, 1960.

The No. 1 motor generator set continued to vibrate excessively following the bearing replacement reported last month. Heavier mounting frames will be installed in an effort to correct the situation.

Mr. A. W. Mosen of General Atomic visited the loop on February 1 and 2, 1960, to assist in improving the gas chromatograph performance. Alterations were made in the sampler piping on his recommendation, and the chromatograph results are now in agreement with mass spectrometer analyses.

Messrs. H. C. Hopkins, Jr. and B. E. Kotts of General Atomic visited the loop February 20 to observe the discharge of the MCR-II fuel element.

H-1 Loop (KAPL-120 Loop)

The empty in-reactor loop was on process water cooling during the report period. The following items were accomplished in preparation for charging the NRM fuel assemblies (KAPL-120-8B test):

1. The fuel core thermocouple leads were made up and tested.
2. An in-line oxygen analyzer was installed.
3. The fuel core temperature recorders were modified and checked.
4. A crud probe was installed.
5. The make-up ion column was replaced with two mixed bed columns and one deoxygenating column.

The fuel assemblies were inspected and their loading observed by F. E. Dearing during meetings held at Bettis Atomic Power Laboratory, Pittsburgh, Pennsylvania, on February 3 and 4.
A meeting was held at HAPO on February 4 with E. R. Smith of Westinghouse Electric Corporation's MTR-EUR Site Operations, Irradiation Testing, and Hanford Laboratories personnel. The water chemistry program was discussed and clarified during this meeting.

Other Irradiation Experiments

The third in-reactor assembly designed to provide samples of graphite irradiated in the 200-300 C temperature range was discharged from the inner tube facility in 1573 DR on February 12 (HAPO-124). The assembly was discharged prematurely because of heater circuitry failure. The process tube was returned to normal operation.

The in-reactor test of Zircaloy-2 fuel element jackets was discharged from the KE Reactor 2A test hole on February 8 (HAPO-230). The irradiated capsule was shipped to Radiometallurgy for out-of-reactor testing.

Sample Irradiations

The following samples were irradiated or undergoing irradiation during the report period:

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Test Hole</th>
<th>Facility</th>
<th>Request Number</th>
<th>No. of Samples</th>
<th>Material - Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE</td>
<td>2B</td>
<td>Magazine</td>
<td>HAPO-119</td>
<td>6</td>
<td>Graphite-damage studies</td>
</tr>
<tr>
<td>KW</td>
<td>2C</td>
<td>Hot Graphite</td>
<td>HAPO-177</td>
<td>1</td>
<td>&quot;</td>
</tr>
<tr>
<td>KE</td>
<td>2C</td>
<td>&quot;</td>
<td>HAPO-177</td>
<td>6</td>
<td>&quot;</td>
</tr>
<tr>
<td>C</td>
<td>Y</td>
<td>&quot;</td>
<td>HAPO-177</td>
<td>1</td>
<td>&quot;</td>
</tr>
<tr>
<td>DR</td>
<td></td>
<td>Process Tube</td>
<td>HAPO-124</td>
<td>1</td>
<td>&quot;</td>
</tr>
<tr>
<td>E,D,DR</td>
<td></td>
<td>PCCF</td>
<td>HAPO-184</td>
<td>11</td>
<td>Washington Designated Program</td>
</tr>
<tr>
<td>B,D,D</td>
<td></td>
<td>Process Tube</td>
<td>HAPO-218</td>
<td>3</td>
<td>Natural uranium-fission product release studies</td>
</tr>
<tr>
<td>F</td>
<td>E</td>
<td>Quickie</td>
<td>HAPO-227</td>
<td>1</td>
<td>UO3-isotope production</td>
</tr>
<tr>
<td>F</td>
<td>G</td>
<td>Quickie</td>
<td>HAPO-229</td>
<td>3</td>
<td>UO2-thin films for damage studies</td>
</tr>
<tr>
<td>KE</td>
<td>2A</td>
<td>General Purpose</td>
<td>HAPO-230</td>
<td>1</td>
<td>Zirconium-burst test</td>
</tr>
<tr>
<td>C</td>
<td>D</td>
<td>Bare Channel</td>
<td>HAPO-237</td>
<td>1</td>
<td>Inconel-PTR gas loop components</td>
</tr>
<tr>
<td>DR</td>
<td></td>
<td>Process Tube</td>
<td>HAPO-235</td>
<td>4</td>
<td>Neptunium-isotope production</td>
</tr>
<tr>
<td>KW</td>
<td>4C</td>
<td>Snout</td>
<td>HAPO-238</td>
<td>1</td>
<td>Cobalt-isotope production</td>
</tr>
<tr>
<td>KW</td>
<td>4B</td>
<td>Snout</td>
<td>HAAP-110</td>
<td>3</td>
<td>GdO2, SmO2-control rod material study</td>
</tr>
<tr>
<td>KW</td>
<td>2A</td>
<td>General Purpose</td>
<td>HAPO-199</td>
<td>1</td>
<td>In-reactor thermocouples in a gas atmosphere</td>
</tr>
<tr>
<td>KW</td>
<td>3A</td>
<td>General Purpose</td>
<td>HAPO-236</td>
<td>1</td>
<td>Zirconium-creep test</td>
</tr>
<tr>
<td>KE</td>
<td>Gamma</td>
<td>HAPO-148</td>
<td>6</td>
<td>pH probes-damage studies</td>
<td></td>
</tr>
<tr>
<td>KE</td>
<td>Gamma</td>
<td>HAPO-171</td>
<td>16</td>
<td>Plastics and rubber-damage studies</td>
<td></td>
</tr>
</tbody>
</table>
Borescoping Activities

1. VSR channels 41 and 58, 105-C - Both channels were obstructed by front-to-rear filler blocks that had moved into the channel.

2. VSR channel 19, 105-C - This channel had a considerable number of balls located in the gaps between the tube and filler block layers.

3. Process channel 1960-C - An estimated 50 per cent of the channel surface area between 13'5" and 24'10" in from the front shows severe pitting.

4. The following process channels were inspected to assist the Maintenance Operation in retubing: 3666-DR, 2052-KE, 1076-D, 2368-D, 3373-D, and 3582-C.

5. The following process tubes were inspected to determine their condition prior to charging: 1179-B, 3087-B, 3048-KE, and KER-1.

6. PCCF tube 2185-DR was inspected to assist in removal of a stuck charge.

Detailed reports of the borescoping activities have been circulated to all interested parties.

Vertical Bowing Measurements

A summary of the results of vertical bowing measurements follows. All distances are measured from the front van stone.

<table>
<thead>
<tr>
<th>Area</th>
<th>Date</th>
<th>Tube</th>
<th>Distance</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>105-B</td>
<td>2-9-60</td>
<td>4574-B</td>
<td>23'</td>
<td>Up .19&quot; at 9'8&quot; since 10-8-59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Up .04&quot; at 20' since 10-8-59</td>
</tr>
<tr>
<td>105-DR</td>
<td>2-2-60</td>
<td>4675-DR</td>
<td>36'</td>
<td>Up .09&quot; at 8'8&quot; since 7-21-59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Down .16&quot; at 19' since 7-21-59</td>
</tr>
<tr>
<td>105-F</td>
<td>2-2-60</td>
<td>4676-F</td>
<td>36'</td>
<td>Up .29&quot; at 9'4&quot; since 9-11-59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Up .15&quot; at 20' since 9-11-59</td>
</tr>
<tr>
<td>105-F</td>
<td>1-25-60</td>
<td>3776-F</td>
<td>35'</td>
<td>No previous data</td>
</tr>
<tr>
<td>105-B</td>
<td>1-22-60</td>
<td>4574-B</td>
<td>34'</td>
<td>Up .18&quot; at 9'8&quot; since 10-8-59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Up .05&quot; at 20' since 10-8-59</td>
</tr>
<tr>
<td>105-KW</td>
<td>1-24-60</td>
<td>Y-2</td>
<td>41'</td>
<td>Up .34&quot; at 11' since 10-3-58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Down .66&quot; at 29' since 10-3-58</td>
</tr>
<tr>
<td>105-KE</td>
<td>2-22-60</td>
<td>5870-KE</td>
<td>40'</td>
<td>No previous data</td>
</tr>
</tbody>
</table>

COOLANT TESTING

During February, 1960, activities of the Coolant Testing Operation included operation of the 1706-KE in-reactor and out-of-reactor equipment; operation of the 1706-KER in-reactor loops; and installation and revision of additional test facilities.

A summary record of activities involving each facility follows, including significant items of performance, changes, and improvements:
1706-KE Single-Pass Tubes (PT-IP-197-A)

The six central zone tubes were operated during the month under specified production test conditions as follows:

<table>
<thead>
<tr>
<th>Tube</th>
<th>pH</th>
<th>Water</th>
<th>Dichromate</th>
</tr>
</thead>
<tbody>
<tr>
<td>4355</td>
<td>7.0</td>
<td>Filtered</td>
<td>1 ppm</td>
</tr>
<tr>
<td>4456</td>
<td>7.0</td>
<td>Filtered</td>
<td>1 ppm</td>
</tr>
<tr>
<td>4557)Control</td>
<td>7.0</td>
<td>Process</td>
<td>2 ppm</td>
</tr>
<tr>
<td>4863)Tubes</td>
<td>7.0</td>
<td>Process</td>
<td>2 ppm</td>
</tr>
<tr>
<td>4963</td>
<td>6.5</td>
<td>Process</td>
<td>2 ppm</td>
</tr>
<tr>
<td>5063</td>
<td>6.5</td>
<td>Process</td>
<td>2 ppm</td>
</tr>
</tbody>
</table>

Ferric chloride addition (160 ppm) was started to tubes 4557 and 4863 on February 12 for chemical effluent activities studies. This increased the normal cooling water concentration by a factor of 10. The studies were completed on February 14 as authorized by PT-IP-197-A, Supplement A.

1706-KE Mock-Up Tubes

The steam-heated mock-up tubes operated during the month for tests on:

1. Corrosion evaluation of sample lots of nickel-plated I&E slugs corresponding to lots of slugs which have recently been charged into one of the old reactors. These tests are being run in 80 °C, 120 °C and 165 °C process water.

2. Evaluation of sprayed silicate coating for protection of fuel elements during shipping and charging. This test is being run in the same tube as (1) above.


5. Test in 170 °C process water of X-6001 aluminum elements which have been deliberately defected with scratches was completed.

6. NPR control rod galvanic couple test between titanium and aluminum in 80 °C process water.

Out-of-Reactor Loops

ELMO-1 - The loop continued operation to determine scale build-up rates on the water side of the heat exchangers with No. 1 operating at 175 °F and No. 2 at 200 °F.

ELMO-4 - Construction forces are progressing on installation of the loop and safety shield. The work is approximately 70 per cent complete.
ELMO-5 - The loop operated at 290 C and pH 10.0 for tests of corrosion of samples of Zircaloy-2 and Zircaloy-4.

ELMO-6 - The loop was operated at 300 C and pH 4.5 during the month, primarily for testing CO2 gas addition as a method of pH control. Corrosion effects on aluminum, stainless steel, and carbon steel coupons were also studied.

ELMO-7 - The loop remained shut down during the month for line heater revisions, routine maintenance, revision of test manifolds, and changes in instrumentation and control.

ELMO-8 - Work continued on relocation of the control panel and other revisions necessary before the loop may be safely operated on a routine basis.

ELMO-10 - Screening decontamination tests Nos. 25 through 31 were completed during the month.

CEP-1 - The effect of repeated decontaminations using alkaline permanganate-Turco 4518, followed by high temperature loop operation, were continued during the month. Two decontamination cycles were completed and loop operation resumed at 300 C, pH 10.0 with LiOH. No unusual corrosion was noted on carbon steel, stainless steel, Zircaloy-2, or carbon steel welded to stainless steel coupons.

CEP-2 - Insulation of the loop piping was completed and the loop operated the balance of the month at 316 C in preparation of the first corrosion testing of coupons.

CEP-3 - This loop is being returned to the fabricator for electrical and mechanical revisions before final installation.

CEP-4 - The effect of operation at 300 C, pH 10.0 with LiOH, and cyclic decontamination with peroxide carbonate-alkaline permanganate - Wyandotte 112, continued through the third decontamination cycle. Examination of the welded carbon steel to stainless steel coupons revealed serious pitting corrosion in the heat-affected area of the carbon steel.

Carbon steel and carbon steel-to-stainless steel weld sections removed from the loop piping have revealed some pitting in the carbon steel heat-affected area, although not as severe as the coupons. The loop will remain down until the severity of the corrosion is fully evaluated.

In-Reactor Loops

KER-1 - The loop continued operation at 232 C, pH 10.0 with LiOH until February 7, when a rupture occurred, causing a reactor shutdown. The fuel elements were successfully discharged, using a special tray to prevent damage from the fuel elements dropping into the basin. The rupture was found on one of the external rods of the fuel elements and was a blister 30 to 40 mils high, 1-1/4 inch long, and 1/2 inch side wall split.
The process tube was borescoped and visual observation revealed several scratches, gall marks and what appeared to be pits.

The tube was recharged with dummies and placed on single-pass operation.

KER-2 - The dump valve malfunction which caused a reactor shutdown on January 31 was found to be caused by a ruptured diaphragm. The diaphragms were replaced and recirculation operation at 269°C, pH 10.0 with LiOH, was resumed on February 9. The tube remains charged with fuel elements authorized by PT-IP-292-A.

KER-3 - The loop operated at 269°C, pH 10.0 with LiOH, during the month, with fuel elements authorized by PT-IP-288-A.

KER-4 - The dichromate addition test for water quality control, authorized by PT-IP-298-A, was completed on February 11.

During the outage of February 22, the tube was charged with two 18-inch elements authorized by PT-IP-292-A and one 36-inch element authorized by PT-IP-250-A, Supplement C.

Equipment Experience

The differential pressure across both KER-1 canned rotor pumps decreased about 50 psi below normal operation February 22, and the pump amperage increased slightly. The pumps were replaced with spare units during the February 22, 23 outage. Preliminary examination of the failed pumps indicates failure of the upper and lower bearings on both pumps. The investigation of the cause of these failures is continuing.

Coolant Testing Operation Outage Performance

One unscheduled outage, caused by the KER-1 rupture, resulted from testing activities in the KER loops during the month. A total of 20.7 hours of outage time was charged to the operation and is broken down as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Item</th>
<th>PT</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-7-60</td>
<td>Losses because of unscheduled nature of outage, discharge KER-1 rupture, and borescope KER-1 tube.</td>
<td>IP-226-A</td>
<td>16.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supp. A</td>
<td></td>
</tr>
<tr>
<td>2-7-60</td>
<td>Replace split nut on KER-2 rear cross-header.</td>
<td>IP-292-A)</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP-284-A)</td>
<td></td>
</tr>
<tr>
<td>2-21-60</td>
<td>Discharge KER-4 dummies.</td>
<td>IP-298-A</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Charge KER-4 with fuel elements and reflare rear crossheader.</td>
<td>IP-250-A</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supp. C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP-292-A</td>
<td>0.4</td>
</tr>
</tbody>
</table>
COMPONENT TESTING

Irradiated Material Examination

Fuel elements from the following 43 tubes were examined at the 105-C Metal Examination Facility during the month of February, 1960:

<table>
<thead>
<tr>
<th>PT No.</th>
<th>Tube No.</th>
<th>PT No.</th>
<th>Tube No.</th>
<th>PT No.</th>
<th>Tube No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rupt.</td>
<td>2362-C</td>
<td>95A</td>
<td>2878-D*</td>
<td>216A</td>
<td>2882-K*</td>
</tr>
<tr>
<td></td>
<td>2484-C</td>
<td>216A</td>
<td>3084-B</td>
<td></td>
<td>2453-K*</td>
</tr>
<tr>
<td></td>
<td>2276-C</td>
<td></td>
<td>3670-D*</td>
<td></td>
<td>2269-B*</td>
</tr>
<tr>
<td>39A</td>
<td>1876-K*</td>
<td>3772-D*</td>
<td>4978-K*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>84A</td>
<td>0672-B</td>
<td>1067-B</td>
<td>1877-B</td>
<td>227A</td>
<td>3688-D</td>
</tr>
<tr>
<td></td>
<td>0773-B</td>
<td></td>
<td></td>
<td></td>
<td>2276-H</td>
</tr>
<tr>
<td></td>
<td>0767-B</td>
<td>1768-B</td>
<td>2062-B</td>
<td>247A</td>
<td>1768-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1872-B</td>
<td>1675-B*</td>
<td></td>
<td>1862-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1880-B</td>
<td>1978-B*</td>
<td></td>
<td>1872-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1881-B</td>
<td>2281-B*</td>
<td></td>
<td>1880-B</td>
</tr>
<tr>
<td>85A</td>
<td>3370-B</td>
<td>3077-K*</td>
<td>259A</td>
<td></td>
<td>3773-C</td>
</tr>
<tr>
<td></td>
<td>2084-C</td>
<td>3084-K*</td>
<td>272A</td>
<td></td>
<td>3873-C</td>
</tr>
</tbody>
</table>

*Visual examination only.

Cartridges

One cartridge has been accepted and tested in Metal Examination Facility examination equipment and found to be satisfactory for operation with certain modifications. The changes are being made by the vendor.

Probolog Testing

The fuel element Probolog was used to examine 150 non-irradiated fuel elements in a test designed to obtain additional information on the relationship of bond and penetration defects to Probolog response signals. Fifty fuel elements of each of the following three types were examined: internal penetration rejects, internal bond rejects, and acceptable fuel. Considered as a group, the Probolog traces from the internal bond defect fuel elements were different from those traces obtained from penetration rejects and acceptable fuel elements. Treated as a group, no difference could be detected between penetration reject traces and acceptable fuel element traces. However, the trace characteristics which made bond rejects appear different as a group were also found, but less frequently, on penetration rejects and acceptable fuel elements.

The effects of unbonding and penetrations on Probolog response signals are being studied to aid in the interpretation of spire wall corrosion loss measurements made with the Probolog.
Dejacketer

Two ruptured fuel elements were dejacketed and the numbers which were stamped on the cores were determined. This operation was the first attempt to dissolve jackets from fuel element failures. Following jacket removal, several large particles of irradiated material remained in the reaction vessel. The addition of concentrated nitric acid dissolved these particles and the solution was then routed to the permanent underground storage tanks.

Process Tube Corrosion Monitoring Program

In-reactor measurements of 188 process tubes were completed during the month. Listed below are the number of tubes measured per reactor and the document number of the reports issued.

<table>
<thead>
<tr>
<th>Reactor</th>
<th>No. of Tubes Problogged</th>
<th>Report No.</th>
<th>HW Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>12</td>
<td>4</td>
<td>63717</td>
</tr>
<tr>
<td>F</td>
<td>81</td>
<td>5</td>
<td>63783</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>6</td>
<td>63899</td>
</tr>
<tr>
<td>D</td>
<td>56</td>
<td>7</td>
<td>64035</td>
</tr>
</tbody>
</table>

There were eight tubes from C Reactor and six tubes from DR Reactor that were problogged but were not reported. These 14 tubes were removed from the reactors for actual measurements and the Problog results will be included in the actual measurements reports.

Visual examination, wall thickness and rib height measurements were completed on process tubes as follows:

<table>
<thead>
<tr>
<th>Reactor</th>
<th>B</th>
<th>D</th>
<th>DR</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Tubes</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Tube 1880-B was a ribless aluminum tube. The corrosion in the tube was very uniform. There was no evidence of ledging-type corrosion or hot spot areas caused by warped or misaligned slugs. No scratches were noticed in the tube caused by the supports on the slugs.

Tubes 1987-DR and 1960-H were removed because they were leakers. The leak was not found in tube 1987-DR. In leaker tube 1960-H, two transverse cracks were found approximately 25 feet from the rear van stone flange. Tube 2981-H was removed because it contained a ruptured slug.

Tube 2185-DR was a poison column tube in which five lead-cadmium slugs had melted. After slitting the tube in the basin the five slugs which were not accounted for by reactor personnel were found. Two slug cans with holes were found; however, they contained no lead-cadmium metal. Two slugs were fused to the tube and the remaining slug can which contained no metal was also fused to the tube. Tube 2276-C contained a stuck ruptured slug which was difficult to remove. The tube was laid out in the basin according to its location in the reactor for 100-B Maintenance personnel observation. Photographs were taken of the area where the ruptured slug stuck in the tube.
Tubes 1168-DR, 1371-DR, 1587-DR, and 3162-H were removed from the reactors for routine monitoring of second generation tubes.

The sector probe was tested on February 2 and again on February 19 at DR Reactor. On February 2, an attempt was made to probe two tubes, but a trace was obtained from one tube only. The probe would not go beyond the front nozzle on the other tube. On February 19, another attempt was made to probe two tubes. Again the probe would not go beyond the front nozzle of one tube. The probe will be retested after mechanical modifications are made.

Panellit Programs

Gauges processed by Maintenance personnel during the month totaled 395. Component Testing Operation inspection of these gauges resulted in detection of 91 gauges which did not meet inspection criteria, for a reject rate of 23.3 per cent.

In-board reliability examinations were performed on 1442 gauges. Of this number, 222 were found to be defective and were removed from service. This is a percentage defective of 15.4 and is compared to previous removal rates as follows:

<table>
<thead>
<tr>
<th>Last month</th>
<th>11.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last year, avg/mo</td>
<td>12.7%</td>
</tr>
</tbody>
</table>

Bourdon coil leak examinations, in-board, on 875 gauges resulted in detection of two leaking coils. This is a leak incidence rate of 0.23 per cent which is about one-half the past year's monthly average.

Response times were determined on a total of 1442 gauges during the month. Of this number 7.4 per cent or 107 gauges showed slow response and received corrective action. Percentage-wise, slow response for the past five months was as follows:

- February: 7.4
- January: 12.5
- December: 9.5
- November: 12.0
- October: 6.9

Document HW-63890, "Panellit Gauge Failure Analysis Report for December, 1959, and January, 1960," was issued. During the month, 63 gauges were subjected to failure analysis examination.

The front-of-panel range change gauge was installed in the C Reactor panel by authority of Design Change No. 342 and has performed satisfactorily to date (six weeks).

The two "Sigma" magnetic amplifiers, placed on test last month, were installed on the coincidence scram system panel mock-up and performance testing was initiated. The magnetic amplifier circuit is designed to provide coincidence scram system supervision and component failure identification.

DECLASSIFIED
INVENTIONS

All Research and Engineering Operation personnel engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during February except as listed below. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

<table>
<thead>
<tr>
<th>Inventor</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

O.H. Greager
Manager, Research and Engineering
IRRADIATION PROCESSING DEPARTMENT
MANUFACTURING OPERATION

GENERAL SUMMARY

I. Organization & Personnel

There were no significant changes in the organization.

A. Force Summary

<table>
<thead>
<tr>
<th></th>
<th>E</th>
<th>NE</th>
<th>Total</th>
<th>Change This Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Production Operation</td>
<td>14</td>
<td>13</td>
<td>27</td>
<td>+1</td>
</tr>
<tr>
<td>B-C Reactor Operation</td>
<td>72</td>
<td>282</td>
<td>354</td>
<td>+2</td>
</tr>
<tr>
<td>D-DR Reactor Operation</td>
<td>77</td>
<td>309</td>
<td>386</td>
<td>+2</td>
</tr>
<tr>
<td>F Reactor Operation</td>
<td>40</td>
<td>164</td>
<td>204</td>
<td>+2</td>
</tr>
<tr>
<td>H Reactor Operation</td>
<td>59</td>
<td>266</td>
<td>325</td>
<td>0</td>
</tr>
<tr>
<td>KE-KW Reactor Operation</td>
<td>82</td>
<td>337</td>
<td>419</td>
<td>-1</td>
</tr>
<tr>
<td>Total</td>
<td>346</td>
<td>1373</td>
<td>1719</td>
<td>+6</td>
</tr>
</tbody>
</table>

The above includes NPR trainees.

G. S. Spencer, Supervisor - 100 Operations I, transferred from B-C Reactor Operation to FFD. C. P. Sutter, Assignment Supervisor, transferred from CPD to F Reactor Operation. R. E. McGrath, Specialist - Operations Analysis, D. F. Bolender, Supervisor - 100 Operations I and J. G. Herdan, Assignment Engineer, resigned.

B. Personnel Activities

Eight Manufacturing Operation Managers attended an industrial engineering workshop presented by G. E. Manufacturing Services specialists on the subject "Work Simplification for Managers."

II. Safety, Security and Radiation Experience

There were 37 medical treatment injuries, no disabling injuries, security violations or radiation overexposures. One serious accident occurred at 105-B Reactor when a loaded T-cart fell into the charging elevator pit.

F Area completed a second consecutive year without a disabling injury and its tenth injury free year since the start of the F Plant.

III. Production Summary & Statistics

Reactor input production was 0.7 percent above forecast; 4.3 percent below at the six old reactors and 8.2 percent above at the K's.
Overall time operated efficiency was 76.5 percent (82 percent forecast); 75.3 percent at the six old reactors and 80.4 at the K's. Efficiency was low due largely to ruptures and small increases in outage time caused by water leaks and production tests.

The combined reactor instantaneous power level was not increased. Record levels at the individual reactors were increased 40 megawatts at B (1685 to 1725), 5 at C (2065 to 2070), 55 at D (1710 to 1765), 70 at DR (1710 to 1780), 10 at F (1815 to 1825), 65 at H (1825 to 1890), 70 at KE (3730 to 3800), and 30 at KF (3810 to 3840).

Twenty-one ruptures, seventeen I&E regular, three solid regular and one I&E-E, were removed from the reactors. Five of the I&E regular metal ruptures were at G, 5 at K, 3 at KE, 2 at B, one at KE and one at F. Two of the solid regular metal ruptures were at KE and one at H. The I&E-E rupture was at KE. A cluster fuel element failure was removed from KER-1 February 7.

Processing and Power statistics for individual reactor areas are tabulated on pages C-8 through C-12.

PRODUCTION AND REACTOR OPERATION

I. PRODUCTION OPERATION

Production Planning and Scheduling

A. Production Forecasting

Compilation of data for the next eighteen month forecast was begun. Considerable effort was channeled into working up figures for the Plant Improvement Program study.

B. Production Scheduling

a. Discharge Concentration

The discharge goal exposure for I&E regular slugs at B Reactor was reduced from 725 MWD/Ton to 675 MWD/Ton because of an excessive number of slug ruptures. Other goal exposure plans remained unchanged. The amount of material discharged outside the normal discharge range has increased greatly as shown by the table below.
### Below Goal Discharging - February, 1960

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Tons Disch.</th>
<th>Tons Excess Usage</th>
<th>Material Type</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>0.3</td>
<td>0.1</td>
<td>E</td>
<td>To adjust enrichment</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>0.6</td>
<td>Reg.</td>
<td>To adjust enrichment</td>
</tr>
<tr>
<td></td>
<td>14.0</td>
<td>7.6</td>
<td>Reg.</td>
<td>Rupture prone lot KL 356 D</td>
</tr>
<tr>
<td>C</td>
<td>1.3</td>
<td>0.5</td>
<td>Reg.</td>
<td>Temporary Poison</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>9.5</td>
<td>Reg.</td>
<td>Zirconium tube installation</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>0.8</td>
<td>Reg.</td>
<td>Discharged in error</td>
</tr>
<tr>
<td></td>
<td>25.0</td>
<td>11.8</td>
<td>Reg.</td>
<td>Material Discharged from a zone believed to be rupture prone probably due to flux peaking</td>
</tr>
<tr>
<td>D</td>
<td>1.3</td>
<td>1.1</td>
<td>Reg.</td>
<td>To adjust enrichment</td>
</tr>
<tr>
<td>DE</td>
<td>*</td>
<td>9.5</td>
<td>Reg.</td>
<td>Discharge of entire central zone under FITA-294C</td>
</tr>
<tr>
<td>F</td>
<td>3.6</td>
<td>2.3</td>
<td>Reg.</td>
<td>Rupture prone lot SL 108 C</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>0.5</td>
<td>Reg.</td>
<td>Process tube replacement</td>
</tr>
<tr>
<td></td>
<td>2.1</td>
<td>0.8</td>
<td>Reg.</td>
<td>Rupture prone lot KL 356 D</td>
</tr>
<tr>
<td>H</td>
<td>0.6</td>
<td>0.2</td>
<td>Reg.</td>
<td>High powered solid charges converted</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>1.4</td>
<td>Reg.</td>
<td>Rupture prone lots KL 339 C and SL 102 C</td>
</tr>
<tr>
<td></td>
<td>18.7</td>
<td>4.5</td>
<td>Reg.</td>
<td>Discharge of lots KL 364 C and KL 366 C after a single rupture in each coupled with generally poor appearance of material.</td>
</tr>
<tr>
<td></td>
<td>6.5</td>
<td>1.3</td>
<td>Reg.</td>
<td>Discharge of lot KL 340 C under circumstances similar to lots KL 364 C and KL 366 C above.</td>
</tr>
<tr>
<td>KE</td>
<td>16.0</td>
<td>7.7</td>
<td>Reg.</td>
<td>High powered solid charges converted to I&amp;K.</td>
</tr>
<tr>
<td>KW</td>
<td>4.0</td>
<td>1.4</td>
<td>Reg.</td>
<td>Tubes discharged as rupture prone because they were equipped with spline caps.</td>
</tr>
<tr>
<td></td>
<td>100.7</td>
<td>52.5</td>
<td>Totals for Regular</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td>0.1</td>
<td>Totals for Enriched</td>
<td></td>
</tr>
</tbody>
</table>

* A total of 128 tons was discharged at 671 MWD per ton versus a goal of 725 MWD per ton, hence, the 9.5 ton excess usage. The actual tonnage discharged below goal is not broken out because it is partially balanced by over-exposure of some material.
A comparison of February discharge exposures with those of previous months shows a further decline in exposure levels (see table below).

**Comparison of February Discharge Exposures (MWD/T)**

<table>
<thead>
<tr>
<th></th>
<th>Regular U</th>
<th>Enriched U</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solid</td>
<td>l/a</td>
</tr>
<tr>
<td>December</td>
<td>716</td>
<td>696</td>
</tr>
<tr>
<td>January</td>
<td>677</td>
<td>659</td>
</tr>
<tr>
<td>February</td>
<td>61.4</td>
<td>62.2</td>
</tr>
</tbody>
</table>

*Future reports will omit this item because the amount of such material being discharged has become insignificant.*

b. **Process Tube Replacement**

Tube replacements reported in February are:

- B - 2
- C - 10 (7 zirconium)
- D - 7
- DR - 12
- F - 38
- H - 3
- KE - 3
- KW - 4

**Total** 79

c. **Off-Plant Shipments**

Ten casks of polonium were shipped to Mound Laboratory. The amount shipped was considerably above the amount requested because of discharge of material which had been used as spacers in certain production test tubes. The excess after appropriate decay will be used to reduce future requirements.

c. **Operations Analysis**

Production data for use in the Plant Improvement Program were reviewed and revised to reflect changes in programming. This work is being continued as more information is developed by groups assigned to expansion studies.

Tube corrosion analysis continued and data compiled in preparation for issuance of a revised tube replacement forecast. A study of zirconium tube replacement for C Reactor was begun.

Slug rupture analysis was begun for manufacturing use.
Production Computing

Tube-by-tube source data were processed to establish the current production and corrosion status for each tube in all reactors. Routine and emergency reports were issued to implement the scheduling, forecasting, and accountability functions of the Production Operation. Charge-discharge and tube replacement information for each reactor operation was provided in accordance with production schedules. Production data were supplied to each Pile Physicist for reactivity evaluations, and to Process Technology for EDM processing.

Individual tube source data were supplied to the SS Accountability Operation for calculating weights of SS material in discharges and month's end in reactor inventories.

A permanent procedure was established in February for the purpose of improving the accuracy and completeness of our lot number records. The essential features of the procedure are a rigorous mechanical edit of the validity and accuracy of recorded data and a crosscheck with the area clerk so that data as recorded in our punched cards are compared directly with source records at the reactors.

Essential Materials

Rail and truck shipments received in February were as follows:

| Carload shipments for IPD | 232 |
| Carload shipments for other Dept’s. | 196 |
| Truck shipments for IPD | 120 |
| **Total** | **548** |

Helium consumption during the month of February in all reactors was as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>100-B</td>
<td>603,500</td>
</tr>
<tr>
<td>100-C</td>
<td>905,300</td>
</tr>
<tr>
<td>100-D</td>
<td>282,000</td>
</tr>
</tbody>
</table>
| 100-DR    | 100-DR | 433,700
| 100-F     | 415,700 |
| 100-H     | 659,100 |
| 100-KE    | 345,700 |
| 100-KW    | 420,000 |
| **Total** | **4,065,000** |

In addition to the routine duties involved in the procurement and delivery of essential materials a letter was sent to Purchasing stating HAPD's requirements of sulfuric acid for the period June 1, 1960 through May 31, 1961. New contracts will be negotiated for this material.
Production Reports & Statistics

Routine processing of the Daily Production and Daily Operations Reports and the monthly Manufacturing Operation Record Report was continued. Data involving reactor operation and associated equipment were collected and tabulated in historical record books. Chart Books were maintained for the HAPO and IFD General Managers and Manufacturing Operation Manager. A large volume of both routine and non-routine data were supplied to IFD personnel. Some routine data were also supplied to the FPD, CPD and HLO.

Miscellaneous Activities

Security classification matters continued to be handled for the department. New guidance from the AEC-HOO and the Hanford Laboratories Operation was given appropriate distribution and interpretation within IFD.

Planning for the IFD "Fundamentals of Manufacturing" training course continued. The schedule for the first class of 16 participants was established, with the first session to be on March 14. The course offering "package" was completed and was distributed to all eligible first-line supervisors and equivalent specialists in the Manufacturing Operation, and in functionally related components of Facilities Engineering and Research and Engineering. Applications were being tabulated at month-end. Other integrative work on training continued in connection with union relations, radiation protection, and reactor fundamentals.

IFD liaison was established with the central Relations Operation regarding the scheduled March 8-9 visit of two G.E. Mfg. Services representatives who are coming to discuss HAPO participation in the Company's Mfg. Training Program.

Arrangements were handled for the Feb. 16-17 industrial engineering workshop presented by G.E. Mfg. Services specialists to IFD management on the subject "Work Simplification for Managers". Mfg. Operation management was well represented.
<table>
<thead>
<tr>
<th>MONTH</th>
<th>REACTOR OPERATIONS STATISTICS - PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 1960</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INPUT PROD./Pu (% OF FORECAST)</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>DR</th>
<th>F</th>
<th>H</th>
<th>KE</th>
<th>KW</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>96.6</td>
<td>89.5</td>
<td>109.8</td>
<td>82.5</td>
<td>92.9</td>
<td>103.6</td>
<td>104.5</td>
<td>111.8</td>
<td>100.7</td>
<td></td>
</tr>
</tbody>
</table>

| TIME OPER. EFF. (% OVERALL) | 74.8 | 73.0 | 86.7 | 69.2 | 68.8 | 79.1 | 78.3 | 82.5 | 76.5 |

<table>
<thead>
<tr>
<th>NO. OF REACTOR OUTAGES &amp; HOURS</th>
<th>NO.</th>
<th>HRS.</th>
<th>NO.</th>
<th>HRS.</th>
<th>NO.</th>
<th>HRS.</th>
<th>NO.</th>
<th>HRS.</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHEDULED</td>
<td>0</td>
<td>91.2</td>
<td>0</td>
<td>72.0</td>
<td>1</td>
<td>87.1</td>
<td>1</td>
<td>134.6</td>
<td>1</td>
</tr>
<tr>
<td>UNSCHEDULED - SCRAMB</td>
<td>1</td>
<td>6.8</td>
<td>1</td>
<td>0.9</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>2.8</td>
<td>1</td>
</tr>
<tr>
<td>OTHER</td>
<td>3</td>
<td>77.5</td>
<td>5</td>
<td>112.1</td>
<td>5</td>
<td>5.7</td>
<td>3</td>
<td>77.0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4</td>
<td>175.5</td>
<td>6</td>
<td>188.0</td>
<td>1</td>
<td>92.8</td>
<td>8</td>
<td>214.4</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BREAK'D OF REACTOR OTGE HRS.</th>
<th>TOTAL HRS.</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLANNED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGE - DISCHARGE</td>
<td>40.4</td>
<td>24.8</td>
</tr>
<tr>
<td>TUBE REPLACEMENT</td>
<td>18.6</td>
<td>15.8</td>
</tr>
<tr>
<td>PROJECT WORK</td>
<td>7.5</td>
<td>3.7</td>
</tr>
<tr>
<td>PRODUCTION TEST</td>
<td>6.3</td>
<td>38.7</td>
</tr>
<tr>
<td>MAINTENANCE</td>
<td>44.5</td>
<td>8.5</td>
</tr>
<tr>
<td>MISCELLANEOUS</td>
<td>91.2</td>
<td>72.0</td>
</tr>
<tr>
<td>SUB - TOTAL</td>
<td>87.1</td>
<td>134.6</td>
</tr>
<tr>
<td>UNPLANNED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGE - DISCHARGE</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>PRODUCTION TEST</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>RUPTURE REMOVAL</td>
<td>72.1</td>
<td>114.5</td>
</tr>
<tr>
<td>WATER LEAK</td>
<td>5.4</td>
<td>0.6</td>
</tr>
<tr>
<td>INSTRUMENTATION</td>
<td>6.8</td>
<td>0.9</td>
</tr>
<tr>
<td>MISCELLANEOUS</td>
<td>84.3</td>
<td>116.0</td>
</tr>
<tr>
<td>SUB - TOTAL</td>
<td>5.7</td>
<td>79.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>175.5</td>
<td>188.0</td>
</tr>
</tbody>
</table>

| NO. OF RUPT. (ALL TYPES)     | 2           | 5   |
| NO. OF TUBES INSTALLED       | 2           | 10  |
| TYPE OF WATER LEAK - TUBE    | 1           | 3   |
| VAN STONE                    | 2           | 2   |

REMARKS:
1. Stuck Charges.
2. Loose venturi assembly.
3. Misc. front and rear pigtails or cap leaks.
4. Trips caused by KER test facilities.
<table>
<thead>
<tr>
<th>TYPE MATERIAL</th>
<th>TUBE NO.</th>
<th>TYPE RUPTURE</th>
<th>REMOV HRS</th>
<th>CHARGE DATE</th>
<th>RUPTURE DATE</th>
<th>ACT. CONC.</th>
<th>LOT NO.</th>
<th>REMOVAL METHOD</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;E Reg.</td>
<td>2875-C</td>
<td>Hot spot</td>
<td>10.8</td>
<td>12-14-59</td>
<td>2-4-60</td>
<td>316</td>
<td>KJ-193-C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>2276-C</td>
<td>Side other</td>
<td>33.1</td>
<td>12-9-59</td>
<td>2-6-60</td>
<td>344</td>
<td>KJ-190-D</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Solid Reg.</td>
<td>0755-H</td>
<td>Hot spot</td>
<td>7.4</td>
<td>11-4-59</td>
<td>2-8-60</td>
<td>427</td>
<td>KA-278-A</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>0782-C</td>
<td>Unknown</td>
<td>42.2</td>
<td>12-14-59</td>
<td>2-10-60</td>
<td>344</td>
<td>KJ-186-C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>3880-B</td>
<td>Hot spot</td>
<td>15.4</td>
<td>11-27-59</td>
<td>2-11-60</td>
<td>423</td>
<td>KL-356-D</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>3661-H</td>
<td>Hot spot</td>
<td>15.3</td>
<td>11-28-59</td>
<td>2-11-60</td>
<td>519</td>
<td>KL-364-C</td>
<td>X</td>
<td>Leaker</td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>0770-H</td>
<td>Side other</td>
<td>0.3</td>
<td>12-28-59</td>
<td>2-8-60</td>
<td>275</td>
<td>KL-389-D</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>0884-H</td>
<td>Hot spot</td>
<td>3.8</td>
<td>11-28-59</td>
<td>2-13-60</td>
<td>532</td>
<td>KL-366-C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>0765-C</td>
<td>Hot spot</td>
<td>19.0</td>
<td>12-9-59</td>
<td>2-14-60</td>
<td>416</td>
<td>KJ-186-C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Solid Reg.</td>
<td>5556-KE</td>
<td>Split</td>
<td>9.0</td>
<td>11-16-59</td>
<td>2-21-60</td>
<td>478</td>
<td>KA-274-A</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>2673-H</td>
<td>Hot spot</td>
<td>12.6</td>
<td>11-28-59</td>
<td>2-22-60</td>
<td>569</td>
<td>KL-340-C</td>
<td>X</td>
<td>Leaker</td>
</tr>
<tr>
<td>Solid Reg.</td>
<td>4645-KE</td>
<td>Split</td>
<td>3.1</td>
<td>10-30-59</td>
<td>2-22-60</td>
<td>500</td>
<td>KA-274-A</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>4651-KE</td>
<td>Hot spot</td>
<td>Time</td>
<td>12-7-59</td>
<td>2-23-60</td>
<td>563</td>
<td>KJ-149-D</td>
<td>X</td>
<td>Leaker</td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>2459-KW</td>
<td>Hole</td>
<td>20.9</td>
<td>11-29-59</td>
<td>2-23-60</td>
<td>689</td>
<td>KR-119-D</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>1935-F</td>
<td>Hot Spot</td>
<td>7.8</td>
<td>12-8-59</td>
<td>2-23-60</td>
<td>589</td>
<td>KL-360-C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>3284-B</td>
<td>Unknown</td>
<td>48.0</td>
<td>11-27-59</td>
<td>2-26-60</td>
<td>592</td>
<td>KL-383-D</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>1151-KE</td>
<td>Hot Spot</td>
<td>0.7</td>
<td>1-11-60</td>
<td>2-26-60</td>
<td>363EFT</td>
<td>KJ-117-F</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I&amp;E Reg.</td>
<td>3057-C</td>
<td>Hot Spot</td>
<td>9.4</td>
<td>11-7-59</td>
<td>2-29-60</td>
<td>715</td>
<td>KJ-179-C</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Cluster 2160-KE
Fuel Element Loop #1 Jacket Split 16.6 8-24-59 2-7-60 2846 Suppl B X
# Reactor Operations Statistics - Power

## Month: February, 1960

<table>
<thead>
<tr>
<th></th>
<th>100-B</th>
<th>100-C</th>
<th>100-D</th>
<th>100-DR</th>
<th>100-F</th>
<th>100-H</th>
<th>100-KE</th>
<th>100-KW</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>River Water (BLDG.191)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Reservoir (BLDG.182) GPM AVG.</td>
<td>10232</td>
<td>4386</td>
<td></td>
<td>2666</td>
<td>2632</td>
<td></td>
<td></td>
<td></td>
<td>19916</td>
</tr>
<tr>
<td>To Filter Plant (BLDG.182) GPM AVG.</td>
<td>61110</td>
<td>86041</td>
<td></td>
<td>63209</td>
<td>73200</td>
<td>156200</td>
<td>162600</td>
<td></td>
<td>601760</td>
</tr>
<tr>
<td>To Filter Plant (C&amp;DR) GPM AVG.</td>
<td>94917</td>
<td>51079</td>
<td></td>
<td></td>
<td></td>
<td>106</td>
<td></td>
<td></td>
<td>145996</td>
</tr>
<tr>
<td>To R &amp; E (Ker) &amp; PEO GPM AVG.</td>
<td>203</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>309</td>
</tr>
<tr>
<td><strong>Total</strong> GPM AVG.</td>
<td>166529</td>
<td>111709</td>
<td></td>
<td>65675</td>
<td>75432</td>
<td>156306</td>
<td>162600</td>
<td></td>
<td>767981</td>
</tr>
<tr>
<td><strong>Total</strong> M GAL.</td>
<td>69430.0</td>
<td>5917.8</td>
<td></td>
<td>2742.6</td>
<td>3150.0</td>
<td>6527.3</td>
<td>6790.2</td>
<td></td>
<td>32070.9</td>
</tr>
<tr>
<td><strong>Reservoir Water (BLDG.182)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Power House (BLDG.184) GPM AVG.</td>
<td></td>
<td>34</td>
<td></td>
<td>36</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td>159</td>
</tr>
<tr>
<td>To Cond. System (BLDG.180) GPM AVG.</td>
<td></td>
<td>1620</td>
<td></td>
<td>2044</td>
<td>2809</td>
<td></td>
<td></td>
<td></td>
<td>6473</td>
</tr>
<tr>
<td>To Cond. System (110DR &amp; 110P) GPM AVG.</td>
<td></td>
<td>2700</td>
<td></td>
<td>386</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3086</td>
</tr>
<tr>
<td>To Export System GPM AVG.</td>
<td>10198</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10198</td>
</tr>
<tr>
<td><strong>Total</strong> GPM AVG.</td>
<td>4727.3</td>
<td>183.1</td>
<td></td>
<td>103.0</td>
<td>118.3</td>
<td></td>
<td></td>
<td></td>
<td>831.7</td>
</tr>
<tr>
<td><strong>Filter Water (BLDG.184)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Power House (BLDG.184) GPM AVG.</td>
<td></td>
<td>193</td>
<td>214</td>
<td>148</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
<td>715</td>
</tr>
<tr>
<td>To Process (BLDG.190) GPM AVG.</td>
<td>67472</td>
<td>78286</td>
<td>72044</td>
<td>41734</td>
<td>61052</td>
<td>69500</td>
<td>164565</td>
<td>156860</td>
<td>714313</td>
</tr>
<tr>
<td>To 108 GPM AVG.</td>
<td>2500</td>
<td>4500</td>
<td>1352</td>
<td>1080</td>
<td>1230</td>
<td></td>
<td></td>
<td></td>
<td>10602</td>
</tr>
<tr>
<td>To 1089 GPM AVG.</td>
<td></td>
<td></td>
<td>1352</td>
<td>1080</td>
<td>1230</td>
<td></td>
<td></td>
<td></td>
<td>1352</td>
</tr>
<tr>
<td>To Filter Plant (BLDG.180) GPM AVG.</td>
<td></td>
<td>10131</td>
<td>9219</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(19350)</td>
</tr>
<tr>
<td>To F &amp; E System GPM AVG.</td>
<td>166</td>
<td>232</td>
<td>152</td>
<td>126</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6416</td>
</tr>
<tr>
<td>To R &amp; E (Ker) and PEO GPM AVG.</td>
<td></td>
<td>153</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>153</td>
</tr>
<tr>
<td>Backwash GPM AVG.</td>
<td>910</td>
<td>2000</td>
<td>1475</td>
<td>864</td>
<td>837</td>
<td>1584</td>
<td>6535</td>
<td></td>
<td>14205</td>
</tr>
<tr>
<td><strong>Total</strong> GPM AVG.</td>
<td>2975.0</td>
<td>3963.7</td>
<td>3593.1</td>
<td>2518.0</td>
<td>2639.6</td>
<td>3031.7</td>
<td>6522.9</td>
<td>6790.2</td>
<td>32034.2</td>
</tr>
<tr>
<td><strong>Process Water (BLDG.190)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Reactor GPM AVG.</td>
<td>67072</td>
<td>77886</td>
<td>71644</td>
<td>59034</td>
<td>66652</td>
<td>69000</td>
<td>147800</td>
<td>152900</td>
<td>705988</td>
</tr>
<tr>
<td>To Reactor GPM MON.</td>
<td>80500</td>
<td>94500</td>
<td>78900</td>
<td>82000</td>
<td>81900</td>
<td>179000</td>
<td>179000</td>
<td></td>
<td>866100</td>
</tr>
<tr>
<td>Power House (K Area) GPM AVG.</td>
<td>46</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>108 (K - EW) GPM AVG.</td>
<td>898</td>
<td>3546</td>
<td>1444</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1444</td>
</tr>
<tr>
<td>To R &amp; E (Ker) GPM AVG.</td>
<td>521</td>
<td>521</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>521</td>
</tr>
<tr>
<td>Building Usage GPM AVG.</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>500</td>
<td>400</td>
<td>400</td>
<td>3300</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong> M GAL.</td>
<td>2817.6</td>
<td>3269.2</td>
<td>3008.6</td>
<td>2482.6</td>
<td>2549.5</td>
<td>2920.3</td>
<td>6250.0</td>
<td>6550.5</td>
<td>29829.7</td>
</tr>
</tbody>
</table>

**River Data**

<table>
<thead>
<tr>
<th>Elevation (BLS, FT.)</th>
<th>MAX.</th>
<th>MIN.</th>
<th>AVG.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>397</td>
<td>389.7</td>
<td>390.1</td>
</tr>
<tr>
<td>Temperature (°F)</td>
<td>38.0</td>
<td>36.9</td>
<td>37.7</td>
</tr>
</tbody>
</table>

---

**DECLASSIFIED**
<table>
<thead>
<tr>
<th>MONTH</th>
<th>REACTOR OPERATIONS STATISTICS - POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>February, 1960</td>
<td></td>
</tr>
<tr>
<td>WATER TREATMENT DATA</td>
<td>100-B</td>
</tr>
<tr>
<td></td>
<td>MM GALS</td>
</tr>
<tr>
<td>AT BLDG. 182</td>
<td>2552.0</td>
</tr>
<tr>
<td>BLDG. 183</td>
<td>MM GALS</td>
</tr>
<tr>
<td>CHEMICAL CONSUMPTION</td>
<td></td>
</tr>
<tr>
<td>CHLORINE (BLDG.182)</td>
<td>LBS.</td>
</tr>
<tr>
<td>(BLDG. 183)</td>
<td>LBS</td>
</tr>
<tr>
<td></td>
<td>AVG PPM</td>
</tr>
<tr>
<td>Alumina ALUM</td>
<td>LBS</td>
</tr>
<tr>
<td></td>
<td>AVG PPM</td>
</tr>
<tr>
<td>Separan</td>
<td>LBS</td>
</tr>
<tr>
<td></td>
<td>AVG PPM</td>
</tr>
<tr>
<td>SULPHURIC ACID (AS 100%)</td>
<td>LBS</td>
</tr>
<tr>
<td></td>
<td>AVG PPM</td>
</tr>
<tr>
<td>Dichromate</td>
<td>LBS</td>
</tr>
<tr>
<td>PURGE MATERIAL CONSUMPTION</td>
<td>LBS</td>
</tr>
</tbody>
</table>

*Alumina & Alum combined for average ppm in alum column.
### Reactor Operations Statistics - Power

**February, 1960**

#### Analytical Data

<table>
<thead>
<tr>
<th>Raw Water</th>
<th>100-B</th>
<th>100-C</th>
<th>100-D</th>
<th>100-DR</th>
<th>100-F</th>
<th>100-H</th>
<th>100-KE</th>
<th>100-KW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
<td>8.00</td>
<td>7.60</td>
<td>8.24</td>
<td>8.24</td>
<td>8.18</td>
<td>8.06</td>
<td>7.54</td>
<td>7.49</td>
</tr>
<tr>
<td><strong>Turbidity</strong></td>
<td>PH AVG</td>
<td>4.0</td>
<td>4.0</td>
<td>8.0</td>
<td>7.0</td>
<td>7.3</td>
<td>7.0</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>PPM AVG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Finished Water

<table>
<thead>
<tr>
<th><strong>pH</strong></th>
<th>PH AVG</th>
<th>7.05</th>
<th>7.05</th>
<th>7.05</th>
<th>7.05</th>
<th>7.06</th>
<th>7.06</th>
<th>7.07</th>
<th>7.04</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Turbidity</strong></td>
<td>PPM AVG</td>
<td>.004</td>
<td>.005</td>
<td>.006</td>
<td>.005</td>
<td>.007</td>
<td>.006</td>
<td>.006</td>
<td>.006</td>
</tr>
<tr>
<td><strong>Cl₂ Residual</strong></td>
<td>PPM AVG</td>
<td>0.5</td>
<td>.05</td>
<td>.10</td>
<td>.10</td>
<td>.05</td>
<td>.06</td>
<td>.07</td>
<td>.07</td>
</tr>
<tr>
<td><strong>Dichromate</strong></td>
<td>PPM AVG</td>
<td>1.80</td>
<td>1.74</td>
<td>1.80</td>
<td>1.80</td>
<td>1.80</td>
<td>1.83</td>
<td>1.80</td>
<td>1.80</td>
</tr>
</tbody>
</table>

#### Team Data

<table>
<thead>
<tr>
<th>Generated (Max)</th>
<th>LBS/HR</th>
<th>121000</th>
<th>354000</th>
<th>222000</th>
<th>81000</th>
<th>778000</th>
<th>73000</th>
<th>59000</th>
<th>132000</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Avg) LBS/HR</td>
<td>96000</td>
<td>105000</td>
<td>70000</td>
<td>64200</td>
<td>335200</td>
<td>333345</td>
<td>34106</td>
<td>34689</td>
<td>78755</td>
</tr>
<tr>
<td>Total M LBS</td>
<td>64644</td>
<td>73845</td>
<td>50213</td>
<td>43361</td>
<td>232063</td>
<td>30698</td>
<td>26116</td>
<td>54814</td>
<td>47332</td>
</tr>
</tbody>
</table>

#### ELECTRICAL DATA

| Total Generated KW HRS. | 1472800 | 1540000 | 3012800 |

---

*Note: The text is partially obscured and may contain redactions.*
II. B-C REACTOR OPERATION

GENERAL

A. Administration - Review of N Reactor criteria, specifications and prints continued. The annual Salary Review was completed and Appraisal Contacts were started. Efforts were continued to revise the transportation, security, and radiation protection procedures for entering and leaving the 100 Areas. Action was started to obtain pocket dosimeters for on-the-job monitoring of radiation doses.

B. Personnel Development - Exempt: Ten personnel participated in NPR Design Information Meeting training, eight personnel attended classes on Fundamentals of Reactor Processing and twelve personnel attended the Reactor Physics Meetings. Non-exempt: Approximately 60 to 70 personnel participated in courses in Rescue Crew Training, Electronics, Charge Seaters, Radiation Monitoring and Pile Operating Techniques. Twenty-six exempt personnel indicated interest in the new "Fundamentals of Manufacturing" Course to be offered in IFD on a long-range continuing basis.

C. Cost - Planned Maintenance Job No. 21, "Pressure Monitor Repair and Modification - 105-C," was approved by the Department General Manager. Estimates of FY 1961-1962 budgetary requirements for personnel, overtime, essential materials, planned maintenance and equipment not included in construction projects were submitted to the Financial Operation.

D. Landlord - Routine.

E. Suggestions - Start of month - 52, received - 16; completed - 11; end of month - 57.

B PROCESSING OPERATION

A. Production - Input production was 96.6 percent of forecast and the TOE was 74.8%. Limiting factors were tube powers and graphite temperatures.

B. Operating Experience - There were four unscheduled outages.

<table>
<thead>
<tr>
<th>Day</th>
<th>Outage Hours</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.7</td>
<td>Conclusion of January 31 outage.</td>
</tr>
<tr>
<td>2</td>
<td>3.1</td>
<td>Shutdown to correct an error in a front-face orifice installation.</td>
</tr>
<tr>
<td>9</td>
<td>39.1</td>
<td>Unexplained Panellit trip.</td>
</tr>
<tr>
<td>11</td>
<td>21.7</td>
<td>Rupture in Tube 3880, removed with a Blackhawk jack.</td>
</tr>
<tr>
<td>2</td>
<td>73.9</td>
<td>A rupture in Tube 3284 caused a high Panelli trip. The charge was stuck and was very difficult to remove.</td>
</tr>
</tbody>
</table>
C. Equipment Experience - During a pre-startup inspection, a leaking front flexible connector was found; it was replaced and will be inspected to determine the cause of the leak. Probolog measurements of 61 process tubes resulted in four tubes being held for future replacement. Boroscopy of two PCF tubes revealed worn ribs; one or two of these tubes will be removed for examination. Two VSR gas seals were replaced. A cracked section of a rear-face omega seal was filled with silicone rubber foam. The near rear neoprene seal was coated with a sealant.

D. Improvement Experience - Production Test IP-247-A-8FP, "Irradiation of 1.47% Enriched Self-Supported I&I Fuel Elements in Ribless Process Tubes" - The self-supported test slugs were discharged from four ribless tubes and the test was terminated.

Production Test IP-34-A, "Evaluation of Slugs Having Projections for Use in Ribless Process Tubes" - Five ribless process tubes were charged with projection slugs. Ribless Tube No. 1880 was removed for corrosion evaluation and was replaced with a ribbed tube.

Project CG-817, "Crossheader Differential Indicators" - Work continued on the installation of the annunciator alarm system.

Project CG-791, "Reactor Confinement" - Excavation work for the filter building was completed, and work was started in preparing the concrete forms.

E. Radiation Monitoring Experience - Rupture removal work resulted in skin contamination as high as 50,000 c/m and protective clothing contamination to a maximum level of 22.5 rads/hr; personnel exposures were kept to less than 50 mrad by prompt removal of the clothing. Rupture removal resulted in contamination levels on the rear face as high as 300 rads/hr.

F. Events Influencing Costs - Approximately 772 hours of overtime were used because of the difficulties encountered in rupture removal. Helium consumption continues to be high despite repair of several gas leaks.

C PROCESSING OPERATION

A. Production - Input production was 89.5 percent of forecast, and TOE was 73.0 percent. Power level was controlled by an Operating Severity Index rupture control limit.

B. Operating Experience - Six unscheduled outages were experienced; a scram recovery was made on one.

<table>
<thead>
<tr>
<th>Day</th>
<th>Hours</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>39.9</td>
<td>Rupture - tube 2875 (regular I&amp;I slug). Discharged with the charging machine after backseating.</td>
</tr>
</tbody>
</table>
**Day** | **Hours** | **Event** |
---|---|---|
6 | 33.1 | Rupture - tube 2276 (regular D&E slug). Discharged with 15,000 pounds force. |
10 | 66.7 | Rupture - tube 1478 (regular D&E slug). Discharged with 12,000 pounds force. |
14 | 28.5 | Rupture - tube 0765 (regular D&E slug). Discharged with the charging machine after backseating. |
15 | 0.9 | Panellit trip on 3867, cause unknown. |
29 | 18.9* | Rupture - tube 3087 (regular D&E slug). Discharged with the charging machine after backseating. |

*Outage continued over month end.*

**C. Equipment Experience** - Borescoping of VSR channel 19 revealed several 3X balls lodged in cracks between the tube bearing and filler blocks; testing of the ball 3X system was temporarily discontinued to permit corrective action.

22 faulty exit thermocouples required repair before reactor startups. The positioning motor on the Low Level Neutron Flux Monitor in H hole burned out and was replaced. Ten process tubes were removed (two due to ruptures) and replaced; seven were ribless zirconium tubes and three were aluminum tubes.

**D. Improvement Experience - PT-IP-272-A - "Pilot Test of Self-Supported Fuel Elements in Ribless Zirconium Process Tubes"** - Tubes were installed in channels 1069, 1076, 2264, 2289, 3427, 3773, and 3774; all tubes were charged with self-supported fuel elements. CG-791 - "Reactor Confinement" - The base slab for the filter building was poured. Replacement Panellit gauges were installed on rows 35 and 36.

A communication paging system was installed throughout the 105 Building as the first phase in a modification program. An instrument was installed in the control room which records the average outlet temperature of 20 selected tubes to assist in maintaining constant power level.

**E. Radiation Monitoring Experience** - A shielding plug was found removed from the D machinery floor; the dose rate at the hole was 120 mrem/hr. A truck, parked outside the exclusion area, was found contaminated to 8,000 c/m. A maximum personnel dose rate of 2,000 mrem/hr was encountered during rupture removal work. The Y and D hole facilities were charged with a maximum personnel dose rate of 1,500 mrem/hr. There were seven reported cases of skin contamination, and all were easily decontaminated. There were two cases of personal clothing contamination, but neither item could be decontaminated.
E. Events Influencing Costs - 342 hours of overtime were required.

POWER OPERATION

A. Operating Experience - 100-B Area continued to carry the raw water export load to the 200 Areas. Filtered water quality was maintained without difficulty. No. 1 boiler at 184-B was inspected by a representative of the Travelers Insurance Company. The two prototype Bauxite Feeders were in service for 22 days with excellent results.

B. Equipment Experience - The synchronous motor stator inspection at 190-B was completed on No. 2-A and 7-A Units. No. 1 and 2 process motors at 183-B were overhauled off-plant, including straightening of shafts and dynamic balancing. No. 11 and 12-C river pumps were class A overhauled. No. 6 north backwash valve in 183-B was replaced. The north and south surge suppressors in 182-B were completely overhauled. Two of the 2300 volt secondary feeder lines (from No. 2 transformer) burned through causing a momentary power outage at 183-B pumproom.

C. Improvement Experience - Modification of the 183-C filter control instrumentation was completed. No. 7-A impeller assembly in 190-B Annex was replaced with the new-design impeller assembly; replacement of 6-A was started. Work was started February 11 on CGI-845 (Increased Pumping Capacity at 181-C); fifty percent of the old Rowan switchgears were removed and excavation was started for the pump base reinforcement and to increase the pad size for the transformer change over. Work on converting to liquid dichromate use at 183-B was started February 22.

D. Events Influencing Costs - Chemical costs were down due to the use of bauxite feed at 183-B.

MAINTENANCE OPERATION

A. Outage Experience - Of the 363.5 outage hours at B-C Reactors, 43 percent were devoted to reactor maintenance. The major work accomplished was: 105-B - 2 ruptures were removed, 209 venturi assemblies were changed, an Omega seal gas leak was repaired and two tubes were removed. 105-C - 7 ribless Zirconium tubes were installed, 5 ruptures were removed and eight tubes were removed.

B. Equipment Experience - Of the seven ruptured fuel elements, three required extensive removal efforts and the other four were relatively easy to remove.

Inspection of the No. 7 process pump motor (4500 HP) at 190-B-A required minor coil rewinding and tying of the bull-ring; a new impeller was installed in the pump as authorized by Project CG-558 and the pump assembly was equipped with a vendor-modified casing head and casing, a new shaft and new bearings.

C. Improvement Experience - Extensive foaming was done with unicellular silicone rubber on the discharge area components at 105-B;
points foamed were the Omega seal at 2-½ crosshead, bellows seal, and graphite thermocouple junction box. At 105-C the remaining two 32-mesh backup water screens were replaced with 8-mesh screens; this completed the 105-C screen changeout.

D. Maintenance Engineering - Sampling of exhaust air at 105-B confirmed that approximately 90% of the gas loss is through the rear face. Efforts at gas loss reduction were continued with the removal of obsolete instrument lines and tightening of instrument line fittings. The gun barrel bellows drill with a 60 degree angle head, the 500 Semkit cartridges, the Semkit mixer and 50 special spiral ground drill bits were received and tested; a mechanical operator for the Semkit and bearing blocks for the drilling operation were designed, fabricated and tested; the drill bits were returned to the vendor for the second time to be reground.

Design Change No. 176-C, Instrument Supply Revision-105-C, was approved and issued; it will permit the revision of the alternator control circuit to provide for automatic start of the alternator in the event of an extended EPA power failure.

Incoming Line Fault - 183-C Building: A three phase fault on the incoming line feeder to the 183-B Building resulted in a trip of breaker C2-X9 in the 15L-B Substation on February 5. Three 500 MCM cables were burned open in a junction box outside the switchgear room and the conduit and junction box were badly damaged, but the exact cause of the fault could not be accurately determined because the evidence was destroyed by the fault. It can be assumed, however, by inspection of the remaining wires, that the insulation of the failed wires had been damaged by the weight of the cable pressing on the edge of the conduit bushing. The remaining wires showed indentation of the insulation at the bushings due to cable weight and stress. An MJM has been submitted to replace the structure and incoming lines.

F. Planning and Scheduling - Of 9,169 manhours of Productive Maintenance scheduled, 90% was completed.
III. D-DR REACTOR OPERATION

GENERAL

A. Administration - Coordination was provided for submittal of appropriate D-DR Reactor Operation Key Personnel Appraisals. Practice assemblies of 100 Areas Emergency Rescue Crews were held on February 16 and 17. Each of the four shift groups participated to determine the efficiency of notification and response under varying conditions.

B. Suggestions - In process at beginning of month 39, submitted 15, reopened 1, completed 6, in process at end of month 49.

C. Personnel Development - The guide outline for Technical Graduate rotational assignments in D-DR Reactor Operation was issued during February. At month end no technical graduates were assigned to the Operation. Development of an informational program designed to acquaint exempt employees with NPR design and operation aspects was in progress.

D. Cost Control - The D-DR Reactor Planned Maintenance and Equipment budgets for FY-1961 and FY-1962 were reviewed to bring totals to a figure commensurate with the proposed IPD budgets. Expenditure patterns in Planned Maintenance were analyzed and budget categories revised with the result that a substantial reduction in the FY-1961 budget was made with a minimum of cancellations. A study was made of operating costs for the balance of FY-1960 in order to identify possible means of reduction should the need arise in order to meet the budget. The monthly D-DR Reactor Operation cost meeting was held on February 23. W. D. Richmond, discussed the Cost Analysis for January and the current status of the D-DR Reactor FY-1960 Operating Budget.

E. Landlord - The metal flashing around the entire roof of Building 186-D was reanchored during the month. This work was necessary to eliminate a safety hazard caused by recent high winds blowing loose sections of the flashing.

D PROCESSING OPERATION

A. Production - Input production was 109.8 percent of official forecast. Maximum operating levels were limited by a tube power limit. A new maximum level, 55 units above the previous high, was attained during the month. Time operated efficiency for February was 86.7 percent.

B. Operating Experience

1. Operating Continuity

There was one scheduled and one unscheduled outage in February for total downtime of 92.8 hours.

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1-60</td>
<td>26.9</td>
<td>Continuation of January outage</td>
</tr>
<tr>
<td>2-21-60</td>
<td>65.9</td>
<td>Dual area trip-out tests</td>
</tr>
<tr>
<td>Total</td>
<td>92.8</td>
<td></td>
</tr>
</tbody>
</table>
Operating Experience (Cont.)

The first outage was spent working on problem channels, charge-discharge, replacement of two rear ball valves, and cab removal. The reactor was shutdown February 21 for the scheduled production test PT-301-I, II "Dual Area Trip-out Test". Test I - decay onto steam pumps proceeded without incident. Test II - decay onto high tanks and raw water system likewise proceeded without incident. Three steam pumps on the raw water system were sufficient to supply approximately 5500 GPM per reactor (D-DR). An analysis of D-DR backup systems is being completed by Research & Engineering based on the test data. Five orifices were found partially plugged following raw water entry into the pile during the production tests, and were cleaned prior to start-up. Other outage work included charge-discharge, replacement of 7 process tubes, probologging of 56 tubes, replacement of 15 front pigtails, and miscellaneous leak repairs.

2. Equipment Experience - Seven tubes were replaced because of thin walls. Probologging verified that one to 5 percent of the central tubes are corroding twice as fast as previous corrosion theory would predict. Fourteen front pigtails were found with broken braids. No. 5 horizontal control rod failed to scram in during the February 21 shutdown. Exercising the hydraulic scram valve corrected the difficulty.

C. Improvement Experience - PT-IP-301-I, II - "D-DR Dual Area EPA Trip-out Test" - This test was performed without incident during the 2-21-60 outage. All data collected was delivered to Research and Engineering for analysis. CG-706 - "Improved Gas Instrumentation" - All instrument line work in the 115 gas tunnel requiring simultaneous gas system outages at D-DR reactors was completed during the 2-21-60 outage. CG-707 - "Sub-Critical Flux Monitor" - The second chamber was installed in "B" hole in place of the PC-triple chamber completing chamber installation at 105-D. Two channels had a sensitivity of less than 10 watts during the last start-up--a large improvement over previous start-up instrumentation. CG-806 - "Improved Nuclear Instrumentation" - The stop gap power-rate-of-rise instrument was installed in its permanent position and connected to ten rear face RTD's. CG-791 - "Confinement Project" - The sub-contractor continued excavation for the filter building, and drove piling to prevent slumping from the 115 building sub-grade.

D. Radiation Monitoring Experience - One lapse of radiation control occurred when contamination up to 60,000 c/m was found on the shoe of a Processing employee while moving buckets of perls in the storage area. Significant dose rates received were 2r/hr at the spline chopper and 2.5r/hr pulling a vacuum hose to the top of the reactor after work on a problem channel. Three cases of shoe contamination and one of floor contamination at the wash pad were reported, both low level.

E. Events Influencing Cost

1. Overtime

<table>
<thead>
<tr>
<th>Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonexempt shift overlap</td>
<td>15.5</td>
</tr>
<tr>
<td>Nonexempt shutdown coverage</td>
<td>275.9</td>
</tr>
<tr>
<td>Exempt</td>
<td>67</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>358.4</strong></td>
</tr>
</tbody>
</table>

DECLASSIFIED
E. Events Influencing Cost (Con't.)

2. Essential Material - Helium losses were about 20 percent over the January loss. The increase was due to need for higher helium concentrations at the higher power levels and purging necessary during a period when dew cell monitor maintenance work was in progress.

DECLASSIFIED

DR PROCESSING OPERATION

A. Production - Input production was 82.5 percent of the official forecast. Time operated efficiency was 83.4 percent of forecast. Production was significantly lower than forecast due to eight unscheduled outages. Tube power limits were increased on February 24. The maximum power level at DR during the month exceeded the previous high by 70 MW.

B. Operating Experience

1. Operating Continuity

Operation was interrupted by eight unscheduled outages during the month:

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1-60</td>
<td>0.1</td>
<td>Changing of burned out indicating light in 3685 PCCF tube circuit caused reactor scram due to faulty equipment.</td>
</tr>
<tr>
<td>2-1-60</td>
<td>45.2</td>
<td>Shut reactor down to remove a HAPO-18½ sample which was stuck in PCCF tube 2173.</td>
</tr>
<tr>
<td>2-3-60</td>
<td>1.4</td>
<td>Manual scram required due to a faulty thermocouple on tube 3874 which gave a very high temperature indication.</td>
</tr>
<tr>
<td>2-4-60</td>
<td>0.7</td>
<td>Unexplained #1 safety circuit trip.</td>
</tr>
<tr>
<td>2-11-60</td>
<td>37.3</td>
<td>Shut reactor down when 086½ front venturi was found to be out 7/16” on the fitting at the crossheader.</td>
</tr>
<tr>
<td>2-13-60</td>
<td>0.3</td>
<td>Panellit scram on tube 1987.</td>
</tr>
<tr>
<td>2-18-60</td>
<td>127.6</td>
<td>Shut reactor down when it was found that 1367 front venturi was not seated properly. Performed block discharge during the outage.</td>
</tr>
<tr>
<td>2-24-60</td>
<td>1.5</td>
<td>Manual scram required by Phase III of bulk outlet temperature Tests.</td>
</tr>
</tbody>
</table>

2. Equipment Experience - Fourteen stuck charges were removed using forces from 2500 lb. to 4500 lb., during the block discharge of February 18. Twelve tubes were replaced, five for out of pile examination, three for overboring the channels, two water leaks, one vanstone leak and one damaged in stuck charge removal. Two outages were caused by improper installation of venturis, finding two holding by only two threads.
B. Operating Experience (Con't.)

Fourteen rear bellows were foamed, using a new method which drills a hole in the bellows rather than punching it. A significant improvement in gas loss was realized. In an attempt to remove a stuck potato drill from a problem channel a second drill became disconnected from the shaft and was left in the channel for lack of time. An obstruction, which developed in the "T" test hole equipment for the low level flux monitor, was removed, restoring the chamber to normal service.

C. Improvement Experience - PT-IP-291AR - Graphite Channel Overboring Demonstration - Graphite channel 0767 was successfully overbored using the overboring rig. An attempt was made to overbore 0773 but a universal joint on the equipment broke after 7.5 feet of graphite had been drilled. Both channels were returned to service with standard gumballs and tubes. PT-IP-294-C - Evaluation of Unit Flattened Zone Discharge at DR Reactor - The block discharge was performed during the 2-18-60 outage. As specified in the production test, critical was established prior to charging the additional enriched columns during the outage. PT-IP-301-I - D-DR FPA Trip-out Tests - The D-DR trip-out tests were performed near the end of the 2-18-60 outage completing this production test. PT-IP-278-A - Verification of Transient Bulk Temperature Surges at the DR Reactor - Phase IIIb of this production test was performed following the 2-18-60 outage without incident. The reactor scram caused by Phase IIIb was performed on 2-24-60. Phase II, which takes place immediately prior to an outage, is the only phase which remains to be performed. CG-791 - Reactor Confinement - The controls for the fog spray equipment have not been connected so that the rear fog spray can be actuated by a switch in the Control Room. Work was started on construction of the filter building. CG-706 - Improved Gas Instrumentation - Tubing was run in the gas tunnel from 115-D for this project. ABC-160 Recirculating Gas Loop - The fuel element in the gas loop was successfully discharged during the 2-18-60 outage and has been shipped off site. The loop temporarily shut down awaiting another element.

D. Radiation Monitoring Experience - Significant dose rates received were 2r/hr removing tube sections in the discharge area, and removing a filter box from the top of the reactor. One case of low level skin contamination was found and easily cleaned. Swearable contamination was detected on the floor of the X-2 level radiation zone. A probable source was an open box of waste left on the floor. There were no lapses of radiation control.

E. Events Influencing Costs - The overtime usage was 778.0 hours. Unit cost should be significantly higher than normal due chiefly to the large number of unscheduled outages during the month which lowered production and raised maintenance costs.

D-DR POWER OPERATION

A. Operating Experience - Boiler operation and water treatment were satisfactory during February. Addition of Separan was started at each water plant on February 8. Excavation for a 6" water supply line, to supply a new Fire station outside the area, was completed. An inspection of annex building pump gears was made by a representative of GE's Gear Department on February 19. All gears were found in good condition.
B. Equipment Experience - 189-D - A liquid alum test facility is nearly complete and ready for operation early in March. 181-D - Vent condenser tubes were replaced on the deaerator feed water heater. 190-D - Shaft and inter-stage replacement and realignment of No. 7 annex pump was performed and No. 4 removed from service for impeller and shaft replacement. 190-DR - No. 7 and No. 8 annex pump units were removed from service for impeller replacement.

C. Improvement Experience - Project GD1-796 - Reactor Confinement. 105-D Area - Re-routing of the 225 psi steam line south of 105-D Building to the sectionalizing valve west of the 115-D Building was completed.

D. Events Influencing Costs - No unusual variance.

D-DR MAINTENANCE OPERATION

A. Equipment Experience - Source of January 31 outage at D Reactor was found to be a defective relay controlling temperature in the helium analyzer oil bath. Loss of this temperature control changed resistance value in the helium cell and put the recorder far out of calibration. Resultant gas makeup created the operating problems. Test equipment and communications were installed for the dual area trip-out test, with all installations functioning well during testing. Clearing of blocked tubes in 105-D presented problems during two outages with a potato drill left in one channel.

B. Maintenance Engineering - Independent Exit Bulk Temperature Recorder - Four resistance temperature detectors were installed for test purposes in the two exit water risers of DR Reactor. These will be utilized with a recorder in the control room to provide temperature readings independent of the present power calculator system. Gemino Graphite Stringer Installation - Final shipment of insulated lead wire is scheduled for March 7. Switch over to the new system will be accomplished as soon as materials are on site. Shop fabrication has been completed and field work not involving outage is done.

Modification of Control Room VSR Switch Panels - The new VSR switch panel was installed at 105-DR in February. Work at 105-D awaits sufficient outage time.

Bellows Trimming Tool - Much of the gas leakage at 105-D Reactor occurs at locations where synthetic rubber boots have replaced the gun barrel bellows. A replacement bellows has been designed which should give the equal of new bellows reliability. To install this bellows requires that the jagged remains of the original bellows be removed. A tool for this purpose is now being designed.

Charging Machine Improvements 105-D-DR - Plans are being formulated to provide improved hose reels and troughs for the hoses and improved torque arm mechanism for 105-D and DR. Two special long stroke cylinders are currently being assembled and will be tested during the next outage at 105-DR.

Improved Spline Disposal 105-D - Detailed drawings have arrived and subsequent discussions have been held with P. B. McCarthy of Mechanical Development concerning spline coiler for D-Area. Installation drawings for D-Area are currently being prepared.

C. Planning and Scheduling - During the month 159 Class A, 272 Class B, and 598 Class C inspections and overhauls were made. Class A inspections are high because 189-D was shut down and opportunity offered to overhaul equipment in that building.
D. Events Influencing Costs - The overtime usage for the month:

Nonexempt - 1076.1 hours
Exempt - 320 hours
IV. F REACTOR OPERATION

GENERAL

A. Personnel Development

Training activities during the month consisted of the following courses attended by exempt and nonexempt employees as indicated.

<table>
<thead>
<tr>
<th>Course</th>
<th>Nonexempt</th>
<th>Exempt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rescue Training</td>
<td>5 (1 Power)</td>
<td>(4 Maintenance)</td>
</tr>
<tr>
<td>Ball 3X Modifications</td>
<td>15 (Electricians)</td>
<td></td>
</tr>
<tr>
<td>Tube Replacement and Rupture Removal</td>
<td>9 (Maintenance)</td>
<td></td>
</tr>
<tr>
<td>Gas Conversion</td>
<td>3 (Maintenance)</td>
<td></td>
</tr>
<tr>
<td>Imperial Tube Bending</td>
<td>3 (Maintenance)</td>
<td></td>
</tr>
<tr>
<td>IPD Fundamentals</td>
<td>1 (Inst. Trm.)</td>
<td></td>
</tr>
<tr>
<td>Job and Project Instrumentation</td>
<td>91</td>
<td>21</td>
</tr>
<tr>
<td>NPR Training</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PEM</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

B. Costs

Operating expense budgets for FY-1961 - 1962, including Personnel Overtime, Essential Material Consumption and Planned Maintenance, were submitted to the Financial Operation.

A review of services being rendered to F Reactor by Data Processing is currently being made to determine if a cost savings can be realized.

C. Landlord Activities

Remodeling of the 1713 Building was completed. Properties outside the new perimeter fence, which have now become identifiable with HLO and CEU, have been transferred to those Departments. The new partition and safety display case were completed at the new badge house. A new exhaust hood and fan were installed in the 105 Lunch Room.

D. Suggestion Evaluation

Suggestions on hand at start of month: 23; received: 14; evaluated and returned: 11; on hand at end of month: 26.

F PROCESSING OPERATION

A. Production

Input production was 92.9 percent of forecast, with a TOE of 68.8 percent. Equilibrium operation was limited by rupture control tube power limits.
B. Operating Experience

1. Operating Continuity

<table>
<thead>
<tr>
<th>Outage Date</th>
<th>Hours</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1-60</td>
<td>134.9</td>
<td>MJA-8 Ball 3X Electrical Modifications, tube replacement and charge-discharge.</td>
</tr>
<tr>
<td>2-6-60</td>
<td>1.4</td>
<td>Manual scram due to insufficient control rods at turnaround.</td>
</tr>
<tr>
<td>2-25-60</td>
<td>30.7</td>
<td>Rupture 1985-F.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total 217.0 Hours</td>
</tr>
</tbody>
</table>

2. Equipment Experience

a. Process Tube Replacement - One hundred fifty tubes were probologged, fourteen were removed because of previous probolog results, and 27 others were removed due to current results. Two additional tubes, one of which had contained a stuck-rupture and one a leaker, were also removed. Of the 43 tubes removed, 38 were replaced.

b. Ruptured Fuel Element

<table>
<thead>
<tr>
<th>Tube No.</th>
<th>Date</th>
<th>Max. Removal Force</th>
<th>Tube Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985-F</td>
<td>2-25-60</td>
<td>3800 psi</td>
<td>Tube removed and replaced.</td>
</tr>
</tbody>
</table>

c. Panellit Panel - Twenty-three new Panellit row relays were installed and system returned to normal.

d. Process Tube Probing - Traverse - Borescope - Graphite Curvature

1) A complete vertical traverse of 4676-F showed a significant increase in the curvature of this channel.

2) Tube 4272 passed a 12" probe, 4459 a 10", 4676 and 4688 passed an 11" probe.

e. Leak Experience - The entire pile was helium leak tested, indicating leaks on headers 8, 9, 19, and 25. Stinger testing of these headers resulted in locating one tube leak, four rear gasket leaks, and one front gasket leak. All gasket leaks were repaired by tightening nozzles.

f. Process Water System

1) Rear Face - Nineteen (6 + 13) rear face thermocouples were replaced. Fifteen rear pigtails were replaced as a result of leaks and a full rear face pigtail inspection.

2) Front Face - Nine far crossheader check valves were repaired. Two front leaking pigtails were replaced.
3) **Vibration Studies** - Pressure transducers were installed at three locations to gain information associated with the vibration studies of the rear face process water system.

g. **Rupture-Prone Metal** - Twenty-nine tubes of Lot SL-108-C were discharged. This lot contained metal from rupture-prone Lot KR-339-C.

h. **Graphite Stringers** - The previously stuck "3" stringer was removed from 1266-F at forces up to 8200 pounds. Geminol stringers were installed in 1266-F and 3484-F.

i. **1904-F** - Eighteen yards of grout were pumped beneath the 1904 outfall building to stabilize the foundation against deterioration from leaks. Several small leaks were sealed.

C. **Improvement Experience**

1. **UPI-817** - Crossheader Differential - Installation of the system was completed during the month.

2. **OCI-806** - Phase IV - Power Rate of Rise - Installation was completed during the month.

3. **HIP-279-AE** - Rear Vanstone Seal Inserts - Installed 37 inserts in tubes for further testing.

4. **MJA-8** - Ball 3X Electrical Modifications - Completed and accepted.

5. **Trip Out Test** - Completed trip out test to evaluate transient flow decay characteristics.

6. **PT-IP-188-C** - A test of start-up procedures with subcritical monitoring was completed.

7. **Design Change 306-F** - The Beckman Flux Monitor range limiting device was installed on all four Flux Monitors.

8. **Design Change 296** - The downcomer was revised according to the design change "Perforation of Baffles and Removal of the Vent." In addition, the annulus drain pipe was found to be leaking and was repaired.

9. **PT-IP-286-I** - One sliding sleeve adapter was installed on the rear of tube 2088-F to evaluate the performance and associated problems of installation.

D. **Radiation Monitoring Activities**

F Reactor Operation incurred three lapses of radiation control. Contamination up to 20 rads/hour was encountered on the interior of test nozzles during modification of the Ball 3X system. The non-penetrating radiation in the nozzles was readily shielded and thus did not present any significant control problem. Light sandblasting of the downcomer reduced radiation
levels from 150 mr/hour to 65 mr/hour for modification work. Seven of the twelve cases of skin contamination encountered during the month were received either during sandblasting or burning operations within the downcomer. All personal contamination cases were readily decontaminated and presented no significant personal radiation exposure. Reactor gas contamination on the top of the reactor was reduced to minimal levels by repair of WBR 27 hopper assembly, replacement of WBR 25 sphincter seal and general tightening of the top flanges of all hoppers.

F POWER OPERATION

A. Operating Experience

1. Tests of process water flow decay to steam pumps and to high tanks and raw water were performed from 1:39 p.m. to 5:36 p.m. on February 5 without incident. Additional boiler reliability data were collected in the first phase of the test. The test was observed by Walter Reed, Steam Power Plant Consultant.

2. The export water system pressure dropped to zero momentarily at 6:58 p.m. on February 5, due to operating difficulties in 100-H Area.

B. Equipment Experience

1. The 24-inch cone valve for the east raw water inlet line was replaced with a repaired valve on February 4.

2. Radiographic and ultrasonic tests of piping for boiler soot removal systems in 184 revealed some below minimum allowable wall thicknesses. Recommended replacements have been scheduled.

3. The No. 7 flocculator meter at the 183 Building was removed for rewinding on February 9.

C. Improvement Experience

No activity during the period.

D. Events Influencing Costs

1. Overtime - The total overtime reported during the month was 128.4 hours.

2. Other

   a. Replacement of the 24-inch cone valve on the east raw water supply line in the 183 Building.

   b. Class "A" inspections and repairs to the steam turbine in 190 Building.
F MAINTENANCE OPERATION

A. Equipment Experience

1. Instruments - Eleven temperature monitor system rear face thermocouples were repaired during the month.

Six gages were replaced in the pressure monitor system due to either bent drive arm, leaker or sticky dial condition.

Four hundred seventy Panellit gages were adjusted during the month.

2. Electrical - Extensive temporary wiring and setting of test equipment between 105, 151, 184, and 190 Buildings was undertaken for the area power trip out tests conducted this period.

Three new style underwater light units were fabricated for the reactor storage basin to undergo a testing period. A new style miniature 500 watt bulb manufactured by the General Electric Company was used.

3. Mechanical - Modifications of the reactor building downcomer were completed.

The removal of the tool dolly from the "D" elevator at the reactor building was completed.

Two new burial cribs were constructed.

A Russell-type adapter was installed on the rear of channel 2088-F for test evaluation.

Problem tubes 0259 and 0887 from previous outages were successfully reactivated and restored to service.

In addition to the "J" type pigtales replaced during tube replacement work, a total of 14 old style pigtales was replaced and, in addition, two front face pigtales were also replaced.

A new safety latch was installed on the "C" elevator gate to the metal elevator.

A helium gas bottle racker was fabricated to agitate the gas bottles prior to use.

A new acid line was installed from the head tank to the west rotameter in the 183 Building.

A Class "A" overhaul was completed on the 12 chemical feeders on the dichromate pumps at the 190 tank room.

B. Maintenance Engineering

1. Instrument Engineering

105 Beckman Range Limiting Switch - Design Change 306-F - Design Change
306-F has been incorporated into all 105-F control Beckman amplifiers. This revision eliminates the range switch stop pegs previously required.

105-F Design Change 203 - Installation of exit thermohms in the riser room cross tie was completed per design change 203. This revision now provides temperature measurement for the Foxboro calculator either ahead or after the downcomer.

107-F Effluent Radiation Monitor Chamber Relocation - Drawings were completed for relocating the 107 inlet chamber to the manhole at the 105 Building.

2. Electrical Engineering

105 Building Rear Face Television - The TV camera is in the process of being overhauled.

MJA-8 - Ball 3X Revision - Performed acceptance tests for the newly installed system per formal ATP.

184 Building Steam Export Underpressure Alarm - Design Change 351-F has been approved.

1717 Building Carpenter Shop Lighting - A new lighting design has been made (SK-1-4069) which will provide the HAFO Standard recommended level of 70 footcandles.

105 Building "C" Elevator Beckman Interference - By cleaning up and insulating the Beckman signal and HV leads (grounded only at Beckman) and installing interference filters on the Beckman 120 VAC branch and remote recorder circuit, it was found that the Beckman was not disturbed by operation of any "C" elevator electrical equipment. The "Cure" was substantiated during the last outage with a "no false trip" record.

F Area Trip Out Tests - Gave engineering assistance to various parties prior to test and followed operation of 184 Building emergency generator during test.

3. Mechanical Engineering

184-F Tank Car Chlorine Handling Facilities - Mechanical (H-1-12275) and electrical (SK-1-4075) drawings were completed. A capital work order (B-22222) for $4,205 was issued for the installation. However, General Accounting requested that no charges be made against this work order as the funds in the budget were depleted. Work on this job will continue when funds are available.

183-F Liquid Alum Feeding Facilities - A scope of the proposed installation has been made and drawings are being prepared. Arrangements were made to procure two 8,000 gallons S/S tanks from the 200 areas.
C. Property Control

A Quarterly Movable Property Inventory was prepared by the 100-F Property Representatives. All pieces of catalogued movable property were reported as located.

During the month, six property disposal requests were prepared for the disposal of various buildings throughout the area.

There were six Declaration of Excess forms prepared during the month, of which four were completed.

One Plant and Equipment Transfer form was prepared for transfer of the refrigerated air conditioning unit from the 1701-F Building to the 1717-F Maintenance Shop.

Twenty-two Property Disposal Request forms were prepared and completed during the month.

D. Events Influencing Costs

1. Overtime - Over-all costs are expected to indicate a rising trend due to the overtime involved in completing scheduled and planned maintenance activities involving the Ball 3X modifications, repairs to 1904, downcomer modifications, tube replacements, etc.

In maintaining the F Reactor facilities, a total of 2056.6 nonexempt overtime hours and 407.3 exempt overtime hours was required. Nonexempt personnel expended 108.7 overtime hours outside F Area.

2. Material - A total of 63 requisitions was issued at a cost of $3966. At month's end, 74 requisitions were outstanding which represented a cost of $18,150. Of this amount, $7504 reflects capital expenditures.
V. H REACTOR OPERATION

A. Cost and Budgets

Equipment budgets for FY-1961 revision and FY-1962 were submitted. Cost activities were routine during the month.

B. Personnel Development

Routine training classes were held for H Reactor Operation personnel.

C. Landlord Activities

Activities were routine during the month.

D. Suggestion Evaluation

| On hand at beginning of month | 22 |
| Received                     | 7  |
| Processed                    | 5  |
| On hand at end of month      | 24 |

* Total of 23 shown on hand at end of January was incorrect due to a miscount. Correct total should have been 22.

Processing Operation

A. Production

Input production was 3.6 percent above forecast. Equilibrium power levels reached 1890 MW which represented a new high for H Reactor. The tube power operating limit was increased from 1140 KW to 1150 KW.

B. Operating Experience

1. Operating Continuity

The operating continuity of H Reactor was affected by the events listed below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-8-60</td>
<td>36.4</td>
<td>Solid natural rupture, 0755.</td>
</tr>
<tr>
<td>2-10-60</td>
<td>0.8</td>
<td>To locate by-pass in Safety Circuit.</td>
</tr>
<tr>
<td>2-11-60</td>
<td>0.2</td>
<td>Panellit trip, row No. 8.</td>
</tr>
<tr>
<td>2-11-60</td>
<td>33.0</td>
<td>I &amp; E natural rupture, 3661.</td>
</tr>
<tr>
<td>2-13-60</td>
<td>3.8</td>
<td>I &amp; E natural rupture, 0884.</td>
</tr>
<tr>
<td>2-13-60</td>
<td>0.3</td>
<td>Rear pigtail failure, 0281.(Panellit Trip)</td>
</tr>
<tr>
<td>2-16-60</td>
<td>32.6</td>
<td>Rupture - water leak in 2978, I &amp; E natural.</td>
</tr>
<tr>
<td>2-17-60</td>
<td>1.6</td>
<td>Panellit trip by rear loose cap, 3270.</td>
</tr>
<tr>
<td>2-17-60</td>
<td>2.8</td>
<td>Panellit trip by rear loose cap, 2675.</td>
</tr>
<tr>
<td>2-22-60</td>
<td>34.2</td>
<td>I &amp; E natural rupture, 2673.</td>
</tr>
</tbody>
</table>
2. Equipment Experience

Three (3) new process tubes were installed. These replaced tubes were damaged by ruptured fuel elements.

A total of six (6) ruptured fuel elements were removed. One (1) was a solid natural and the other five were I & E natural. Four of the failures were of the same can alloy, C54F, and occurred at 79 to 89 percent of goal exposure. A total of 248 charges, which included three separate lots using the C54F can alloy, were discharged at approximately 80 percent of goal because they were considered rupture prone.

Three stuck charges were encountered in the material discharged as rupture prone. A maximum force of 2500# was used to free the charges.

An additional 90 J-2 type rear face pigtail were installed. An old style duPont pigtail on 0281 failed during operation and caused a 0.3 hour outage.

Twenty-one front crossheader screens were examined and cleaned. A welding rod was found lodged in three of them. There was no significant flow restriction by foreign material.

Individual flow increases were made on 48 process tubes by converting from orifices to venturis.

C. Improvement Experience

Slug removal pans have been installed on both near and far pads.

A new self-locking nut has been installed on 25 tube thermocouples for the purpose of keeping the couples seated in the wells. There have been some instances of couples working out of the wells.

The second low level neutron monitoring channel has been installed to complete the installation for H Reactor.

There were still 20 central tubes charged with PT-225 - EN demonstration test material in the reactor at month's end. The material has demonstrated its intended performance and is scheduled for discharge on the next outage.

There were nine charges of PT-216, "Performance of Normal Production I & E Fuel Elements," in the reactor at month's end.

There were 96 charges of PT-243, "X8001F Alloy Aluminum Components," in the reactor at month's end.

D. Radiation Experience

Two Supplemental Crew operators received 50 m of exposure each by sitting on a box of poison pieces which they had failed to recognize as a source of radiation. This was the only lapse of radiation control at H Area during the month.
Evaluation of front face dose rates during reactor operation indicates a 60 percent increase in both gamma and neutrons over last year. Average rates are now 25 mr/hr and 5 mrem/hr of neutrons.

Dose rates up to 75 mr/hr from the rupture debris floating in the storage basin caused restricted entry to the storage area for several hours.

Because of the increased outage radiation zone work, personnel exposures are high compared to the pro-rated 3 r/yr curve:

<table>
<thead>
<tr>
<th>Group</th>
<th>Percent of 3 r/yr curve</th>
<th>No. above 3 r/yr curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operators</td>
<td>70</td>
<td>4</td>
</tr>
<tr>
<td>Radiation Monitors</td>
<td>115</td>
<td>5</td>
</tr>
<tr>
<td>Millwrights</td>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>Pipefitters</td>
<td>90</td>
<td>2</td>
</tr>
</tbody>
</table>

E. Events Influencing Costs

Overtime for the month consisted of 450.4 hours.

The use of "P" dummies has increased because of more frequent outages and higher operating levels.

Helium gas usage has increased because of the He ratio for reactor gas composition has gone up with higher power levels.

Power Operation

A. Operating Experience

A surge occurred on the export water system at 6:56 p.m. on February 5, due to a turbine tripping out at 182-H. 100-H Area was assisting with export water pumping in conjunction with trip-out tests at 100-F Area. Subsequent repairs have been completed to the turbine governor mechanism.

The average steam generating rate was 62,300 pounds per hour. An evaporation rate of 9.14 pounds of steam per pound of coal was attained.

Five pumps at 181 Building were tripped out during electrical relay tests on February 3. Operations were not affected since the equipment was immediately re-started.

Standard quality water was produced throughout the month with an average alum feed of 6.4 ppm.

No adverse operating conditions were experienced due to upstream Columbia River reduced flow-tests. On February 28, the flow at 181-H was reduced to 49,000 second feet at an elevation of 370.3 feet.

B. Equipment Experience

No. 4 river pump at the 181 Building was disassembled for an "A" inspection, primarily to determine excessive wear areas. The pump impellers were found
in good condition with very slight cavitation. Some wear was noted in the rubber guide bearings.

No. 14 west backwash valve in the 183 Building was replaced on February 9. The lime storage hoppers were emptied to the sewer since this material is no longer required and did not have any salvage value.

Rearrangement of the coal storage pit at the 184 Building was completed during the month and a physical survey was made on February 25. Results of the survey will be forwarded by Construction Engineering and Utilities Operation. Progress on the overhaul of No. 1 Boiler was slow during the month because of higher priority maintenance work. Arrangements have been made to replace the thin wall steam supply lines to the soot blowing elements as determined by Radiographics Operation.

Re-wedging of No. 1 Annex unit motor at the 190 Building was completed during the month. During this period, a faulty pump gland seal was repaired, the first stage wheel was polished, and straightening vanes were installed in the pump suction line. No. 8 pump runner was inspected by Facilities Engineering and vendor representatives after approximately one year of operation. Inspection results will be documented by Facilities Engineering Operation. An inspection was made of all eight annex pump unit gears by a vendor representative on February 16. A detailed report will be forwarded by him. A telemetering instrument for 100-H Area total electrical consumption was installed by Minor Construction forces. The work is approximately 60 percent complete.

C. Improvement Experience

A supply of Separan 10 was received and mixed during the month. This material is approved as a potable water additive and will release one filter for regular production during bad water seasons. An improved Separan feeder is also being installed.

H Power vacated the north end of 17-13-H Building (warehouse) during February. This will provide additional storage space for H Maintenance organization.

H Maintenance Operation

A. Field Maintenance

Twenty-eight Panellit gauges were converted to 10-90 trip-range and installed to replace 21 defective like units and seven 25-75 range units. A total of 478 gauge lines were purged and oil replaced per equipment standard.

The Panellit gauge jumper replacement with silver-soldered plug is 90 percent complete.

The static switching was completed for the control room Beckmans; but on test, it was found that the No. 1 Safety Circuit could not be cleared. The system is out of service awaiting design changes.

Three new make-up water ion exchange columns were fabricated and installed, and a new "crud" cell (proportional filter) in the pile tube recirculating loop was installed for the KAPL-120 loop. The L & N temperature recorders for the pile tube fuel elements were also calibrated and a thorough check made of all circuitry.
The stop-gap power rate of rise instrumentation does not function correctly, due to moisture in the rear face RTD wire duct. This has been referred to Maintenance Engineering for corrective action.

The fabrication and installation of new lines for modification of the 110 Building Helium and CO₂ system is complete, except for tie-ins from high pressure systems to the low pressure tanks which will have to be completed during a reactor outage.

The 105 Building discharge area new elevator geared limit switches and troubleshooting test panel are fabricated and are 30 percent installed. The waterproofing of the elevator circuitry will be delayed until the new limit switches are installed to avoid duplication of work.

B. Maintenance Engineering

The 8-point deviation recorder for the 105 Building was received during the month and installation is currently under way. A selector switch required for monitoring one selected point continuously was not included with the instrument. The vendor was contacted and a new door is being sent equipped with the proper switch. Following installation, the old deviation recorder will be returned to the vendor for exchange credit.

Materials have been ordered for the Geminol graphite thermocouple stringers. Instructions were prepared and issued to Central Maintenance for modification of two inlet gunbarrels and for fabrication of three front flange assemblies. Assembly of stringers is scheduled to commence as soon as materials are received.

The Panellit-Beckman Interlock system was installed but, following completion, was found to be inoperative. Subsequent checks disclosed that the Beckman chambers had been changed to new operating positions which invalidated use of the Panellit-Beckman interlock as presently designed. Electrical Development has been advised and is considering future action.

A design was developed to permit installation of the spare horizontal control rod induction regulator at the main 105 Building control panel. This will permit rapid interchange of the horizontal control rod control function in event of breakdown of a regular control unit. Rough sketches of the proposed change have been made. The engineering work should be completed during March.

The 105 Building rear face pad trays were installed during the month; however, more protective shielding will be required in order to prevent a slug from falling behind the trays. This will be installed as outage time permits.

A design change was prepared for relocation of the fresh air compressor to the outer horizontal control rod room, and for relocating the 25-hp service air compressor to the ventilation supply room as part of the Maintenance Shop Study. The change is being circulated for approval signatures.
Central Maintenance

A. Engineering and Planning

A mist coolant attachment was devised for use in the Hot Shop to enable grinding of carbide with diamond wheels. A tool for deburring of triangular perfs and a zirconium tube gauge for C Area were designed. Facilities Engineering Operation's Mechanical Development was assisted in designing a zirconium tube mandrel and tube Van Stone remover. The Reactor Tool Manual, in its revised classified form, was submitted to Classified Files. Facilities Engineering Operation of the Chemical Processing Department was assisted in writing specifications for fabricating a special guillotine for use in the Department. An over-all survey of roof, flashing and rotted wood structure repairs was made in preparation for planning an over-all Central Maintenance approach to the problem.

B. Shops

Hot Shop work included repairs to rear face caps, spline caps, pickup tongs, venturis, nozzle bolts, splitters, and broaches. Work was also done on MJA-8 hot equipment, overboring equipment, ball valve leak testers, a pump and meter assembly for the Hanford Laboratory Operation, and heaters from the Construction Engineering and Utilities Operation.

Project fabrication work included work for projects MJA-8 and CG-617.

Self-supporting stringers for 105-C and five special stringers for other areas were fabricated. Eight special fitting assemblies for NPR were made. Two turbines, one pump assembly, and two river pump shafts were metallized. Seventy-five gunbarrel flanges were modified. Tube holding mandrels and nozzle closure test components were fabricated. One set of river pump impellers were installed and balanced and straightened shafts for same. Fabrication of crossheader valve operators, spline reels for KW, and decontamination tanks for C Area were completed.

C. Project and Special Services

Project activity included: CG-666 - C Area; CG-706 - C, F, D and DR Areas; CG-707 - C, D, H and KW; CG-806 - C and KE; CG-817 - B, C, D, F, H and KW; CG-839 - KE; CG-865 - F; MJA-8 - B and F.

Routine painting was done at D, DR and H. Overboring of channels at DR was performed. Routine scale and fire alarm system checks were made.

Blue nose removal was completed. Electrical work on Elmo-7 was continued. Vertical gamma prototype equipment, slug pans at H, exhaust ducts at B, D, and KER, and a spline duct at KW were installed.
A. Administration

Suggestion Plan Statistics for the month were as follows:

- Suggestions at start of month -- 64
- Received for evaluation ------- 17
- Replies submitted ------------ 32
- On hand at end of month ------- 49

A local adaptation of a "Can You Tell Me" column was initiated within the Reactor Operation in the interests of maintaining free communications. Six queries were answered during the month.

Candidates were enrolled for participation in PBM-1, FMS&L and Fundamentals of Manufacturing.

B. Costs

The following budget information was compiled and submitted to the Financial Operation as a basis for revision of the FY-61 budget and compilation of the FY-62 budget:

- Personnel and Overtime
- Essential Material Consumption
- Planned Maintenance Items
- Equipment Budget Items

C. Landlord Activities

The second phase of the painting program of landlord properties was completed.

Five excavation and core drilling permits were issued.

KE PROCESSING OPERATION

A. Production

Input production was 104.5 per cent of the forecast. Power level was limited by the rupture control tube powers. The maximum level was 70 units above the previous high.

B. Operating Experience

1. Operating Continuity

Reactor outage time totaled 150.9 hours. Operating continuity was affected by the following events:
B. Operating Experience (Cont'd)

<table>
<thead>
<tr>
<th>Day</th>
<th>Hours</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.8</td>
<td>Continuation of January outage caused by KER Loop No. 2 trip.</td>
</tr>
<tr>
<td>7</td>
<td>32.7</td>
<td>Rupture in KER Loop No. 1.</td>
</tr>
<tr>
<td>21</td>
<td>33.1</td>
<td>Rupture in tube 5556.</td>
</tr>
<tr>
<td>22</td>
<td>7.1</td>
<td>Rupture in tube 4645.</td>
</tr>
<tr>
<td>23</td>
<td>43.8</td>
<td>Process tube water leak and rupture in tube 4651.</td>
</tr>
<tr>
<td>25</td>
<td>0.7</td>
<td>Panellit trip.</td>
</tr>
<tr>
<td>26</td>
<td>0.7</td>
<td>Rupture in tube 1151.</td>
</tr>
</tbody>
</table>

2. Equipment Experience

a. Ruptures - Four ruptures were experienced, two solid elements, one I&N natural, and one I&N enriched. In addition, a fuel element failure in KER Loop No. 1 resulted in a scram of the reactor on February 7. The loop was discharged. Borescoping revealed some pitting of the tube. The loop was left empty until evaluation of the tubes condition is completed.

b. Process Water System - The following process water system work was accomplished:

   (1) Replaced tubes 2052, 4651 and 5556.
   (2) Completed revision of venturi and orifice.
   (3) Zoning to improve orifice efficiency.
   (4) Replaced five crossheader expansion joints.
   (5) Completed the inspection of the near side crossheader screens and check valves in accordance with Process Standards requirements.

   The reactor was shut down on February 23 with water leak indications. A total of 1,084 tubes were stinger tested in the suspected area, and 34 crossheaders were checked with the helium leak detector system. Tube 4651 was determined to be the leak and was replaced. By month end a total of 1,262 gallons of condensate was collected.

C. Radiation Experience

1. Radiation Occurrence

Lapse of Radiation Control experience was as follows:

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Number</th>
<th>Assigned Severity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE Processing</td>
<td>1</td>
<td>12</td>
<td>Contamination Spread</td>
</tr>
<tr>
<td>KER</td>
<td>1</td>
<td>8</td>
<td>Violation of Procedure</td>
</tr>
</tbody>
</table>

C-38
2. External Exposure

Dose rates of 1 r/hr or greater were required on eight occasions during the month. Two of these involved rupture removal at dose rates up to 3 r/hr.

An evaluation test of the remote monitor was initiated to determine if penetrating gamma indications, as measured by these fixed remote monitors, can be safely used to set dose rates and still maintain all necessary controls and limits.

KW PROCESSING OPERATION

A. Input production was 111.8 per cent of forecast. A new record maximum power level, 30 units above the previous high, was achieved. Nonequilibrium losses were reduced by charging splines in addition to temporary poison for start-ups.

B. Operating Experience

1. Operating Continuity

   Reactor outages totaled 122.0 hours. Operating continuity was affected by the following events:

<table>
<thead>
<tr>
<th>Day</th>
<th>Hours</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>34.5</td>
<td>Rupture in tube 3890.</td>
</tr>
<tr>
<td>23</td>
<td>60.2</td>
<td>Rupture in tube 2459.</td>
</tr>
<tr>
<td>26</td>
<td>27.3</td>
<td>Rupture in tube 2483.</td>
</tr>
</tbody>
</table>

2. Equipment Experience

a. Ruptures - The slug columns in tubes 3890 and 2459 moved using forces of 2500 psi applied with the charging machine. The charge in 2483 failed to move at 2500 psi and the tube and charge were removed using forces of 6000 psi. All three ruptures involved I&E regular metal.

b. Horizontal Control Rods - Number 2 HCR was removed and the channel was borescoped. No 3X balls were found in the channel. The step plug bearings were polished and the rod was reinstalled. The seisyns on all 20 rods were overhauled and checked.

C. Improvement Experience

1. Production and Process Tests

   The attainment of the new high power level was aided by the use of poison splines. Their use as a supplement to temporary poison lessened nonequilibrium losses. A temperature cycle that developed February 9, was controlled by the use of splines.
D. Radiation Experience

1. Radiation Occurrence

One lapse of radiation control, involving contamination spread to non-controlled zones, was experienced.

2. External Exposure

Dose rates to 1 r/hr were experienced during rupture removal and exploratory work on 2-C hole. The burial of balls from 2-C hole required dose rates to 3 r/hr. Dose rates to 1.5 r/hr were encountered during spline removal. Initial experience with the spline puller system designed to reduce personnel exposure was satisfactory.

KE-KW POWER OPERATION

A. Operating Experience

1. Electrical Peak Control

Peak control was maintained at 325 megawatts by maximum generation of two megawatts on February 18.

2. Number 2 Generator Failure, 165-KE

On February 2 during a reactor outage, the number 2 generator at 165-KE dropped its 1,000 kilowatt load. The unit was manually tripped off the line. After a cursory inspection, it was restarted and carried its load without difficulty. Subsequent examination revealed a groove on the commutator of the pilot exciter, deep enough that a sudden axial movement of the pilot exciter shaft could raise all the brushes simultaneously to a point-contact condition. The commutator was cleaned and smoothed.

B. Equipment Experience

1. Emergency Generator Number 1, 165-KE

On recommendation of the Worthington Corporation, a micarta disc was installed in the coupling of Number 1 emergency generator, 165-KE to eliminate the excessive oscillation of the generator shaft. Subsequent operation was satisfactory and the oscillation did not recur.

2. Anthrafilt Fines, 183-KE-KW Filters

To reduce filter head losses, one-half inch of anthrafilt was skimmed from the top of each filter, with beneficial results. Since this is a difficult and laborious process, tests were initiated to find an effective way to combat fines by special backwashing procedures.
3. Forebay Cleaning, 161-KE-KW

With the assistance of a boat and crew from Radiation Protection Operation, HLO, the river pumphouse trash racks were cleaned of an abnormal accumulation of debris.

C. Improvement Experience

1. CG-775 K Water Plant Expansion

A cam track was installed on the West backwash valve to close the waste valve while the backwash valve is closing. The change was made to save approximately one minute and twenty seconds on the backwash cycle and will also save filtered water.

KE-KW MAINTENANCE OPERATION

A. Equipment Experience

1. Equipment-caused Outages

A startup in 105-KW was delayed for 2.9 hours when "D" elevator was inoperable due to a dislodged key from a synchronizing shaft sprocket. The key was replaced and corrections were made to prevent recurrence.

2. Instruments

a. Panellits - Range changes or checks were made to 1,621 gages. In 105-KW, the range of 86 gages were changed from 10-90 trip to 25-75 trip. Guard rails were installed to protect the manifold valves from being inadvertently flipped in 105-KW, thereby completing the work in both areas.

b. Temperature Monitor System - Three RTD's were replaced in 105-KE and six in 105-KW. Eleven connectors and seven controller boxes were repaired in 105-KW and thirty controller boxes were repaired in 105-KE. One new lead was pulled down in 105-KE and two in 105-KW.

In 105-KE, a system was provided for continuously recording the temperatures of two tubes on one row during spline work and while running a map on the flexwriter. The change permits work on two splines to be carried on simultaneously.

3. Electrical

The following design changes were completed:

a. Design Change 312 - Charging Machine Interlock Bypass

b. Design Change 316 - Removal of Beckman Number 5 and Temperature Monitor From Safety Circuit

c. Design Change 317 - Riser Pressure Switch Replacement (Completed in 105-KE)
4. Mechanical

a. Process Tubes - Forty orifices were replaced with venturis in 105-KE.

After considerable time expended in 105-KE for leak testing of process tubes, HCR's and side-to-side test holes, a leaking process tube was removed and replaced.

b. Process Piping - Five rear crossheader expansion joints were replaced on the far side of 105-KE and two on the near side of 105-KW.

c. Spline Equipment - 105-KW - A spline coiling device designed to wind used splines on a small drum and drop them in "C" elevator pit was installed.

d. Charging Machines - 105-KE-KW - Revisions designed to speed up operation of the tube pushing head were completed.

B. Engineering

1. Graphite Stringers - 105-KE-KW - A study was made of the feasibility of installing a thermocouple stringer without use of graphite blocks through the reactor. Verbal approval was received from R&E. A review of construction, installation and removal aspects was begun.

2. Pressure Monitor System - 105-KE-KW - Pannelit row relay checks were made for drop-out time and insulation resistance between the opened row relay safety circuit contacts. Two faulty relays were replaced.

3. Station Service - 165-KE - Dual PJV relays were installed for automatic bus tie operation at the 480 volt switchgear to increase reliability. The relays also permit servicing without equipment shutdown. The installations complete the work in both 165-K buildings.

4. The following design changes were approved and issued:

   a. Design Change 346 - Temperature Monitor Power Supply Revision - 105-KE-KW

   b. Design Change 358 - "C" Elevator Photocell Bypass - 105-KE-KW

5. Inspection Procedures

The following Inspection Procedures were completed:

   a. Revisions to the liquid rheostat procedure to include the AK-75 shorting breakers.

   b. Revisions to the 165 building electrical power relaying system. Changes included separation of the 86-K relays to operate independently of each other and to add details covering the new relay types added for the 1500 HP low lift pump motor.
6. Inspection Procedures (Cont'd)
   c. A new procedure for switching the 125 volt DC power system at the 165-K buildings.

C. Planning and Scheduling

1. Class "A" overhauls completed included high lift pump motor brush assemblies in the 190 buildings, ERC selsyns in 105-KW including installation of sealed type bearings, five different pumps in 1706-KE-KER, the summer glycol pump in 165-KE and Number 11 and 12 flocculators in 183-KW. The inspections included the shorting breakers on the liquid rheostats in 190-KW and Numbers 1 and 2 generators in 165-KW.

SUPPLEMENTAL CREWS OPERATION

A. Events Influencing Costs

The non-exempt time distribution from February 1 through February 28 was as follows:

<table>
<thead>
<tr>
<th>AREA</th>
<th>PERCENT</th>
<th>HOURS</th>
<th>AREA</th>
<th>PERCENT</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-B</td>
<td>8.9</td>
<td>751</td>
<td>100-F</td>
<td>20.6</td>
<td>1762</td>
</tr>
<tr>
<td>100-C</td>
<td>17.4</td>
<td>1461</td>
<td>100-H</td>
<td>11.0</td>
<td>934</td>
</tr>
<tr>
<td>100-D</td>
<td>5.7</td>
<td>484</td>
<td>100-KE</td>
<td>8.8</td>
<td>748</td>
</tr>
<tr>
<td>100-DR</td>
<td>16.0</td>
<td>1368</td>
<td>100-KW</td>
<td>11.6</td>
<td>988</td>
</tr>
</tbody>
</table>

INVENTIONS

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

R. L. Dickerman, Manager
Manufacturing Operation
IRRADIATION PROCESSING DEPARTMENT
FACILITIES ENGINEERING OPERATION
MONTHLY RECORD REPORT
FEBRUARY, 1960

I. RESPONSIBILITY

There were no changes of assigned responsibilities during the month.

II. ORGANIZATION AND PERSONNEL

A. Force Summary

Employees on permanent roll 180
Technical Graduates (Rotational) 3
Technical Trainees 3

B. Personnel Activities

H. A. Kramer, Engineer, Plant & Industrial Engineering, returned from a leave of absence February 1, 1960.

Lewis M. Keene, Engineer, was placed on the rolls with Reactor Modification Design on February 4, 1960.

Elizabeth A. Tinker, Secretary, was placed on the rolls with Plant & Industrial Engineering on February 8, 1960.

Sharon A. Hodgkin, Secretary, Plant & Industrial Engineering, terminated on February 10, 1960.

C. Safety

Four medical treatment injuries were reported.
III. ACHIEVEMENT

A. Reactor Modification Design

1. Research and Development

The seismic vulnerability study of production reactor facilities as originally outlined has been completed by Holmes and Narver. Arrangements have been completed to extend the study to include an investigation of the seismic vulnerability of the graphite stack and shielding at 105-B, C, and H reactors. Twenty nine drawings have been transmitted to Holmes and Narver to aid in this study.

Preliminary scoping sketches have been prepared for a new seismic resistant last ditch pumping system to replace the existing high tanks and export system. B-C was selected as a typical area. The new pumps would be connected directly to the reactor manifold through an independent piping system.

A contract, SA-115, was negotiated with Washington State University to perform a study of the export water system on the McIlroy Analyzer.

Downcomer testing was resumed at Washington State University under Contract DDR-95. The existing downcomer model will be used to investigate the performance of downcomers at high temperatures. The final report of the testing performed under Contract DDR-41 was received.

The ceramic sleeves for the horizontal control rods at 100-K were not received from the vendor. Cancellation proceedings are now in progress. The order for the sleeves has been sent to seven other ceramic manufacturers for rebid.

2. Design Projects

A. CG-775 - 100-K Water Plant Expansion

Scope design for the total project is ninety percent complete. Ten scope drawings were approved by the Design Council and three were issued for comment.

The revised design high lift impeller was received on Plant and will be installed at 190-KE during the next available scheduled outage.
An analyzer study of the modified K area electrical system was performed at Schenectady during the month. The results of the study are being reviewed and will be issued in report form in April.

b. CGI-791 - Reactor Confinement

Overall design completion at the end of the report period shows 76 percent complete. Design completion percentages retrogressed during the month due to the addition of new drawings to the schedule. The schedule shows completion of Phase III design by April 1 and cleanup of all design work not affected by tie-ins by September 1, 1960.

Rear face instrumentation duct moisture protection drawings have been revised to include comments received from the field. Four electrical drawings were revised during the month. Two new drawings were issued, one detailing the installation of a welding receptacle in each filter building and the second, an orientation drawing locating auxiliary equipment in each filter building.

Phase III scoping is approximately 94 percent complete. Design Council approval was obtained for 32 scope drawings and the installation of two banks of high efficiency filters placed in series. Project Representatives approval was obtained for modification of the existing ventilation supply units to reduce the dust loading of the incoming air to the 105 Building. Supply intakes will be raised in all areas except 100-H where the existing intake is approximately fifteen feet above ground level. Preheat coils will be replaced in B, D, DR, and F areas to permit operation of the air washer on a year round basis.

Phase III detail design is 57 percent complete. Twenty four comment drawings and two approved drawings were issued during the report period.

The testing program is approximately 94 percent complete. Progress of the individual tests not previously reported as complete are listed below:
1. DT-1049 - Exhaust Air Filter Frame Seal

Tests have been completed on the test seal fabricated to the dimensions and material of the prototype seals on order and the sealing characteristics are satisfactory. The final report is being prepared.

2. DT-1050 - Environmental Component Testing

Test units installed in the 105-B and F exhaust tunnels to determine the effect of reactor exhaust air upon individual air filters and halogen collectors have been in operation approximately four months. An increase of .1" w.g. across the filter in 105-F was noted early in February but was not noted in 105-B. Since no adverse weather conditions occurred during the period it is assumed the increase is due to building activity.

3. DDR-68 - Halogen Collector Test Program-A. D. Little

All testing is complete and final report is being prepared. The test facility has been transferred to the Army Chemical Corps - Edgewood, Maryland.

c. CGI-879 - Modification of Fuel Element Test Facilities

A study of the emergency generator bus loads with the 1706-KER pumps at 274 horsepower rather than 200 horsepower was completed. The re-evaluation indicated the necessity that essential loads be balanced between the two generators supplying the emergency electrical system. The KER load has been shifted from the C-F buses as originally scoped to the B-E buses to equalize bus loads. Since each loop has two pumps operating in parallel each designed for full flow capacity, one pump on each loop will be tripped by electrical relay upon BPA failure to reduce the loading on the emergency generators.

Piping scope has been revised to include a single pass flow valve in each loop. The new valve which bypasses the dump valve will be manually operated and will be blocked to prevent operation at loop pressures above 1000 psi.
The drawings of the building addition have been returned by the Architect-Engineer for General Electric Company review.

The prototype nozzle assemblies have been completed at the 1717-H shops. Process tube assembly flow and pressure tests will proceed following fabrication of tube connector assemblies.

d. CGI-844 - 100-K Coolant System

The Design Council approved Project Representative Meeting Minutes No. 2 and four scope drawings covering the 190 steam turbine pump installation and the high pressure crosstie line modifications.

The diesel engines at the U. S. Naval Supply Depot, Clearfield, Utah were inspected on February 9, 1960. Horsepower requirements for the midway pumping station have been established as 1700 horsepower each if two pumps are used or 900 horsepower each if three pumps are used. The AEC has been requested to release the three original 1640 horsepower diesels and place a hold on three of the twelve cylinder, 940 horsepower diesels.

A study of the present 165-K boiler loading is in progress to determine if a limited steam rate will be required for the new steam turbine driven pump in each 190 Building.

e. CGI-883 - K Water Plant Expansion

Total project execution has been initiated by approval of a preliminary project proposal for funds in the amount of $297,000. This phase of the proposal provides for the installation of one modified pumping unit at 190-KW and initiation of detailed design for the complete project. Requisitions have been placed for all engineered items. The purchase of the pump components is being negotiated by HOO-AEC.

3. Visitors

Mr. Weller Reed, Consultant, of Weller Reed Associates, Los Angeles, California visited HAPO on February 6, 1960 to discuss gas turbine application to emergency pumping service.
4. Trips

D. F. Watson visited the U. S. Naval Supply Depot, Clearfield, Utah on February 8 and 9 to inspect excess diesel engines.

W. J. Tupper visited the Washington State University, Pullman, Washington on February 9 and 25 to initiate a study of the export water system on the McIlroy Analyzer.

5. Significant Reports Issued


HW-63873 - "Rear Crossheader Fitting Inspection - B, D, and F Reactors" - February 10, 1960 - F. J. Kempf - Secret
B. Equipment Development

1. Existing Reactor Work

A second, successful, attempt was made to overbore the DR channel on which the first attempt was aborted. Approximately twenty feet - the previously unbored length - was bored out in thirteen minutes operation with a carbide tipped cutter using slow speed and heavy feed. The tool was not visibly dulled. Although the experimental equipment is not optimum for these speed-feed rates, as evidenced by mechanical failure on the second channel attempted, this is regarded as conclusive evidence that overboring is technically feasible.

Flanging and trimming tools developed for installation of smooth bore zirconium tubes at 105-C were again demonstrated by the successful placement of seven tubes making a total of nine currently installed at C Reactor. Difficulty with insertion of the zirconium tubes through the graphite indicated need for improved broaching now being studied. To assure ready tube removal capability in case of rupture damage, a development study of splitters and splitter starters was initiated. In support of the zirconium tube program charging machine design modifications were completed to charge self-supported fuel elements. The modified 105-C charging machine demonstrated a preliminary charging rate of approximately two minutes and thirty-eight seconds per complete tube charge on the first two laboratory runs. Increased rates may be attained without indexing slug position.

The poison spline coiler machine was demonstrated at 105-KW and except for deficiencies in the reel design, performed satisfactorily. An improved reel prototype was designed, fabricated in technical shops, and preliminarily tested with no problems. Comparative production data with and without poison splines has placed additional emphasis on the need for early conclusion of this development program and full plant application of this system for both start-up and flattening control.

Twenty seven Van Stone seal inserts were charged into 105-F reactor rear face process tubes on February 6, 1960. The inserts are fitted with two kinds of silicone sleeves, Dow Corning Silastic 2096 and 6508. Ten of the inserts were charged in tubes scheduled for discharge during the next outage. The on pile test will evaluate the effects of hot water and radiation on the silicone materials and the effect on the charging of the reactor with fuel.

Operational leak detector equipment has been received. The equipment will be assembled and tested prior to testing on the reactor.
2. New Reactor Work

Development and testing were completed for decreasing the total rod insertion time. Speed increases were accomplished by removing flow restrictions (valves) from the hydraulic lines. Acceleration and deceleration pressures increased sharply to 8-9.5 g. Efforts will now be directed at improving low speed operation of the system.

Testing to date has led to the conclusion that any type of elastomer mattress pad is impractical. A test mat of chain mail has been fabricated and initial tests indicate some promise. At this date it would appear that a combination of a chain mail mat and a tip off to drop the element horizontal is the most promising concept.

The second fuel element, one which had been activated at HAPO, was ruptured in the ETR loop on January 22, 1960. No fission product emission was noted at the time of rupture. After a few hours operation with no indication of a rupture, the reactor power was lowered and raised rapidly to provide a thermal shock to the fuel element. Immediately after this, a small (5 mr) increase was noted on the GM tube gross gamma monitor and the presence of fission products was confirmed by the multi-channel analyzer. This signal started to return toward background in a few minutes. The reactor was operated a total of 15 hours after the fuel element was ruptured with no further emission of material from the element (no indication on fuel rupture detector).

Photographs were made of the above fuel element, and also of the first one that was ruptured, after the fuel elements had been sectioned through the rupture location. These show that in the order of one milligram of material was emitted from each fuel element. Since the GM tube detection these small emissions in both cases, it is concluded, tentatively, that the system has adequate sensitivity for NPR requirements.

3. Security Experience

None

4. Visitors

Mr. J. C. Flint and associates of Hughes Aircraft Company visited C. E. Frantz January 21, 1960, following their talk and film in 1707-B annex on their MCBOT II Manipulator.

Mr. G. Forrest of Marman Division Aeroquip Corporation West Los Angeles, California, visited the 189-D Mechanical Development Laboratory on February 4, 1960, to discuss piping couplings for NPR usage.
P. E. Ohmart, President of the Ohmart Company, visited J. W. Green and G. L. Erickson on February 2, 1960, to discuss the prototype nuclear battery type fuel rupture monitor.

Mr. J. Dharma Teja of the Technical Research Group, Incorporated, visited R. R. Henderson and C. H. Gydesen on February 18, 1960, in the 703 Building, 700 Area. The course of the discussion was the developing of a market for special materials being manufactured by his company.

5. Trips

R. F. Scheloske visited Norfin, Incorporated, Seattle, Washington, February 1, 1960, to check corrective work performed on the poison column displacement electric winches fabricated by Norfin.

A trip was made to Toronto - Peterborough, Ontario, Canada, by J. H. Fastabend from January 18 through January 22, to attend a joint AEC-AECL information transmittal meeting on power reactor engineering problems.

C. W. Higby made a trip to Gates Rubber Company and Denver Research Institute in Denver, Colorado; B. F. Goodrich and Goodyear Companies in Akron, Ohio; and U. S. Rubber Company in Passaic, New Jersey, to consult with experienced people regarding cushioning of NPR fuel slugs. This trip extended from January 31 through February 7, 1960.

J. W. Green and R. W. Gilmore visited the ETR site near Idaho Falls to conduct fuel rupture tests from January 16, 1960, to January 24.

Trip by A. J. Lindsay (with W. A. Richards conducting discussion) January 25 to 27, 1960, to Century Electronics, Tulsa, Oklahoma, to discuss NPR requirements for a visual display of rod position. Discussions were held with Bill Johnston of Century concerning their galvanometer light bar display.

C. A. Munro visited APED in San Jose, California on February 11 to 13, 1960, for a job interview.

C. W. Petsford traveled to Salt Lake City, Utah on January 21 to 22, 1960, to visit the Christensen Diamond Products Company for procurement of diamond tooling, and the Joy Machine Company for consultation on overboring problems.

C. H. Gydesen visited the following firms on January 24 to 29, 1960, to discuss analytical and experimental problems associated with ceramic ball for reactor water system:
Lindsay Chemical Division and American Potash and Chemical Company in Chicago, Illinois; Electric Autolite Company and Metallurgical Laboratory in Toledo, Ohio; National Carbon Company in Cleveland, Ohio; and Norton Company, Refractories Division in Worcester, Massachusetts.

R. R. Henderson visited the following firms on January 19 to 29, 1960, to conduct engineering consultations: Wolverine Tube and Metallurgical Products, General Electric, in Detroit, Michigan; A. O. Smith in Milwaukee, Wisconsin; Lindsay Chemical in Chicago, Illinois; Electric Autolite Company in Toledo, Ohio; National Carbon Company in Cleveland, Ohio; and Norton Company in Worcester, Massachusetts.

6. Significant Reports Issued


HW-63152 - "Budget Study FY-1962, Improved Reactor Control (Reactivity Control)," R. F. Scheloske, 1-12-60. (Secret)

HW-63571 - "Design Test 1045 - NPR Process Tube Deflection and Insertion," C. D. Emmons, 1-25-60. (Confidential)

HW-63667 - "Preliminary Report DR-Type Charging Machine," C. A. Munro, 2-11-60. (Unclassified)

HW-63820 - "Development Test IP-306-K Spline Coilers at K Reactor," P. B. McCarthy, 2-11-60. (Unclassified)

HW-63821 - "Final Report - Design Test 1043 Test of Horizontal Rod Gunbarrel Assembly," R. F. Scheloske, 2-15-60. (Confidential)
C. Plant and Industrial Engineering

1. Drafting Operation

Summary of Drafting Operation services provided is:

- New, revised, as-built drawings: 162
- Sketches, layouts and charts: 92
- Microfilm drawings added or retired: 2595
- Film prints produced: 412
- Check prints produced: 989
- Catalogs added: 28
- Customers serviced print files: 319
- Customers serviced catalog files: 43

2. Industrial Engineering

Rear Face Improvements, 105-KE-KW

Improved handling system for rear face nozzle caps incorporates use of a gravity roll conveyor, nozzle cap trucks and cap trays used in conjunction with an engineered system of removing, servicing and replacing nozzle caps for charge-discharge activities. The installations of the new equipment at KE and KW are complete and similar equipment has been programmed for the remaining reactors.

Program of Charge-Discharge Improvement

Methods and procedure development work for charging with charge seaters is continuing. The two-dimensional models of all the "C" elevators have been completed.

The procedure for premarking the front face has been issued as an approved procedure.

Metal Unloading Ramp

An engineered system of unloading fuel elements and other material from delivery trucks at the 105 buildings is being provided at B, D, DR, and F. One ramp unit purchased from Magline Inc. of Pinconning, Michigan, has been delivered to 105-F and is being tested prior to ordering the three additional units for B, D, and DR.

Measurement of KE-KW Outage Work Performance

Complete coverage was provided for the KW outage of January 22-24. The purpose of this outage coverage was to obtain information for comparison of actual performance against scheduled performance and against engineered standard performance. A report was issued to the manager KW Processing, giving suggestions for improvements to enable future outages to conform to engineered standards.
3. Reactor, Plant Engineering

Charge Seaters - All Areas

Equipment to take the place of the charging machines during the seating portion of the charging cycle has been designed and tested. Overhead carriages and associated equipment have been delivered to all areas. Training of operators is essentially complete. The revisions to the charge seaters are underway.

Rear Face Connectors

Hycar "O" rings installed on J-2 connectors at H Reactor showed evidence of deterioration after only two months of service. Laboratory tests of these rings showed that durometer and tensile strength were lower than for test coupons previously checked. Sample lots of the "O" ring have been returned to the Goodrich Company for their analysis, further local testing is in progress and ordering specifications are being revised to clarify the characteristics desired in the final product. H Processing has been advised to use silicone "O" rings for the rear face connectors until the current problems on Hycar can be solved.

Access Hole Manipulators - 105-F

A shop demonstration model for a rear face manipulator to be used through a six-inch access hole has been designed for the 100-F Area Maintenance group. Fabrication sketches, material take-off lists and purchasing specifications were provided.

Rear Face Piping Problem, 105-B, D, DR, F and H

Pressure transducers were installed on a rear crossheader and on the inlet outlet assemblies on one of the process channels served by this crossheader at 105-F. Vibration pickups were also installed on the rear header. All of these points were monitored simultaneously on an oscillograph during a reactor start-up. Rear header pressure fluctuations and vibration appeared to increase with increasing reactor power level. The data were discussed briefly with Dr. R. Plunkett, Consulting Engineer - Vibration from the General Engineering Laboratory, Schenectady.
Inspection of Rear Risers

The 105-B rear risers were inspected on February 1, 1960. The rear riser had one suspect area which may be cracked and a sample line that should be secured. The far riser appeared sound. Recommendations for dye-checking the suspect area and for supporting the sample line were sent to B Processing Management.

Rear Face Connectors

The vendor for the replacement J-2 connectors for 105-H had considerable difficulty in the heat treating and pickling operations. The trouble was diagnosed as improper heat treatment. A longer annealing time followed by water quenching was recommended.

105-H Load Study

The final draft of this report has been completed. "As-built" drawings have been secured and the report is being distributed. This item is completed.

HCR "Deadman" Switch

A comment report was issued to all concerned showing the proposed design criteria for the "deadman" switch control. Most comments have been returned and a final report is being prepared. The total cost of the recommended circuit for all reactors is approximately $25,000.

4. Standards Engineering

Spare Parts

Stores Stock Requests Processed 3
Stock Adjustment Requests Processed 44
Maximum Authorized Dollar Value of New Items Added by SARs $6,491.
Maximum Authorized Dollar Value of Spare Equipment Requested by Letter to Project Engineering 50,600.
Maximum Authorized Dollar Value of Spare Parts Requested for Projects by SARs 178
Number of Engineered Spare Parts Items Reviewed 42
Number of Drawings Ordered Revised 3
Maximum Authorized Dollar Value of Items Deleted From Spare Parts Stock 2,123
Engineering Standards

At the request of IOO-B, C management, in conjunction with their current improved gas-handling program, the Standards Engineering Operation conducted a survey of Helium and CO₂ systems including vessels, piping and safety valves. This survey is the last in a review of all similar gas-handling facilities in the IOO Areas.

Craft Training and Manual Writing

A total of eight "Tube-Replacement and Rupture-Removal" classes were attended by seventy-eight millwrights, pipe-fitters, and maintenance supervisors.

5. Water Plant & Utilities Engineering

100-F, D and DR Decay Tests

Preparation for tests of flow decay to steam pumps and to high tank and raw water were completed, and the tests were performed in cooperation with other components. Tests were completed without incident. Data were obtained on flywheel, high tank, and raw water flow and pressure decay after trip of DPA power at the 151-F and D Buildings. Additional data showing pump speed decay, safety circuit trips, and steam pickup at 184-190 buildings was also recorded. All recording was "timed" so that a coordinated analysis can be made.

Gears - 4500 HP Drives

Assistance was provided to Mr. E. D. Heter, of the Medium Steam Turbine Generator and Gear Department, during his inspection of twenty-eight (28) of the subject units. No unusual conditions were reported. A formal inspection report is planned upon his return to the Lynn Plant.

Coal Utilization Standards

A test of the recently installed coal sampling equipment was made in a manner that permits a four-way check on the accuracy of result. The confidence level indicated by the results of this test was very high. These results were obtained for the purpose of having real numbers to disclose to any vendor who may question our method for sampling. Contract planning for FY-1961 coal procurement is currently underway. Information is being provided to Production Operation in order to assure continuance of the presently improved coal quality.

DR Far Downcomer

An inspection of the DR far downcomer on February 19 revealed that the downcomer, after approximately four months use since
DR Far Downcomer (continued)

the modification of complete tray perforation, vent removal, and beam cut out, was in excellent condition. There was no visible indication of cracking of the welds or any other part of the downcomer.

1904-F

During the last F Area outage, approximately 25 C.Y. of grout were pumped underneath and around the outlet end of the 1904-F outfall box, and the holes in the walls of the box around the outfall lines were caulked with lead, wood and grout.

6. Trips

W. W. Walker attended the annual meeting of the National Board of Boiler and Pressure Vessel Inspectors of the State of Washington held in Seattle on February 1, 1960.

T. M. Clement engaged in recruiting activities at Universities in Kansas and Iowa.

H. A. Kramer made three trips to Priest Rapids Dam in connection with the installation of the new river gage station.

7. Visitors

Weller Reed, boiler consultant, was at HAPO for the trip out test conducted in F Area on February 5 and 6.

E. D. Heter, of the Medium Steam Turbine Generator and Gear Department - Lynn, Massachusetts, was at HAPO from February 15 through 24 to inspect the 4500 HP Drive Gears.

Messrs. C. R. Beecher and D. F. Rawlins, representing Background Music Systems of Kennewick, visited 1704-F and 1717-F on January 29. Their visit was in connection with preparation of bid for proposed contract to supply background music in IPD.

8. Significant Reports Issued

HW-63665 (Unclassified), "Budget Study for Installation of Oil Burners in 184-B, D, F, and H", M. F. Johnson, dated 2/1/60.

HW-63932 (Unclassified), "Budget Study - Effluent Facilities, Lead Reactor", J. P. Corley, dated 2/16/60.
D. Project Engineering

1. Projects

CG-558 - Reactor Plant Modifications for Increased Production

182-PA Pump Test Stand Facility, 100-F Area

Drawings and specifications have been received and preparations are being made to start construction which will complete the test stand facility. When the test stand was authorized drawings and specifications were prepared and a lump-sum contract obtained for the construction. Upon completion of the lump-sum contract portion it was known that certain additional work would have to be accomplished to provide for additional piping, instrumentation and miscellaneous wiring before installing the main drive motor and gear box. All of the remaining work will be accomplished by J. A. Jones Company. This work will be scheduled for completion so that testing can be accomplished on a 190 process pump, DR-1, which will be removed from 190-DR, probably during May 1960, at which time a test pump from Ingersol-Rand is expected to be available on plant.

Process Pump Impeller Improvement Program

During this month all pump modification and impeller replacement work has been completed on all the DeLaval 190 process pumps except for DR-1, which has been reserved for subsequent testing. Also during the month process pump H-8 was opened for an inspection of the PW-1417-2 first stage impeller on February 23, 1960. This unit had operated for a period of 7400 hours--6623 hours of this were with straightening vanes located in the suction line. A detailed report has been prepared on this inspection, but in summary here there was some cavitation damage found which falls under the classification "damaging cavitation." It was noted that this damaging cavitation was found on the outboard vanes of the first stage impeller whereas the inboard vanes were uniformly marked with cavitation not nearly so serious. This pump was reassembled and will be re-observed periodically.

CG-666 - Zone Temperature Monitoring - 100-B, C, D, DR, F & H

Work on this project has now been completed to the point where project is closed out with certain exceptions. Money has been accrued to complete the exception items. The work remaining to be accomplished is principally at 105-C. Because of interferences on the rear face caused by the charge-discharge ball valve pattern, the zone temperature work in this area had to be deferred. The close-out date on this project was February 16, 1960.
CG-707 - Improvements to Reactor Nuclear Instrumentation - All Reactors

During this period the final channel of equipment was installed at 105-D on February 23, and a fault removed from the equipment at 105-KW so that all work on this project is now essentially complete and operating in a satisfactory manner. Some trouble has been experienced on the positioning screw which controls the flux sensing device. Before the project is closed out, we will continue to observe the action of these screws and be sure that there is no continuing problem.

CG-708 - Installation of Additional VSR's - KE and KW

This project was closed out during the month and funds accrued to accomplish certain modification work required to modify the air accelerated feature of the rods to a controlled speed type of rod. These rods will also be removed from the safety circuit. Although the project is essentially complete, the rods cannot be used in the manner originally intended because of graphite deformation in both 105 buildings.

CGI-791 - Reactor Confinement

Phase I - Fog Spray

Modifications to the sampling systems have been completed in all areas. The only work remaining on this phase of work is the installation of the permanent thermal duct shields.

Phase II-A - Site Preparation

All work on this phase of the project was completed on February 19, 1960. Cleaning up of minor punch list items is in progress.

Phase II-B - Filter Buildings

The R. B. Miles Company is approximately 12 per cent complete with their contract. Three concrete pours have been completed in F Area. Base pours have been completed in H, C, and B Areas. Excavation for the filter buildings has been completed in 100-DR. Excavation work in 100-D has been held up until cribbing of a black sand deposit can be completed.

Phase III - Ventilation Modifications and Tie-ins

A draft of the Phase III proposal was submitted to the IPD Review Board on February 18. Final revisions are now being made to the proposal.
General

Project Engineering has been conducting checks of buildings and stacks adjacent to the areas excavated for the filter buildings and underground ducts. To date, these checks have shown no movement of the adjacent facilities.

CAI-835 - Additional Office Space - 100-D Area

Final drawings have not yet been received by the Commission from the A/E which they have employed. We have reviewed the drawings in all stages and have made our final comments. In addition, all information which would be required from GE for the Commission to prepare a bid package and obtain the lump-sum contractor to modify and move the dormitory has been transmitted. It is believed that a contractor will be selected towards the end of March.

CGI-861 - Expansion of Electrical Distribution Systems - 105-B, D, and F Buildings

The purpose of this project is to provide design, procurement and installation of equipment to improve and adequately expand the 105-B, D, and F electrical distribution systems. Design is in process and a Specification HNS-7445 is in final preparation for the procurement of new substation equipment. Construction work will be assigned to J. A. Jones Company, and they have started preliminary work in the 105-B, D, and F tunnels.

MJA-8 - Ball 3X Electrical Modification - 105-B, D, DR, F & H

The purpose of this maintenance job is to modify and improve the ball 3X electrical systems at 105-B, D, DR, F and H. Installation of the first new system was installed at 105-F during an outage February 1 through 6. The work was performed in a very efficient manner and on schedule by Central Maintenance forces. Preparations are now in process for a similar installation at 105-B tentatively scheduled for March 14.

2. Project Proposals

Project Proposals Approved by AEC

CGI-883 Increased Process Water Flow, 100-K Area
(Directive issued, interim funds $297,000)

Project Proposals Submitted to AEC

CAI-868 Columbia River Scale Model
Rev. 1
CGI-887  Critical Mass Monitoring, All Hanford 105 Buildings

Other Projects Awaiting AEC Approval

CGI-869  Operational Charge-Discharge, C Reactor

CGI-884  Rear Face Crossunder Lines, B, D, DR, F and H (Informally approved February 18, 1960)

Requests Received for Project Preparation

CGI-844  100-K Area Coolant Backup
Rev. 1

CGI-883  Increased Process Water Flow, 100-K Area
Rev. 1

R-20930  Cask Handling Facility - 105-KW Building

3. CPFF Service Contract - Designated IPD Representative

We have issued eight new work orders, supplemented four work orders and made two project releases for a total of $154,452 to J. A. Jones Company in the month of February.

Of the eight new orders, they are classified as follows: 4 Davis-Bacon; 2 Maintenance; 2 development. The four non-Davis-Bacon jobs amount to $310 and were sent to J. A. Jones Company because they had the only facility available.

Since change-over to J. A. Jones management, October 1, 1959, the following amount of work was assigned to them: Work Orders - $233,464; Project - $273,960; A total of $507,424.

4. Safety Experience

One minor injury occurred which was reported to First Aid immediately.

E. Principal Engineers and General

1. Activities

The Specialist, Engineering Administration participated in the Company's engineering recruiting of BS and MS degree candidates at California State Polytechnic College, University of Nevada, and the University of California.
The Principal Electrical Engineer attended the AIEE convention in New York February 1 and 2, 1960.

2. Visitors

R. Plunkett, General Electric Laboratory, visited the Principal Metallurgical Engineer to discuss code applications and stress analysis of pressure vessels.

E. D. Heter, General Electric Company of Lynn, Massachusetts discussed materials of construction and heat treatment of gears with the Principal Metallurgical Engineer and the Principal Mechanical Engineer.

3. Trips

The Principal Mechanical Engineer visited the Priest Rapids Dam on February 18, 1960 to observe early evidence of cavitation in the draft tubes of the foreign built hydraulic turbines being installed.

The Principal Electrical Engineer visited General Electric, Schenectady, February 3-11 concerning the network analyzer study of the proposed modified 4160 bus to K plants (CG-775). The study is now complete and a detailed analysis report is being prepared.

IV. INVENTIONS

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report except as listed below. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

NONE

RT Jessen:msw
PERSONNEL PLACEMENT

Nine experienced BS/MS candidates were interviewed with four offers extended. Five offers remain open at month end. No PhD candidates were interviewed. Two exempt men transferred into the Department from other HAPO components and one transferred to another GE Department. There were two exempt resignations.

OFFICE SERVICE & PROGRAM ADMINISTRATION

Portable electric stapling equipment was obtained and made available to components in 100-B Area.

IPD paid a total of $265 in suggestion awards to 20 suggesters. The highest award was $50.

The sixth presentation of PEM-I and fourth Secretarial Proficiency class were completed in February.

COMMUNICATION

Mass communication activities included the publication of eight Management News Bulletins, one Round Table Guide, two IPD Employee Headliners, and two priority messages. Two IPD-OPGs and ten HAPO-OPGs were issued during February. GE NEWS coverage included 13 items about IPD activities totaling 265 column inches. Two Management Information Meetings were held during the month.

SALARY ADMINISTRATION

The Department's 1960 salary review was completed with all sections and the Department operating within prescribed guide ratios. Exempt employee appraisal data were analyzed and the distribution of appraisal numbers was judged to be satisfactory.

WAGE & BENEFITS

Participation in the benefit plans was as follows:

<table>
<thead>
<tr>
<th>Plan</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance Plan</td>
<td>99.9</td>
</tr>
<tr>
<td>Pension Plan</td>
<td>99.7</td>
</tr>
<tr>
<td>Stock Bonus</td>
<td>73.6</td>
</tr>
<tr>
<td>Savings &amp; Security Plan</td>
<td>97.1</td>
</tr>
</tbody>
</table>

Three employees retired during February. There were no deaths during this report period.

HEALTH & SAFETY

Three security violations occurred in February. No disabling injuries were reported but 96 medical treatment injury cases were treated. 100-F Area completed two consecutive disabling injury-free years February 20, 1960. Safety conditions at the 100-N construction site were inspected by AEC and IPD Safety representatives.
General Accounting

During February, one IPD employee attended a meeting of the Washington Society of Professional Engineers in Seattle, Washington. Expenses incurred for this purpose totaled $42. There were no charges incurred during February for attendance at offsite courses and seminars.

Consolidated IPD FY 1961 and FY 1962 Office, Photographic and Radiation Monitoring Equipment, forecasts and General Manager transmittal letter were reviewed with Manufacturing and Financial Managers and forwarded to the General Manager February 5, 1960.

FY 1961 and FY 1962 budget call letter for Equipment Not Included in Construction Projects was distributed to IPD Section and Sub-Section managers February 12, 1960.

Two project proposals of IPD plant acquisition and construction in the total amount of $890,000 were reviewed and recommended for Manager-Finance concurrence February 10 and 24 respectively.

Four appropriation requests in the total amount of $17,185 were received during February, 1960. Of the four reviewed, two were forwarded to C&A0, approved by G.E. Management and distributed, one was returned to the Manager-Manufacturing for incorporation with similar work in an equipment project and one was returned for signature and clarification of the economic justification.

Announcement of a freeze on Miscellaneous Capital Work Orders (PA&C) because of the commitment of all available funds was made in the Management News Bulletin February 25, 1960.

Two Assistance to Hanford authorizations were processed in February: AEN-IP-9-60, Concrete Leak Rate Studies (GKL) for $16,300, and AEN-IP-10-60, MPR Design Review (APED) for $60,000.

Product Cost & Budgets

A maintenance force breakdown for IPD at December 31, 1959 to show the comparison of effective maintenance personnel between reactor plants after allowing for assignments to other than reactor maintenance work, was prepared.

The weekly IBM work order overrun report has been replaced by a written report. The information contained on the IBM overrun report was duplicated.
on weekly work order cost to date runs from which the information is now taken. The new method saves approximately one half hour machine time per week, affords a better control and actually requires less clerical effort than the former procedure.

The Distribution of Maintenance report was revised effective February 1, to provide additional analysis information and to eliminate unessential detail. The number of pages was reduced from 18 to 8, saving considerable clerical effort in Accounting Operations.

Personnel Accounting

Total personnel force for the Department at February 28, 1960 was 2,199; an increase of 6 from January. Personnel by components were:

<table>
<thead>
<tr>
<th></th>
<th>February</th>
<th>January</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>1,709</td>
<td>1,708</td>
<td>1</td>
</tr>
<tr>
<td>Facilities Engineering</td>
<td>180</td>
<td>178</td>
<td>2</td>
</tr>
<tr>
<td>NPS Project</td>
<td>86</td>
<td>81</td>
<td>5</td>
</tr>
<tr>
<td>Research &amp; Engineering</td>
<td>166</td>
<td>168</td>
<td>(2)</td>
</tr>
<tr>
<td>Relations Practices</td>
<td>25</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Financial</td>
<td>30</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>General</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

| Total       | 2,199    | 2,195   | 6      |

Absenteeism for February was 2.6% of available hours and represented a decrease from 2.7% for January, 1960. Absenteeism statistics for exempt and nonexempt employees are:

<table>
<thead>
<tr>
<th></th>
<th>Sickness</th>
<th>Other Causes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exempt</td>
<td>0.8%</td>
<td>0.4%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Nonexempt</td>
<td>2.5%</td>
<td>0.7%</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

Total overtime hours worked by the Department during February was 12,782 or 3.6% of total hours available. The same statistics for January were 10,403 overtime hours worked or 3.0% of total hours available.

Tuition refunds amounting to $495 were refunded to thirty-three Department employees who had successfully completed graduate courses in the University of Washington Center for Graduate Study.

General

No inventions or discoveries were made during the month by Financial personnel.

Manager-Finance

SH Small:kd
I. RESPONSIBILITY

There has been no change in responsibility since last month's report.

II. ORGANIZATION AND PERSONNEL

A. Forces

<table>
<thead>
<tr>
<th>Employees on Permanent Roll</th>
<th>1-31-60</th>
<th>2-29-60</th>
<th>Net Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees on Permanent Roll</td>
<td>81</td>
<td>87</td>
<td>+6</td>
</tr>
<tr>
<td>Technical Graduates</td>
<td>2</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>Technical Trained</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NPR</th>
<th>Tech Grad (Rotational)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Transfers into Operation: 6
Transfers out of Operation: 0
Payroll Removals: 0

Field and Operations Engineering:

D. R. Resner transferred from H Maintenance, Manufacturing, into the Maintenance NPR group as a maintenance engineer. Sandra Abernathy transferred as a Steno-Typist and Rick L. Tramel as a clerk into the Drawing and Specification Control group. D. G. Hindman transferred into the Special Materials NPR group as a clerk and R. I. George and R. I. McAndrew transferred into this group as engineering assistants (presently on loan to HLO).

Process Design:

Technical Graduate D. W. Constable transferred out on rotation.

B. Safety and Security

No disabling injuries have been reported during the month and no security violations were reported.
III. ACHIEVEMENT

A. Process Design

1. Research and Development

The IBM Piping Flexibility Analysis Program is essentially complete. A number of test problems are being utilized to verify the ability of the program to calculate stresses and moments for various piping geometries. The main difficulty in the formulation of this program has been the ability of the computer to accurately invert matrices where round-off errors can be a problem. So far, 6 x 6 matrices associated with the simpler piping problems have been successfully inverted without much round-off error. Inversion of large order matrices occurring in complicated piping problems has yet to be tested. It is estimated that 78 x 78 matrices can be inverted. This size matrix would permit calculation of problems involving a combination of thirteen branch points and partial restraints.

2. Project CAI-816

Due to continued uncertainty regarding the long term graphite contraction under NFR operating conditions, a final review was made of design provisions which would permit accommodation of contraction in excess of the design criteria. Among the proposals which were evaluated was a method of supporting the process tubes from the top shield by means of replaceable zirconium alloy tubular hangers. The tubes, in turn, would act as beams to support the graphite between hanger locations. Brief analysis indicated that such a system could be designed with adequate strength to make maintenance of tube and control channel location and contour independent of graphite contraction effects. However, the consequences of a process tube rupture as well as problems in meeting earthquake criteria would be unacceptable. Therefore, actual changes resulting from the subject review were limited to items such as shortening of the process tube blocks, over boring of the tube entry blocks, provision of cleavage planes, and modification of the notch depth pattern to provide a more articulated process channel as well as maximum latitude for channel conditioning late in the life of the reactor.

During the month, representatives of Electric Boat visited HAP to discuss NFR piping design problems. A new proposal has been submitted by them for a review of the stresses in the primary piping system. A contract is being written which will insure that the more critical problems will receive priority attention and which will permit the work to be terminated at any point by GE.
2. Project CAI-616 (Continued)

Agreement was reached with the A-E during the month on a common specification for fabrication and erection of both the 105-N and 190-N portions of the primary piping system. The primary piping bid package was completed and delivered to the construction contractor on schedule. The reactor plant portion consisted of 28 piping drawings and 56 information drawings, as well as the extensive piping specifications. It should be noted that this design information was issued without benefit of the Electric Boat pipe stress review. It has been necessary, due to schedule considerations, to accept the risk that their review may result in significant changes in design.

Reactor plant design over-all progress stands at about 50 per cent complete. The final scope item, that of fuel element criteria, was discussed by the project representatives during the month but no final action was taken. The peak effort on the initial bid packages has kept the drawing output on schedule. Review has been made of the design work needed in support of procurement. A more detailed schedule of purchase requisitions requiring engineering preparation has been developed as a basis for future work programming in this area.

Development and testing work continues to lag about 7 per cent behind schedule. However, significant advances were made during the month in the areas of fuel dropping, connector couplings, rupture detection and horizontal rod drive debugging.

The latest heat dissipation system design progress schedule, dated February 19, 1960, reports Title II work to be 80 per cent complete, against 41 per cent scheduled. Scope design on this portion of the plant is calculated to be 76 per cent complete. Discussions were held during the month with A-E management regarding steps which could be taken to avoid slippage of the design schedule which would endanger project completion dates and to halt the rising trend in estimated capital cost which has been noted since project inception on this portion of the plant.

A proposal was received during the month from APED for the performance of an over-all engineering audit of the NPR design. Approval was received from the AEC for such an audit and a letter of authorization sent to APED. Work will proceed as soon as satisfactory security clearance arrangements have been made.

3. Visitors

Dr. L. H. Chen, W. Bascom, and C. W. Prentice of Electric Boat Division of General Dynamics Corporation visited Reactor Plant Design February 3 and 4 to discuss piping stress analysis programs.
3. Visitors (Continued)

A total of 98 individuals, representing 42 potential vendors, visited Richland to attend a pre-bid conference on NPR inlet and diversion valves, held February 11, 1960.

G. L. Locks, nuclear consultant to the Sub-Section, was here February 17 through 19 to discuss NPR design problems.

T. D. Russell of Burns and Roe visited Reactor Plant Design and System Design personnel February 17 and 18 to assist in final stages of the 105-N and 190-N primary piping bid package.

4. Trips

A. B. Carson accompanied the Section Manager and representatives of the AEC on a visit to Burns and Roe offices in Hempstead, New York, February 15, 16, and 17 to discuss NPR design schedule and capital cost problems.

M. H. Russ was in Hempstead, New York February 8 through 19, with representatives of BES and Operations to work with Burns and Roe on expediting design progress.

D. D. Stepnewski visited NERTS site at Idaho Falls, Idaho, on February 15 to discuss off-gas treatment problems with representatives of GE-ANFD.

E. R. Astley participated in a presentation on the NPR confinement system given to the ACRS Hanford Sub-Committee February 18 in Washington, D. C.

G. T. Haugland spent February 17 through 24 discussing welding and machining of boron steel with a number of potential manufacturers in the east and mid-west.

J. F. Nesbitt visited the Bremerton Navy Yard on February 23, in the company of other GE and construction contractor representatives to inspect and discuss special purpose hydraulic elevator facilities.

5. Significant Reports Issued


5. Significant Reports Issued (Continued)


EW-57044 ADD1 - "100-N Design Bases - Part II - Addendum 1, Primary Loop Pressure Control", February 9, 1960, D. L. Condotta.

B. Development and Testing

Listed below are significant developments for the New Production Reactor primarily reported by the Equipment Development Operation of Facilities Engineering.

A pre-proposal conference on procurement of inlet butterfly valves and exit diversion valves, which involve the prototype procedure, was held on February 11, 1960. Approximately eighty representatives from forty firms attended the six-hour session. Sufficient questions were raised and points clarified that an addendum to the specification was issued on February 19, 1960. Due date for engineering proposals was extended to March 22, 1960. Several favorable comments were received from vendors on the conference presentation and the approach used to procure critical engineered equipment.

Feasibility of discharging irradiated NPR slugs by gravity moved toward realization when early test drops of slugs onto an underwater mat of interlocked chains were favorable. The mat, approximately two-feet by six-feet in size, was suspended underwater by springs at each end of the longer dimension; the links were one-fourth inch in diameter and included an opening approximately one-half inch by one-inch in plan. The mat deflected more than ten inches under impact, the link openings permitting passage of water. Apparently movement of water through the mat is required to reduce the effects of impact, and water resistance to mat movement is required to dampen the recovery motion. Testing is continuing.

Fyro Electric and General Cable Company cables have been cycled more than 240 times from room temperature to 300°F. There is no evidence of insulation resistance breakdown.

Cycling tests were completed on Edison strap-on resistance temperature detectors. Edison and Ruge immersion resistance temperature detectors have been received and have been temperature-cycled more than 240 times.

Barton flow switches for the moderator coolant flow monitor have been received and tested satisfactorily for (a) trip-point accuracy (0 and 200 psi), (b) flow accuracy, (c) trip reset differential, (d) contact resistance without switch cycling, and (e) over-pressure effect on flow and trip point calibration. Penellit flow switches have been received and are under test.

Modifications were made to a prototype solenoid for the ball trip system which decreased its "drop-out" time from 0.7 seconds to an acceptable 0.18 seconds. A life test of 1,000 cycles is scheduled.
C. FIELD AND OPERATIONS ENGINEERING

I. Activities

Construction

Work was started this period by George A. Grant Construction on the installation of sanitary sewer lines and the area septic tank and tile field. The initial placement of reinforcing steel on the base of the septic tank was rejected by Burns and Roe because of unsatisfactory compaction of the soil under the tank. This has since been corrected. This subcontractor completed the column footings and foundations for the 1704-N Building.

Bob's Woodworking started work on the 1734-N storage building.

The excavation for the 181-N river pump house has been completed to grade and the keys beneath the base slab have been poured. General Electric personnel had not been permitted in the bottom of this excavation due to the unsafe condition of the sides. In the period of February 20 through February 22, considerable material slid down from these slopes knocking out the plywood barricade and knocking out approximately 60 lineal feet of forming which had been in place for the base slab pour. Approximately two working days' time has been lost so far due to this condition. During the latter part of the month a weighted curtain was secured to the face of the excavation to minimize wind erosion and to retard falling material. Since this time the restriction on access of General Electric personnel has been modified to permit normal activity consistent with safety.

Graphite

An analysis of precise level readings taken on the 2101 base cast iron indicates that it will be necessary to perform some grinding to bring the over-all base within reasonable flatness tolerances. In addition, unit load testing of selected individual blocks will be performed to determine if any fault exists in the foundation. These tests are now under way.

Kaiser Engineers are continuing renovation and clean-up of the fabrication and storage facilities with the goal of starting machining of the existing "K" inventory on April 1. Start of machining of top and bottom reflector is scheduled to start June 1. Design of the required tooling and inspection equipment for these programs is continuing. Some orders for this equipment have been placed.
Design drawings of pre-shop inspection equipment have been completed and transmitted to Kaiser Engineers, for procurement and installation.

Design work is continuing on fabrication shop inspection facilities.

Procurement of pneumatic gaging equipment required for the inspection of notched graphite blocks has been initiated.

Production of the reflector material has been started by National Carbon and Great Lakes Carbon Companies. Progress with each company is as follows:

**National Carbon Company**

Extruding of 1440 bars was started January 19. These bars are scheduled to be removed from the baking furnace by March 4 and the graphitizing furnace by April 8, and to be shipped by April 15.

**Great Lakes Carbon Company**

Forming for the full order of 6750 bars started February 3. The first lot of bars was removed from the baking oven February 26, 1960. The first lot of 2235 bars is scheduled to be machined and ready for shipment by April 15, 1960.

Specifications for the remaining graphite material for NPR is now being prepared. Comment issues of the design and technical sections have been issued.

**Zirconium**

Progress on the pilot tube orders is as follows:

**Chase Brass and Copper Company**

Eleven tubes were shipped on February 8. Two additional tubes of the pilot order have been rejected. Price redetermination of the pilot order was completed at Chase Brass February 11.

**Allegheny-Ludlum Steel Corporation**

Ten tubes were shipped from Allegheny February 16. One additional tube presently not acceptable. Price redetermination of the pilot order was completed at Allegheny-Ludlum on February 17.
Harvey Aluminum, Incorporated

One tube has been received at Hanford. Twelve are in the process of final inspection. Three of these tubes at present will not pass inspection due to ovality. Auditors are now at Harvey Aluminum and price redetermination is scheduled for the week of March 7.

The inquiry for the production order of tubing was submitted to the vendors January 28. During the week of February 8, a demonstration for the benefit of prospective bidders was held at Hanford on dye penetrant and ultrasonic testing. A pre-bid conference is scheduled at Hanford March 1.

Design of inspection equipment for the process tube shop is continuing. Custody of the shop was transferred from J. A. Jones Company to Kaiser Engineers, February 8, 1960. Kaiser craftsmen started work in this building the next day. Work has started on installation of specific processing and inspection equipment needed to demonstrate ultrasonic and dye penetrant testing on the long NPR tubes. A test in autoclaving a bundle of closely nested PRTR tubes shows that bundling provides as good a film as spacing. This means more tubes can be autoclaved for each heat.

Procurement

In cooperation with Process Design and Kaiser Engineers background information is being prepared for evaluation of hydraulic elevator bids due March 10, 1960.

Following is the present status of procurement:

**REACTOR DESIGN**

**General Electric Originated - Kaiser Purchase**

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated Cost</th>
<th>Bid Amount</th>
<th>Actual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 Open Requisitions</td>
<td>$3,950,684.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Open Purchase Orders</td>
<td></td>
<td>172,815.00</td>
<td></td>
</tr>
<tr>
<td>3 Complete Purchase Orders</td>
<td></td>
<td></td>
<td>442.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$4,123,941.00</td>
</tr>
</tbody>
</table>

**General Electric Originated - General Electric Purchase**

**Zirconium and Graphite**

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated Cost</th>
<th>Bid Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Open Requisitions</td>
<td>$7,360,000.00</td>
<td>3,487,040.00</td>
</tr>
<tr>
<td>5 Open Purchase Orders</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**HEAT DISSIPATION PLANT**

*Burns and Roe Originated - Kaiser Purchase*

<table>
<thead>
<tr>
<th>Requisitions</th>
<th>Estimated Cost</th>
<th>Bid Amount</th>
<th>Cost Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 Open</td>
<td>$20,980,400.00</td>
<td>4,858,640.00</td>
<td>$25,839,040.00</td>
</tr>
<tr>
<td>6 Open Purchase</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*NPR RELATED*

*General Electric Originated - Kaiser Purchase*

<table>
<thead>
<tr>
<th>Requisitions</th>
<th>Estimated Cost</th>
<th>Actual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Open Requisitions</td>
<td>$87,500.00</td>
<td>55,475.00</td>
</tr>
<tr>
<td>3 Complete Purchase</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL:** $40,952,396.00

**Administration**

The following material was issued by Drawing and Specification Control during the month:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawings</td>
<td>557</td>
</tr>
<tr>
<td>Criteria</td>
<td>25</td>
</tr>
<tr>
<td>Specifications</td>
<td>83</td>
</tr>
<tr>
<td>Requisitions</td>
<td>40</td>
</tr>
<tr>
<td>Other</td>
<td>59</td>
</tr>
</tbody>
</table>

**TOTAL:** 764

**Design Review and Consultation**

Reviews were completed and formal comments were offered as follows on engineering material during the month:

<table>
<thead>
<tr>
<th>Review Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Detail Drawings</td>
<td>416</td>
</tr>
<tr>
<td>On Specifications</td>
<td>22</td>
</tr>
<tr>
<td>On Scope Drawings</td>
<td>2</td>
</tr>
<tr>
<td>On Criteria</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL:** 442
Operations Planning

Studies of three different operating organization arrangements for 100-W were submitted to Manufacturing Section for review. The studies included functional organization as well as position reporting and personnel numbers charts.

A program for the selection and testing of personnel for non-exempt and first-line supervisory operating positions was prepared and recommended to Manufacturing Section.

Pursuant to the idea that good use can be made of simulation studies to define and develop operational procedures, R. A. Harvey of the Hanford Laboratories Operation Analog Computer group was visited. It was determined that the analog equipment is particularly adaptable to the intended use and that this service is available on either a service or consulting basis. Since the work load of this group is scheduled only two to three months in advance, an arrangement was made to keep them advised of our needs on a quarterly basis. As needs become more firm, more definite efforts can be programmed.

2. Visitors


3. Trips

J. E. Stice visited the Puget Sound Naval Shipyard in Bremerton, Washington, February 23, 1960, in company with J. F. Nesbitt, Process Design Operation, Voyle Wood, Design Engineering, Construction Engineering and Utilities Operation, and Oscar Carlson of Kaiser Engineers to consult on problems of hydraulic elevator design, installation and maintenance. He also inspected Boeing Aircraft Company's maximum clearance crane installation together with Kaiser Engineers for assistance in design of temporary work crane over the reactor.

C. E. Love and F. D. Collins visited National Carbon Company, Cleveland, Ohio, and Clarksburg, West Virginia, and the Great Lakes Carbon Company, Morgantown, North Carolina, during the period of February 1 through February 4 to review progress of NFR graphite fabrication.
C. E. Love visited Chase Brass and Copper Company, Waterbury, Connecticut, during the period of February 9 through 11, and the Tube Reducing Corporation, and Allegheny-Ludlum Steel Corporation, Watervliet, New York, during the period of February 12, through 17 to assist in negotiating price redetermination on the NPR zirconium tube pilot orders.

E. W. Wilson spent the period from February 8 through 19 at Burns and Roe, Incorporated, in Hempstead, New York as a Heat Dissipation Plant Project Representative engaged in design consultation and scope review and approval.

### D. Consulting Engineers

1. **Significant Reports Issued**


2. **Visitors**

   An information meeting was held February 22, 1960, with Mr. C. A. Pursel, Chief, Boiling Water Reactors Branch, Division of Reactor Development, AEC, Chicago, Illinois, to discuss carbon steel primary loop technology. His branch is considering the feasibility of a carbon steel loop for a process heat reactor. The meeting covered corrosion, decontamination, water treatment, construction, operation, maintenance and R&D status of HAFO carbon steel loops. Present were W. J. Love, H. R. Kosmata, H. G. DeVoss, W. A. Massen, W. R. Conley, M. C. Fraser, of IPD, and M. Lewis, J. Atwood, N. Miller and J. Ayres of HLO.

### E. Program Evaluation

1. **Activities**

   **Costs and Estimates**

   **NPR Cost Estimate**

<table>
<thead>
<tr>
<th></th>
<th>2-14-59</th>
<th>2-11-60</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary Construction</td>
<td>1,573,700</td>
<td>1,573,700</td>
<td>0</td>
</tr>
<tr>
<td>General Area Facilities</td>
<td>8,664,200</td>
<td>9,465,400</td>
<td>+ 801,200(1)</td>
</tr>
<tr>
<td>Administration Building</td>
<td>456,700</td>
<td>456,500</td>
<td>- 200</td>
</tr>
<tr>
<td>Attendants Building and Gas Pump</td>
<td>5,500</td>
<td>5,500</td>
<td>0</td>
</tr>
<tr>
<td>105 Building</td>
<td>53,653,800</td>
<td>53,781,900</td>
<td>+ 128,100(2)</td>
</tr>
<tr>
<td>Water Treatment</td>
<td>3,571,700</td>
<td>3,730,300</td>
<td>+ 158,600(3)</td>
</tr>
<tr>
<td>River Pump House</td>
<td>3,377,700</td>
<td>3,295,400</td>
<td>- 82,300(4)</td>
</tr>
<tr>
<td>Standby Power House</td>
<td>4,210,500</td>
<td>4,852,900</td>
<td>+ 642,400(5)</td>
</tr>
<tr>
<td>190 Building</td>
<td>34,349,700</td>
<td>33,914,700</td>
<td>- 435,000(6)</td>
</tr>
<tr>
<td>High-Lift Pump House</td>
<td>1,801,800</td>
<td>1,746,900</td>
<td>- 54,900(7)</td>
</tr>
<tr>
<td>151 Switchgear Building</td>
<td>829,700</td>
<td>779,700</td>
<td>- 50,000(8)</td>
</tr>
<tr>
<td>Health Inst.</td>
<td>0</td>
<td>200,000</td>
<td>+ 200,000(9)</td>
</tr>
<tr>
<td>Final Functional Testing</td>
<td>300,000</td>
<td>300,000</td>
<td>0</td>
</tr>
</tbody>
</table>

   **Subtotal**

   112,795,000 114,102,900 1,307,900

   **Indirect Costs**

   23,142,000 23,142,000 0

   **Escalation**

   7,419,700 6,711,700 - 708,000

   **Contingency**

   5,000,000 5,708,000 + 708,000

   **Total**

   148,356,700 149,664,600 +1,307,900
(1) **General Area Facilities:** $750,000 of this increase resulted from extending the two 84" diameter effluent lines out to the mid stream of the river 920 feet plus a $110,000 increase in the Sub-Contractor's Overhead and Profit.

(2) **105 Building:** Sub-Contractor's Overhead and Profit went up $135,000.

(3) **163-183 Water Treatment Facility:** The structural and process power electrical increased $117,000 based on new estimate by Burns and Roe dated 12-29-59. Sub-Contractor's Overhead and Profit went up $41,000.

(4) **181 River Water Pump House:** Direct costs dropped $162,000 based on a new estimate and Sub-Contractor's Overhead and Profit went up $80,000.

(5) **184 Standby Power House:** Direct costs on process equipment, process pipe, process power electrical went up $663,400 (including a $150,000 savings taken on the boiler). Subcontractor's Overhead and Profit dropped $21,000.

(6) **190 Building:** Direct cost for the structure, process equipment and process piping dropped $793,700. Sub-Contractor's Overhead and Profit went up $356,700.

(7) **High-Lift Pump House:** Direct cost dropped $73,000. Sub-Contractor's Overhead and Profit went up $18,100.

(8) **151 Switchgear Building:** Direct cost dropped $48,100.

(9) **Health Inst:** An allowance of $200,000 was included this time for radiation monitoring equipment, blue tools, shop and miscellaneous equipment for change and lunch rooms, etc.

During a visit to Burns and Roe on February 15-17, 1960, by the AEC and GE, Heat Dissipation costs and schedules were reviewed. Burns and Roe proposed to prepare a list of potential cost reductions. Their representative will be in Richland the week of March 7 to review these items in detail.

The next Burns and Roe, General Electric, and Kaiser Engineer cost review meeting is scheduled for the week of March 29. Following this review, a new estimate will be issued about April 15.

**Schedules**

Kaiser Engineers issued a new Sub-Contract Schedule on February 21, 1960. Burns and Roe is to issue a revised schedule on March 1, 1960.
**Status**

<table>
<thead>
<tr>
<th>Wt'd Total</th>
<th>Certified Schedule</th>
<th>Actual % Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>actor Plant as of 2-29-60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Title I**

Scope

100 99.5

**Title II**

<table>
<thead>
<tr>
<th>Drawings</th>
<th>70</th>
<th>47.0</th>
<th>47.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifications</td>
<td>8</td>
<td>51.0</td>
<td>35.0</td>
</tr>
<tr>
<td>Requisitions</td>
<td>8</td>
<td>6.5</td>
<td>2.1</td>
</tr>
<tr>
<td>ATP's</td>
<td>4</td>
<td>4.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Development and Testing</td>
<td>10</td>
<td>64.5</td>
<td>57.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>42.0</td>
<td>42.2</td>
</tr>
</tbody>
</table>

**Heat Dissipation Plant as of 2-29-60**

**Title I**

Scope Criteria

100 82

**Title II as of 2-19-60**

Detail Design

41 40

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Req'd</th>
<th>Scheduled</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Drawings</td>
<td>520</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Preliminary Drawings (bid)</td>
<td>585</td>
<td>184</td>
<td>160</td>
</tr>
<tr>
<td>Detail Drawings (for const.)</td>
<td>650</td>
<td>65</td>
<td>57</td>
</tr>
<tr>
<td>Specifications (bid)</td>
<td>157</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Requisitions</td>
<td>170</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>ATP's (no. being developed)</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Composite Design Completion
(Reactor and Heat Dissipation Combined)

<table>
<thead>
<tr>
<th>Certified Schedule</th>
<th>Actual % Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>49</td>
</tr>
</tbody>
</table>
IV. INVENTIONS OR DISCOVERIES

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report except as listed below. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

[Signature]
MANAGER
NPR PROJECT

JS McMahon: mf
END

DATE
FILMED

4 / 9 / 93